The Japanese Approach to Quality Management – A Human Resource Perspective

John Zhuang Yang

Fordham University, Graduate School of Business Administration, New York City, New York, USA

Introduction

In learning about the design and effects of the process-based Japanese approach to quality control, few studies in the US have explicitly focused on the generic relationship between superior product quality and team-oriented human resource management policies and practices in Japanese firms. Most of the research in the US tends to focus on the technical aspects of total quality management such as quality circles, statistical quality control, speedy production setups, performance measures and so on, but neglects an important component of the total quality management: team-based human resource management system and practices. These practices can be characterized by the flexibility of the organizational structure, the multifunctional work teams, the broad job classification system, the continuous on-the-job training programme and the job rotation system. In the absence of making fundamental modifications of the traditional human resource management (HRM) system, many US business firms have achieved little success in developing the total quality management programme.

The main theme of this article argues that the process-based total quality mechanism in Japan is inseparable from the team-based human resource management practices. In the absence of modifying the highly specialized and job-focused employment system in the US, it is difficult, if not impossible, to carry out successfully a process-based quality control programme at the plant level.

In this article I first analyse the relationship between production systems in the US and Japan and the corresponding HRM system and practices in both countries. I believe that HRM practices in both Japan and the US are functions of the prevailing production system. In the US case, for instance, the prevailing Scientific management principles and Fordist production system tend to create a highly functional and job-oriented HRM system. This job-focused personnel system prevents US firms from achieving success in improving product quality at the source and in the production process. In comparison, the flexible production model in large Japanese plants tends to be highly integrated with the team-based HRM principles. The flexible HRM system developed after World War II contributes to the Japanese success in controlling product quality.
in the production process. Team-oriented HRM practices are a prerequisite on which the success of the process-based total quality management depends.

Second, I provide some empirical findings about how Japanese-owned plants operating in the USA have integrated the process-based quality programmes with team-oriented HRM policies and practice.

A Conceptual Discussion
Features of the Traditional Production Model
The traditional model of production has its roots in Taylor's Scientific management paradigm and Henry Ford's Fordist production model. Taylor's Scientific management focused on the principles of division of labour, task specialization, time and motion studies and the use of monetary incentives. In light of these principles, the Fordist production model was composed of the general principles of mass production, task specialization, assembly-line technologies and high degrees of mechanization (see Table I).

Mass production was the most important principle adopted by Henry Ford in producing the famous Model T car for the masses. Henry Ford found that only high volumes of production – economies of scale – could lead to lower unit cost. To be able to mass produce cars, Henry Ford also adopted the division of labour principle dating back to Adam Smith and strongly advocated by Taylor's Scientific management. Unlike the traditional practice of having each worker do a job completely, under Henry Ford workers were divided into specific functions and work was highly specialized. To achieve the economies of specialization, automation and mechanization were strongly emphasized under Henry Ford, leading to the replacement of workers with machines. Heavy emphasis on specialization resulted in an organization structure which was highly hierarchical and centralized. Detailed specialization also laid the foundation for a quality control system which relied heavily on professional inspectors and engineers, rather than depending on front-line workers. The final element of the traditional production system was the just-in-case inventory system under

<table>
<thead>
<tr>
<th>Mode of Production</th>
<th>Type of human resource policies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fordist production model</strong></td>
<td><strong>Traditional personnel model</strong></td>
</tr>
<tr>
<td>Mass production</td>
<td>Low commitment to employees</td>
</tr>
<tr>
<td>Economies of scale</td>
<td>Hire functional specialists</td>
</tr>
<tr>
<td>Emphasize automation</td>
<td>Mass layoffs when necessary</td>
</tr>
<tr>
<td>Hierarchical structure</td>
<td>Detailed job classifications</td>
</tr>
<tr>
<td>Use inspectors for quality</td>
<td>Limited on-the-job training</td>
</tr>
<tr>
<td>Just-in-case inventories</td>
<td>Individual responsibilities</td>
</tr>
</tbody>
</table>

Table I. Traditional Production and Personnel Models
which monthly or even yearly inventories were usually piled up in factories in case of shortages.

**Features of a Functional HRM Model**

Influenced by the needs of the traditional production technologies, the functional-oriented personnel model focused on acquiring and terminating employees according to the short-term profit objectives of the organization and the signal of market supply and demand for labour. The production model determines the nature of personnel policies, which in turn support the operation of the mass production technology. The personnel model has several features:

1. **Low commitment to human resources by top management:** Top management shows little, if any, long-term commitment to personnel issues. Management tends to treat human resources as variable assets, rather than fixed assets. Personnel issues are of secondary importance. Priorities are on the non-human side of the operations, such as financial control and production automation.

2. **Emphasize hiring specialists:** The emphasis on specialization of the traditional production model leads to a focus of firms to hire professionals and specialists to fill in specific jobs. Hiring decisions are driven by short-term needs of the business firm. Compensation is market driven and skill-based.

3. **Engage in mass layoffs when necessary:** Employment-at-will is the rule. There is little, or no, job security in the firm. Mass layoffs are conducted whenever the firm faces financial difficulties and poor business and economic conditions. Layoffs are the major solution to cost cutting and revenue saving.

4. **Detailed job classifications:** The strong focus on work specialization leads to detailed job classifications and numerous job titles. In US business firms, the emphasis is on the job, not on the person (Sethi et al., 1984). Job classifications are highly formalized and narrowly specialized across functional departments including quality inspectors in the quality control department.

5. **Limited on-the-job training:** Since employees are hired for their specialities and paid market wages for their experience, many business firms do not consider it economical to invest in on-the-job training. Additionally, employees are more loyal to themselves and less to the organization, leading to high turnovers, which further reduce firms' incentives to offer job training.

6. **Encourage individual responsibilities:** Given the emphasis on work specialization and a hierarchical organizational structure under the traditional production model, workers have less incentive to work in teams. Detailed job structure cultivates individual responsibility and individual accountability.
The Japanese Production Model

The changing competitive environment and consumer tastes after World War II have had dramatic impact on the Fordist management policies and production technologies. During the 1950s, a new production technology was being evolved in the Toyota auto company in Japan, challenging the validity of the traditional Fordist model. Krafck (1988) attributed the success of Japanese auto firms in productivity and product quality to the adoption of a "lean" or small lot production system. Unlike mass production, according to Krafck, the "lean" production system can rapidly respond to shifts in the market, changing consumer tastes and demands for new products, and allow production strategies to be integrated with HRM practices (see Table II).

Flexible production or the "lean" production (Krafck, 1988) or the "small lot" production (Aoki, 1988), rather than mass production, is the most important feature of the new production model. Instead of focusing on economies of specialization, the flexible production model emphasizes economies of co-ordination across functions within the firm, thus making it possible for firms to respond rapidly to market signals and produce new products tailored to different customers. Although production automation and mechanization are still perceived as important, the new model is dependent on human control of product quality and productivity. Unlike the Fordist production model where the organization is rigidly hierarchical and decisions are centrally made most of the time, the new production model is characterized by its flat organization and wide span of control. Instead of using quality inspectors, the new production model focuses on total quality control and builds product quality into the product by involving all employees in the organization. And finally the new production model uses Just-in-Time inventory strategy, thus minimizing waste in manufacturing and increasing production efficiency.

The Japanese-style HRM Model

In contrast with the traditional production model, the Japanese production model is highly dependent on and integrated with an internal labour market

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<thead>
<tr>
<th>Japanese production model policies</th>
<th>Japanese human resource policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>The production model</td>
<td>The personnel model</td>
</tr>
<tr>
<td>Product flexibility</td>
<td>Use lay-offs as the last resort</td>
</tr>
<tr>
<td>Economies of scope</td>
<td>Develop a broad job structure</td>
</tr>
<tr>
<td>Emphasize human control</td>
<td>Emphasize on-the-job training</td>
</tr>
<tr>
<td>Flat organization structure</td>
<td>Extensive use of work teams</td>
</tr>
<tr>
<td>Total quality control</td>
<td>Total employee participation</td>
</tr>
<tr>
<td>Just-in-time inventories</td>
<td>Job rotation and multi-skills</td>
</tr>
</tbody>
</table>

Table II. Japanese Production and Personnel Policies
practice which emphasizes job security, job training, employee participation and team work. Shimada and MacDuffie (1987) develop a “humanware” model of Japanese production and HRM systems which, they argue, are highly dependent on team-oriented human resource policies. Krafcik (1988) writes that a traditional production system is “robust” in that it is highly bureaucratized and can function without a high degree of employee participation. On the other hand, the new production system is “fragile” in that it is too structurally informal and requires the help and interaction of all members of the organization through the applications of work teams. Krafcik finds that advanced machines and robots are of little use if they are not supported by the active participation of all members of the organization. Characteristics of this HRM model are (Table II):

1. **Use lay-offs as the last resort:** Top management has deep commitment to employees and personnel issues. Management views human resource as important as financial assets. Management recognizes that superior product quality and high productivity are dependent on the skill and commitment of employees. It is essential for management to develop stable employment policies and use lay-offs as the last resort even under severe economic conditions. Job security reduces costs associated with turnover, such as recruitment and training.

2. **Developing a broad job structure:** The emphasis on total quality management requires co-ordination of production activities across functional divisions. Since workers are hired not for their functional skills, but for their knowledge in coping with key product and quality issues, hiring criteria emphasize worker attitudes and the ability to learn multifunctional skills. Job positions are broadly defined.

3. **Emphasize on-the-job training:** The Japanese production technology and total quality management emphasize flexibility and cross-functional activities, which require intensive and continuous on-the-job training. Aoki (1988) writes that the sole purpose of establishing broader job classification, flexible job assignments and job rotation across functions in Japanese plants is to enable workers to learn a wide range of different skills and “facilitates knowledge sharing among workers” (p. 15) which is the key to product quality. He writes:

   The knowledge possessed by a single worker extends beyond a particular job jurisdiction, so that there is considerable overlap in the knowledge of individual workers of different status on the shop floor (p. 15).

Koike (1984) studies the lifelong process of Japanese blue-collar workers on the shopfloor acquiring intellectual skills similar to those possessed by Japanese white-collar workers. Compared with Japanese workers, American workers have little time to develop another skill. Koike asserts that Japanese managerial policies such as long-term employment and on-the-job training contribute to the multi-skilling of workers and lay the
foundation through learning by doing. The productive consequence of these policies is a process of white collarization of blue-collar workers. The white-collarized skills have formed a foundation for better productivity and superior product quality.

(4) Extensive use of work teams: The emphasis on total quality control is highly dependent on team work and quality circles. Through small group activities, members of the firm contribute their ideas to improving quality and building quality into the product. While individualism is discouraged, teams make full use of the talents of every member of the organization. Aoki (1988) argues that while American firms focus on efficiency through work specialization and job demarcation, Japanese firms emphasize the capability of work teams to “cope with local emergencies autonomously” (p. 16). This ability is developed through “learning by doing and sharing knowledge on the shop floor” (p. 16). This sharing of knowledge is the key of process-based quality control.

(5) Total employee participation: To improve continuously the process of quality control, Japanese firms have developed various forms of organizational learning mechanisms such as the suggestion system. In about 40 years, for instance, Toyota has received some 20 million ideas for improvement through the employee suggestion programme (Zhao, 1991). New ideas and suggestions not only provide inputs and benefits for producing good quality products, but also motivate workers and keep them highly committed.

(6) Encourage job rotation and cross-functional skills: The emphasis on coordination and co-operation across departments makes it imperative for firms to encourage multifunctional skills so that workers will be able to learn cross-functional skills and share these with one another to accomplish organizational goals. Job rotation across functional departments is done systematically and regularly. Job rotation contributes to strong and effective work teams, which are the key for better product quality. Taira (1989) writes:

> The pursuit of worker versatility calls for extensive job enlargement, frequent re-assignments and rigorous discipline. The hiring and retention of versatile workers are the central functions of the Japanese employment system.

How Japanese Firms Integrate Quality Control with HRM

To have a better understanding of how Japanese HRM practices have contributed to total quality management, I engaged in two field studies of Japanese-owned companies in Tennessee during 1989 and 1991.

The first set of interviews were conducted during 1989 with the support of Columbia University Center for Operations. In early February 1989, I contacted senior managers of about ten Japanese-owned plants in Tennessee for our March visit. The criterion of firms selected for our visit was that these firms
have at least 100 employees locally hired, regardless of the type of products they produce or the length of time their plants have been operating in Tennessee. After engaging in repeated, sometimes time-consuming, telephone and fax exchanges with senior managers of Japanese plants about the purpose of our visit, five Japanese plants agreed to have us visit their location. All were assured confidentiality with respect to specific details. In addition to Japanese firms, I also contacted the Tennessee state government, The Japan Center of Tennessee and a professor from Vanderbilt University for interviews on Japanese investments in the state. The five Japanese-owned factories selected included one large tyre manufacturing plant, one large construction equipment plant, one auto supplier for Nissan, one television assembling plant and one electronic component plant.

The 1991 revisit to six Tennessee plants, supported by a Fordham University faculty research grant, was a follow-up study of the 1989 visit (Starr and Yang, 1990) and based on similar interview method. The 1991 study researched not only how Japanese firms developed HRM policies, but also how they were able to produce high quality products through team work. Unfortunately only two plants which had been included in the 1989 visit agreed to the 1991 study. As a result, I had to contact seven other Japanese plants to the visit. After repeated consultations, four new plants agreed to the interviews. The final six companies of the 1991 visit included a Japanese auto-manufacturing plant, the construction equipment plant, the same tyre-manufacturing plant, a typewriter-assembling plant, a microwave oven and TV-assembling plant and an auto conveyer-manufacturing plant.

Empirical Findings
*Top management commitment to superior product quality:* One striking impression from the visit is the strong and deep commitment of management and workers to superior product quality. In all factories I visited in 1989 and 1991, to produce the highest quality product for customers is stated as the most important corporate mission, along with management commitment to people. The quality consciousness starts from top management and is built into the mindset of every manager and employee in the factories. The emphasis on superior product quality is linked to management commitment to job security and HRM programmes.

The auto-manufacturing plant has developed a complex and sophisticated quality control programme in which everyone in the factory is involved in making quality the number-one concern. There are quality control professionals, quality circles and work teams, all of which are aimed at reaching zero product defects. The auto produced in the plant tends to have few defects. A worker comments:

I guess I have had probably six or seven leased cars since I have been here and I have not had any major problem with any of them.
To produce the best quality has become a concrete symbol of corporate culture and is the first thing discussed at the beginning of each work shift. An official from the plant explains:

...the first seven minutes of every shift is a work group meeting and that is paid time. This is where the manager and the work group sit down together and discuss any production, quality, company concerns before they go out into the line. So that is the primary communication source right there.

Quality is perceived as everyone's responsibility, not one that is confined to professionals. Every single worker in the plant is told to be responsible for quality. The official says:

...every technician [worker] is responsible for the quality of his work. If he senses that something happened or if there is a problem with the equipment, he will say something immediately. Maintenance would be called immediately and they would probably resolve the problem as quickly as they could so it's seldom that something would happen that would shut the line down, but it is certainly just an option.

Employees of the television-manufacturing plant view quality as the key element of the corporate culture. The firm has formulated every policy, including HRM policies, centred on high quality products. Management has developed employee programmes which aim at increased quality consciousness. The plant HR manager says:

It is all centred around the quality of the product. Producing a good quality product is basically the life of our business. The president has made it clear that if we produce but one unit, it should be the best quality that we can do. The product is not going to go through that assembly process without someone being sure that the quality that we want is built in the product.

Engineers of the plant are critical of the American approach of inspecting quality at the end of the production process and leaving room for product defects. After working in the Japanese plant for some time, the American engineer says:

In most American companies you have a bunch of inspectors at the end of the process that are trying to force quality into the product at the end. For the Japanese philosophy, or the correct philosophy, is to try to build the quality into the product as you are manufacturing and have the quality built into the process engineered into the process. The biggest problem I had when I was in quality assurance is some of our older manufacturing managers still have that mentality. I will call it the old American philosophy that anything and any product that you can get past the inspector without him either catching it or not noticing some discrepancy is okay. The idea that quality is a good thing to have as long as it doesn't slow down production. Whereas the Japanese might say oh that is okay we'll ship that one. We just do not make any more and we must find out what caused this problem. The Japanese would let a bad one go but they would make sure they didn't make another one.

The Japanese construction equipment plant, long known for its superior earth-moving products, has developed a sophisticated total quality control philosophy which emphasizes building quality into the product and production process. One manager says:
Our philosophy is to make each person responsible for his own quality and they add check sheets throughout the production process. And we expect them to build the quality into the machine. We do not have any intentions of trying to inspect quality into the machine at the end of the line. It has to be built in throughout the process from the time the part comes in the back door.

Screening of employees is the key to product quality: Japanese factories in Tennessee recognize that product quality cannot be guaranteed without team work and that work teams cannot be fully functioning unless members of the teams share common work values and are willing to help one another. One strategy to accomplish this goal is to develop a tight screening procedure in hiring.

Major Japanese factories in Tennessee which I visited in 1989 and 1991 have developed sophisticated methods for recruiting of new employees. Because of high wage rates and better working conditions based on local standards, most of these Japanese factories are perceived as the employment choice and have attracted tens of thousands of job applicants from Tennessee and elsewhere. The current recession in the state's economy makes it even more desirable for people to get a position from these Japanese plants.

The hiring process of Japanese firms has several features:

1. Prior work experience is not required. Contrary to the common practice of American business firms where hiring decisions tend to be heavily dependent on an applicant's prior work experience in the industry, four Japanese factories I visited in 1991 clearly de-emphasize applicant's past work experience, especially those gained in the same industry. Past experience is not a prerequisite for the job. On the contrary, preference for hiring is often given to applicants who do not have any skills or prior work experience used in the industry. A major reason for this practice is that past experience and prior perceptions about a particular industry in the USA are perceived to contradict the practice of Japanese industrial plants in the USA. This would thus hinder the implementation of Japanese managerial approaches to production, inventory and quality control, and flexible work rules. This in turn would be detrimental to shared values and team work and lead to internal conflicts. Take for example the Japanese auto transplant in Tennessee. According to the plant's General Counsel, the auto plant would usually get 100,000 applications for every 2,000 positions. Many of those new workers hired by the factory had no prior work experience at all in the auto industry. Quite a few of these new workers had been teachers before they were hired. The General Counsel explains:

Our employment guidelines state simply that you must have 18 months of demonstrative work experience. So they [workers] have work experience before they came here but not necessarily automotive experience. We have lots of school teachers for instance who work on the plant floor. It is easier to teach people that do not have pre-conceived ideas about how it should be done if you teach them the correct way to hold a weld gun. If they have been doing it wrong in the past then they have to
unlearn that way to be able to learn the correct way. You know there is a lot of training
that is required.

The HR Director of the auto-manufacturing plant says that though industrial experience is important, prior auto experience is not required. The Japanese auto factory recruits local employees who have basic learning in mathematics and reading, but not specialized knowledge about how to build a car. This helps the factory to teach the Japanese approach to quality control. As a matter of fact, interviews with managers in the plant imply that for new recruits, especially production workers (not engineers), prior experience in the US auto industry may be perceived as negative. One says:

We do not require prior auto experience. We require demonstrated work performance, preferably industrial. We require the ability to read and basic math. Through our interview process we bring them in for an initial interview and then if they pass that interview or are successful then we bring them back for an interview with a panel of our supervisors and HR representatives. So I think we are also looking for the appropriate spirit of teamwork.

(2) Emphasize potential to learn cross-functional skills. To guarantee high quality products, even for those plants that hire skilled workers, such as the case of the auto conveyer plant, managers from Japanese factories indicate that new job applicants must have the potential to learn new and cross-functional skills, and learn them willingly and quickly. One HR manager says:

We’re looking for someone who can do that but somebody who also has potential. Somebody who learns well. If somebody comes in here and had some basic skills but they are constantly learning, constantly growing and developing, they become more valuable. Once they learn our product they learn how to do other parts of our product without as much training. We don’t want someone who comes in and operates just one machine and that’s all they can do. We are not looking for that type of person. We are looking for someone who’s got some flexibility because of the product we produce.

The HR manager from the television assembling plant says that the plant does not require functional expertise and professional background. Rather, it emphasizes the job applicants’ trainability:

[American companies] are looking for an individual with a certain amount of experience in a particular area. We do not necessarily look for the experience in that particular area. We do not necessarily look for an individual who has a background in electronic assembly so to speak. Because we plan to train and develop the person that we hire to produce the type of quality that we want.

The auto tyre manufacturing plant requires those who have been newly hired to have a flexible work attitude and be able to work anywhere in the factory. The screening process focuses on the individual’s flexible work attitudes and the potential to learn new things. It is important for the auto plant to hire non-specialized employees because it needs these
people to work together in teams which is the key to better product quality. A manager says:

[We hire] the type of candidate who would like to be involved. He could work anywhere in the factory. There is not a specific position in our mind. We put them through 20 hours worth of education prior to joining the company. They are exposed to the TQC concepts of our company culture. They learn about the company and learn to solve problems. Then they go through a two-day orientation. They are finally assigned a specific job. We will not know this specific job until probably that day.

(3) **Work values, work ethic and personalities:** One criterion of recruiting a new employee in Japanese-owned factories in Tennessee is his personality, work ethic and values, although one factory manager does not particularly like the idea of rating people based on personalities. The major reason for emphasizing applicants’ value systems and personalities is to ensure that the factory is able to pursue team-oriented HRM policies and that management is able to shift around people according to the needs of production. Rotating employees is considered a key to better product quality. The emphasis is also on the idea of fit. A manager says:

…it doesn’t matter basically what the background that the individual has [in hiring]. However we do look for the type of personality and attitude that would fit into our organization.

At the auto conveyor plant, the screening process of new hires is very tough. The key is to find out the suitable work ethic of the individual. The factory hires temporary employees who may become permanent only if the factory feels that the individual’s ethic is compatible with that of the factory. The HR manager says:

What I try to do during a screening process is to find out the work ethic of this individual. We have already seen the work ethic from working three months to two years on an individual. We know the skill level of this individual. A lot of the screening that I would have to do is already done because the other supervisors are able to watch the individual.

**Develop flexible rules and broad job design:** Many US business plants and organizations are characterized by a highly functional-oriented division of labour and a strict hierarchical authority relationship under which employees are expected only to accomplish clearly-defined functions without going across functional boundaries. In some US plants, the highly functional nature of the typical American work system actually discourages full participation of employees in process quality controls – it is the responsibility of quality inspectors, not assembly workers, to take care of quality issues. A high functional organization which fails to change work rules and clings to the idea of specialization of control tasks seems destined to lose the battle on quality.

In Japanese plants in Tennessee, to produce the best product quality requires the design of flexible and broad work structure. One distinctive feature of the Japanese human resource management system has been its strong emphasis on
vague job descriptions, few job titles and broad job classifications. This system is different from US personnel management in which the focal point is on the job, not on the person. (In a 1970 Dictionary of Occupational Titles, it is recorded that there were 22,000 separate job titles in the USA.) The Japanese system of a broad job description strongly supports the philosophy of a flexible job concept and an extensive job rotation. The strategy of developing a wider range of employee skills ensures the successful operation of team work and guarantees that as the demand for different types of skills evolves over time there will be more employees available to fill those new requirements. It is a useful strategy to control product quality in the production process, rather than at the end of the production.

In the light of the highly specialized firm structure in many US plants, how can Japanese managers achieve this goal?

At most of the Japanese factories I visited in 1989 and 1991, flexible work structure and broad job design are the two key features of the personnel system. The Japanese auto-manufacturing plant, for instance, has designed only four job categories: the production technicians, material handling technicians, quality technicians and maintenance technicians. (All people in the factory are called technicians by management, an indication of management respect for people.)

The auto tyre plant manager thinks that the broad job idea is an important strategy to maintain jobs because if one loses one's job, one can immediately go to work another job in the plant:

...if you have a broad range of abilities you can go from one job to another. I think when there is a problem somewhere, they can use your productive capacity in another area to help keep production flowing. From a business standpoint it is great. But a lot of people do not like it, a lot of production workers do not like it, because they feel like if their particular job is shut down or there is a problem they ought to be able to sit down and not do anything.

The constructive equipment plant has seven different job categories including assembler, painter, welder, machinist, inspector, material handler and maintenance. The few job categories have brought about a lot of flexibility. One manager says:

If we want to take a welder and bring him over here painting counter, we just do it. You may want to bring a material handler and have him weld. There is a tremendous amount of flexibility...

Even for the auto conveyer's plant where a lot of skilled workers are hired, management does not develop a very detailed job classification system for reasons of flexibility and quality control. But the emphasis is on merit and individual ability:

We do not have the classification. We purposely want everything based on merit and the skills of the individual and the individuals' ability. We do not want to have a classification structure in which if you are a fitter you have a pay range of (x) amount of dollars to (x) amount of dollars. We do not want that. We want the flexibility. If someone is a really good fitter, for instance, but he does not come to work very often, we want the ability to reduce his pay, say, less than somebody who is actually more qualified... we prefer the flexibility.
At the auto tyre plant, the idea of being able to do multifunctional skills is passed on to front-line workers. A production worker explains the flexible work rules this way:

For example I might be able to do a one-time job. I may also be a heck of an electrician. But I might be just a 50 per cent plumber. Instead of calling the 100 per cent guy over here that knows what he is doing, I might half way fix it. But to be competitive you have to know different skills, and that is what they [Japanese management] were looking at.

*On-the-job training and quality control:* Several Japanese factories, particularly those large and integrated MNC subsidiaries (auto plant, auto tyre plant, construction equipment plant) have developed sophisticated and systematic on-the-job training programmes for improving quality and labour productivity. The training programmes of smaller assembling plants are not as well developed.

The auto-manufacturing plant has set up perhaps the most systematic training programmes of all the factories visited. An HRM official of the plant explains that before someone is hired all the applicants for the job have to complete 48 hours of pre-employment training. Basic skills training is conducted even before someone is hired at the factory. After new employees are hired they spend the first two weeks in training and again that training is at that plant. It is specific to the place where they will be assigned. The first two weeks are called new employee assimilation training. Half of that time would be spent in the classroom where new employees are getting more instruction about the organization of the company, different Human Resources policies, safety, quality, all the things they will need to know to be an employee. The other half of the shift is spent on the workfloor, in the area where they are assigned so that they can begin to become familiar with the tools, with the work in that particular area. And then the training is given on the job during those first several weeks. And they work with another employee who has higher skills until they can do their jobs alone. So for the first few months there is much training. Most of it is given after they complete those first two weeks on the shopfloor with experienced people in the group to train them on how to do their job. And then as needs occur, if they discover they need further training, it is the area manager who decides the employee needs to be taught such and such skill, then there is training given as needed. Total training is around 80 hours.

At the small auto conveyer plant, there are some workers who started out with few skills. The company has installed an on-the-job training programme:

We were able to train them in blueprint reading and welding. Some of the people who came in and welded and barely read blueprints can now read blueprints very well and were quite good fitters. They are a lot stronger than just a welder. The people who came here who were good with blueprints have learned a lot and have grown and are extremely good with them now. A lot of on-the-job training and a lot of opportunity to give people chances to perform in ways that they never would have had the opportunity had we been a structured system.

The construction equipment plant also has a variety of training programmes including a pre-employment skills training programme of about 75-80 hours. In addition, the plant is engaged in a very well developed on-the-job training
programme. The plant also has other forms of training, including Japanese culture training with some professors invited from local colleges to give presentations.

Process-based quality control mechanisms: Contrary to common American management practices that put a great percentage of the responsibility for quality control on managers and engineering staff, Japanese management has been trying to develop an environment and organizational structure under which everyone, from production workers, shopfloor workers, foremen, to supervisors, managers and top managers, involve themselves in and take responsibility for quality control during the whole production process. The philosophy, dating back to W. Edwards Deming and J. M. Juran, is simply aimed at building quality control into the structure of tasks and labour management relations (McMillan, 1984). To change the old behaviour, Japanese management tried to concentrate first on American managers and hold special seminars on process-based employee-involved quality control. Once American managers change their mentality, they in turn will influence lower-level American employees to follow this philosophy. To help US workers to develop team small group activities, technical personnel, including quality control engineers, now only serve as facilitators of quality products and take charge of testing responsibilities. Front-line workers are to be responsible for product quality. In the auto speaker factory, for instance, the Japanese quality control manager says that he seldom gives specific instructions to his subordinates on what they should do, but through questioning, encourages them to come up with ideas on how to achieve quality products. He encourages full participation of line managers and employees to locate and discover quality problems and take full responsibility for their actions.

One major change in these Japanese factories in the US is the extensive use of work teams and quality circles as a specific mechanism for implementing the process-based quality strategy. Many Japanese companies which I visited have adopted quality circles at the grass-roots level to improve product quality. QC usually is composed of seven to nine workers whose job it is to discuss regularly quality-related issues and measures to improve product quality. At the car parts plant, for instance, there are now 75 QC teams, with each circle completing three major goals in 1989. There are full time Japanese facilitators on each team and through them the value system is brought to the basic level of the plant. The Japanese facilitators handle the training of American managers and employees through period seminars. They advise the circles and explain the processes. They infuse them with a value system. As a production engineer says:

As a company we have our philosophy of supplying the highest quality product to our customers. We demonstrate that to our employees. They believe us because we say what we mean, we mean what we say. Out attitudes and what we do become the official policy of our company.

Job security and quality management: Management believes that job security is the key to implementing team-based quality control strategy. The 1991 study of
the Japanese factories took place at a time when the economic recession ran deep in the USA and companies were engaging in mass layoffs as the most widely used approach to reduce costs. The visit to the six Japanese factories, however, finds something quite different from the usual practice adopted in US firms. Top management of Japanese factories tends to view lay-offs as the last resort. To many Japanese plants, job security is the key to worker commitment, teamwork, quality and productivity. Five of the six Japanese factories I visited had never laid off a single individual since they began operating in the US. One factory laid off some workers about four years ago when the economy was not good. But the manager said that lay-offs would be viewed as the last resort by management. It would first seek other alternatives to lay-offs.

At the construction equipment factory, where inventories were seen piling up on the factory ground due to severe recession in the construction industry, there was mounting pressure from other US plants of the joint venture with the Japanese plant[1] to lay off employees in order to reduce costs. The Japanese VP in charge of the plant is said to have shown great concern for his workers and tried his best to protect workers in the Tennessee plant from being laid off. At the time of the visit, the vice-president was seen meeting with the US HRM manager to discuss ways to reduce costs and keep jobs in the plant. He is viewed as a godfather-like person on whom American workers depend. At a time when the plant's major competitor, Caterpillar, is engaging in mass-layoffs and fighting against union workers, the construction equipment plant has tried all methods to maintain jobs. Despite pressure from other US plants of the joint venture, the Japanese plant in Tennessee has so far not laid off a single employee. One manager comments:

Mr Ochi [the plant VP] is our saviour if you will. He is really going the extra mile in making a tremendous effort to protect our employees. He is strongly protecting this facility.

At the auto-manufacturing plant, top management describes job security as the "primary underlined philosophy" of the company. And the factory has designed a flexible training system that allows the plant to maintain jobs when the economy is bad. In the absence of job security, it is difficult to develop a process-based quality programme. One manager describes it in this way:

When I think "flexible" I think we have people who are trained to be flexible. They are trained for many different jobs so that they are not locked in. And therefore do not lose their jobs when their skills are no longer necessary in one area. We think flexibility in terms of the number of units that we will produce of cars or trucks going up and down in order to provide job security for our employees. So when you talk flexibility to the human resource person you talk about the flexibility that allows us to provide job security.

The tyre industry has been in deep recession and the future prospect is not too bright for expansion. The plant manager says that despite the poor economic conditions in the industry, it is important for management to have continuity and stability in the workforce. He feels that if management treats human resources as a disposable asset and uses them when times are good and discards them when times are bad, "then we are not going to have employees
who are committed to making our facility, our company grow and prosper. So we must find a harmony together that says in good times and bad times we can keep people here working”.

*Using simple statistical methods:* In most of the factories I visited, quality control programmes actually involve simple methods and rules, consisting of little mathematics or sophisticated charts and statistics. In some plants, only quality engineers are required to read sophisticated documents while production workers form small quality control groups and are trained to use simple basic concepts such as X-bar charts, medians, modes, means[2] – rules that those who have attended junior high school can easily learn and follow. This contrasts with the practice of many US firms where quality control programmes are normally not carried out in teams, and are sometimes characterized by fancy charts, sophisticated documents and computers, with technical experts mainly responsible for quality in the final stage. As one Japanese manager says:

American managers like PCs and sophisticated tools for the purpose of possessing them, but in Japanese factories, the main purpose is to achieve good product quality through the use of PCs and simple statistical methods. Means are used to serve ends.

In one factory, management takes the approach that is based on customer requirements in QC programmes. Management thinks that it is important to use the statistical chart specifically so that people recognize the importance of it rather than charting everything which may diminish the importance of quality. In the tyre plant, quality control is now moved out of the technical area and into the production areas. Technical personnel serve only as advisers. Workers are encouraged to shut down the conveyor belt if they discover a process problem. Each production problem is not addressed as a single issue and management tries to work on facts, rather than experience, to attack quality problems.

In the tyre factory, according to a Japanese engineer, US workers have not only accepted the idea of quality control, they are even “enjoying it”, for QC activities have generated improvement by workers themselves. After years of QC practice, the tyre factory has produced sons and daughters of QC teams and these teams have been very effective. Japanese engineers helped workers realize their ideas and the workers have a base now to define the problem themselves and modify the designs.

*Kaizen: constant and continuous improvement:* A flexible and process-oriented quality control system requires minimum product defects. Unlike many US organizations where an “Acceptable Quality Level” (AQL) has been the rule, in Japanese factories we visited, zero defect remains the goal. To reach this goal, however, management considers it important to build up a work system that makes steady, constant, incremental and evolutionary change and improvement – Kaizen – using the popular Japanese word, rather than revolutionary and abrupt change. They believe that the key to product quality and zero product defect lies in doing a little better every day for every person.
This requires a long-term orientation and much patience on the part of management and workers. As one Japanese manager put it:

We do not need the most advanced technology in order to achieve high product quality. What we need is the minimum effort of every worker. Strive for the better, better than what we were yesterday. Do not need to become the best, since the best means no growing up.

Based on this philosophy of incremental and continuous improvement of product quality, the factories we visited have been able to produce better quality products with lower product defects. The television sets produced by the TV assembly plant, for instance, have been named as the “most reliable brands” by consumer reports for the past three years. The warranty return rates remain within the 1.5 - 2.0 per cent range, which is low by industry standards. For the speakers produced at the electronic plant, the company reduced product defective ratios from 4.33 per cent in 1983 to 0.66 per cent in 1988. The warranty return rates remain 0.08 per cent for the plant, compared with 0.14 per cent of their biggest US competitor. The heavy equipment produced at the industrial equipment plant has received very few customer complaints for the past year and product defective rates have remained near the zero level. The tyre factory has been maintaining quality control throughout the production process to produce steel-radial truck and bus tyres that require 700 different kinds of materials. The overall percentage of tyres scrapped declined from 5.1 per cent in 1983 to less than 1 per cent in 1988, an 80 per cent decrease. The auto component supplier has been named by the Nissan auto plant as one of the five top suppliers in terms of product quality. Its auto-related products have reached a low defective rates of 0.004 per cent.

Analysis and Conclusions
The two visits to the Japanese plants in Tennessee in 1989 and 1991 provide evidence of the positive contribution of team-based human resource practices to total quality management. These visits have also shown the relatively successful adaptation of Japanese key managerial practices in US manufacturing facilities. They lend support to the thesis of this article that a well-developed process-based quality control programme has to be integrated with a team-oriented and flexible human resource management system. Key findings of these visits are:

- **An emphasis on superior product quality**: All managers in the factories I visited seem to have a strong desire to improve the quality of their products and to be the best in their fields. This desire to be the best in quality seems to have transcending importance for Japanese managers to American managers and production workers alike. Superior quality is considered a key management strategy to success in all these Japanese plants. And the philosophy does not remain on paper. People at these firms, both labour and management, seem to be working together to establish and modify work rules and production processes to reach this goal. By various quantitative and qualitative measures, these plants
have achieved the goal of producing high quality products and they are continuing their improvement in this respect.

- **Effective use of human resource management in quality management**: A major factor which makes these Japanese firms successful in producing high quality products is management's deep concern for people and a set of sophisticated human resource policies formulated and executed at these plants. People are carefully selected, well trained, respected and recognized as important partners with management in achieving company goals.

- **Process-based total quality control mechanism**: Top management for people lays the foundation for a process-based total quality system in the Japanese plants. In all Japanese factories I have noticed an integrated strategy of engaging in a total quality control in the production process. "Total" means that quality control is not confined to the product; rather it is an idea that links material, technology and labour and corporate strategy. At the tyre plant, for instance, the management concentrates on the so-called "Four Ms" – Man, machine, method and materials. Notice that Man is the most important M of the four Ms. Whenever there were problems in the factory, the management would do the Four M analysis to find out whether the plant followed the right method, whether there is a problem with the materials used, or there is something wrong with the machine, or whether man is doing things right. By doing so the management is able to focus on what the true problem is. That is what Japanese firms view as the basis of total quality control which tends to be structured and standardized.

The emphasis on product quality through team-based human resource management practices cannot be labelled as a Japanese invention. Dr W. Edwards Deming first brought the idea of quality control to Japan in the 1950s. Many respected American firms such as Ford, GE and IBM have shown respect to people, to product quality and to technological development. These values and policies are good business practices based on common sense.

Despite tremendous successes in producing high quality products through the development of team-oriented human resource policies, the Japanese plants I visited in 1989 and 1991 are not devoid of problems. Some problems are external and environmental, which are beyond the control of plant managers. Other problems are internal and people-related. One major problem revealed in the studies was a perceived lack of education on the part of hourly workers in some factories I visited. One engineer commented:

"Our biggest constraint is the relative inexperience of our engineering staff. We have tended to hire young engineers pretty much out of schools. Because the Japanese place a heavy emphasis on process, we are really lacking in terms of experience in the engineering function. I think that is a key for us to hire more experienced engineers, and not lose them."

A second more serious problem was the failure of some Japanese plants to recruit and retain high salaried employees, experienced engineers, and middle-
level managers. There are many reasons that account for this problem. Limited promotion opportunities, limited authority, lack of incentive components in the compensation structure for professionals and a poor understanding on the part of American managers of the Japanese work rules – such as the work structure and the broad job classification systems – at Japanese firms may account for the turnover rates of US managers and engineers. This problem has prevented some Japanese firms from implementing the process-based quality control mechanism.

A third problem was the tension between labour and management in one Japanese-owned plant. In the 1989 visit, the plant was able to maintain co-operative labour and management relations. In 1991, due to the worsening business conditions in the USA and Japan, there emerged many conflicts between labour and Japanese management over work rules, job structure and compensation. These conflicts made it very hard for management and workers to concentrate on quality and productivity improvement.

A final problem is whether the current economic and business conditions in Japan and the rest of the world will allow Japanese companies to continue the lifetime employment practices and sustain their team-oriented human resource practices. Lay-offs by some large Japanese companies have already become a social reality in Japan. Since key quality control mechanism and team-based human resource polices are dependent on long-term employment practice, and the change in lifetime employment will surely affect all other management policies, it is interesting to follow how Japanese firms make adjustments and respond to changes.

In spite of these problems, the studies of Japanese plants in Tennessee have provided us with insights into the Japanese approach to quality management through the development of human resources. Under Japanese management, quality and people issues are never separated. Management takes the initiative and makes the commitment to their workers. Workers respond to management initiatives with high morale and commit themselves to achieving company goals. Japanese manufacturing firms in the US have been largely successful because they have smoothly integrated total quality management with team-based human resource practices. The two seemingly different issues in many US factories are thus closely linked and inseparable. US firms can learn two key practices from the Japanese, despite all the problems. First it is the emphasis Japan places on joint efforts and the commitment to it by all the parties involved in achieving high quality standards. Second, it is their conscious and constant improvement of managerial techniques that pursue total quality management through team-based human resource practices. These unique management practices have enabled Japanese manufacturing plants to remain formidable and highly competitive in the international market.

Notes
1. The Japanese construction equipment plant in Tennessee formed a 50:50 per cent joint venture with a large US construction company in 1988. The US plants of the joint venture have been downsizing due to deep recession in the industry.
2. One reason for using simple methods is the average low level of education of hourly employees hired locally. In one factory, for instance, 30 per cent of the hourly employees are functionally illiterate. As a result, the factory institutes special training programmes in improving English as well as technical skills.

References


