

# **Kanban-an Integrated JIT System**

## **1-0 INTRODUCTION**

Japanese are good at manufacturing. Just ask any global producers of automobiles, copiers, or personal electronics what happened in the 1980s. They will probably tell you how the Japanese captured a large share of the global-market by creating world-class standards in design, materials, and management. What is often overlooked is the attempt to understand how the Japanese industry succeeds at the services that support the manufacturing process (Krajewski et al, 1987: 40). Within the production field, the Kanban process is the most significant of these services.

The concept of time-based management is nothing new for managers outside of Japan and has been in practice for many years. However, the Kanban process involves more than just in time deliveries and inventory control. Briggs (1993: 29) notes that Kanban process components are the most 'exportable' of Japanese techniques, but the complete process itself has not yet been successfully adopted outside Japan.

## **1-1 THE ORGANIZATION OF THIS REPORT**

This report will focus on the interlinked components and features which constitute the Japanese Kanban process of time-based management. In addition, it will examine the potential for the successful implementation of the process into Australian manufacturing firms. Experience from the adoption of Kanban theories in North American manufacturers will serve as the foundation on which the Australian case is built upon.

## **2-0 THE JAPANESE KANBAN PROCESS- MORE THAN INTERNAL 'JUST IN TIME PRODUCTION' TECHNIQUES**

Most Japanese manufacturing companies view the making of a product as continuous-from design, manufacture, and distribution to sales and customer service. For many Japanese companies the heart of this process is the Kanban, a Japanese term for "visual record", which directly or indirectly drives much of the manufacturing organization. It was originally developed at Toyota in the 1950s as a way of managing material flow on the assembly line (Perelman, 1994: 85). Over the past three decades the Kanban process, which Bernstein (1984: 48) identifies as "a highly efficient and effective factory production system", has developed into an optimum manufacturing environment leading to global competitiveness.

The Japanese Kanban process of production is sometimes incorrectly described as a simple just-in-time management technique, a concept which attempts to maintain minimum inventory. The Japanese Kanban process involves more than fine tuning production and supplier scheduling systems, where inventories are minimized by supplying these when needed in production and work in progress is closely monitored. It also encourages; Industrial re-engineering, such as a 'module and cellular production'

system, and, Japanese human resources management, where team members are responsible for specific work elements and employees are encouraged to effectively participate in continuously improving Kanban processes within the Kaizen concept (Stainer, 1995: 11).

## **2-1 THE KANBAN**

The Japanese refer to Kanban as a simple parts-movement system that depends on cards and boxes/containers to take parts from one work station to another on a production line. Kanban stands for Kan- card, Ban- signal. The essence of the Kanban concept is that a supplier or the warehouse should only deliver components to the production line as and when they are needed, so that there is no storage in the production area. Within this system, workstations located along production lines only produce/deliver desired components when they receive a card and an empty container, indicating that more parts will be needed in production. In case of line interruptions, each work-station will only produce enough components to fill the container and then stop (Roos, 1992: 112). In addition, Kanban limits the amount of inventory in the process by acting as an authorization to produce more inventory. Since Kanban is a chain process in which orders flow from one process to another, the production or delivery of components are pulled to the production line. In contrast to the traditional forecast oriented method where parts are pushed to the line (Roos, 1992: 113).

The Kanban method described here appears to be very simple. However, this "visual record" procedure is only a sub-process in the Japanese Kanban management system.

### **2-1-1 SIMPLE VERSUS INTEGRATED KANBAN PROCESSES**

The Kanban process utilizes two different kinds of cards - transport Kanban and production Kanban. Both of the cards do not have to be used simultaneously in a production process.

The transport Kanban contains information from where the part/component originated and its destination. When only this card is used, it is known as a simple Kanban process. In this system components are ordered and produced according to a daily schedule. Roos (1992: 113) describes this system as "ordering a box when it is the only one left on line".

The production Kanban, on the other hand, outlines to what extent and when work has to be accomplished by a specific station on the production line (Roos, 1992: 113). Together with the transport Kanban, it is known as an integrated Kanban process. This system is often used between the corporation and its suppliers. Here, the corporation's transport Kanban is the card which regulates the supplier's production Kanban. The same amount of components are produced as used in production and the maximum stock level is determined by the number of cards that are in circulation. The number of cards in circulation can be determined by an algebraic formula (refer appendix 1).

### **2-1-2 EXAMPLE**

In the case of many manufacturing plants, the supplier is the warehouse and the customer is the assembly line. In this case, one box of components goes to the correct station at the assembly line at a time. When the box is empty, an operator takes it back to the warehouse, and this automatically triggers the delivery of the next box of components. Since only the transport Kanban is used, this example represents the application of the simple Kanban system.

Toyota of Japan has taken the example discussed above one step further. Here, certain components are directly supplied from suppliers to the production line. Stock levels are therefore kept low and factory overhead can be reduced. The supplier's work stations are regulated by the production Kanban, which in turn is regulated by the transportation Kanban from Toyota's production lines. The transport Kanban is simultaneously used internally between the warehouse and the production lines. This is an excellent example of the integrated Kanban system.

### **2-1-3 ADVANTAGES OF THE KANBAN PROCESS**

Roos (1992: 115) notes the following advantages of Kanban over the traditional push system:

- 1 A simple and understandable process
- 2 Provides quick and precise information
- 3 Low costs associated with the transfer of information
- 4 Provides quick response to changes
- 5 Limit of over-capacity in processes
- 6 Avoids overproduction
- 7 Is minimizing waste
- 8 Control can be maintained
- 9 Delegates responsibility to line workers

He further indicates that "Kanban represents an efficient tool to continuously rationalize the production process and find the source of problems" (Roos (1992: 115). Since the circulation of Kanban will stop if there is a production problem on line, it is easy to both spot and correct the problem instantaneously.

### **2-2 THE KANBAN PROCESS- MORE THAN INVENTORY CONTROL**

To managers outside of Japan, Kanban may look only like a pure production method having little or nothing to do with the surrounding environment. This is a fallacy. Instead, the concept takes form on the shop floor, in close interaction between the work force and management, and more importantly, involves both internal and external customers. Kupanhy (1995: 62) identifies Kanban as a production system which draws many of its elements from two primary sources: industrial re-engineering, and work force (Japanese) Kanban management.

## **2-3 INDUSTRIAL RE-ENGINEERING AND KANBAN**

Industrial re engineering which goes hand in hand with Kanban consists of elements such as:

- 1 Modular/cell production. Flow-of-products-oriented layout of processes and machines layout.
- 2 U-shaped production/processing lines
- 3 Total preventive maintenance
- 4 Mass production of mixed models

The interrelationship between the Kanban concept and industrial re-engineering is clear.

Modular/cell manufacturing, which is sometimes referred to as group technology involves organizing machinery so that related products can be manufactured in a continuous flow (Kupanhy, 1995: 62). Here, products flow smoothly from start to finish, parts do not sit waiting to be worked on, and forklift trucks do not travel kilometers to move parts and materials from one part of the plant to another. This can be contrasted to a typical production system, where machines are grouped by function and products move from function to function from one end of a facility to another and back again. This results in long waiting times between procedures. Kanban will not work effectively without efficient logistics systems and process-oriented plant layouts. Kanban controlled production and the Kanban itself must be able to flow smoothly between processes (Kupanhy, 1995: 63). Modular/cell manufacturing can be realized by U-shaped processing lines, which integrate the manufacturing process into a continuous flow and increase supply accessibility to the lines. It would be impossible to join different processes to form a U-line if processes are not integrated. In addition, Total Preventive Maintenance, which prevents machines from breaking down or malfunctioning during the production time, also contributes to the efficiency of Kanban.

Toyoda Gosei Co. advisor Taiichi Ohno, architect of the Toyota Kanban system believes that the real benefits of Kanban probably will not be realized until the auto industry moves into a mixed production mode in which modular production methods are employed (Schreffler, 1987: 74).

## **3-0 JAPANESE KANBAN PROCESS MANAGEMENT**

In addition to the industrial re-engineering concept of Kanban based management, the Kanban process indirectly focuses on the human factors of production. It involves; multi-machine manning working structure, standard operations, quality control circles, suggestions systems, and continuous improvement/Kaizen. All these concepts provide for the supportive environment necessary to implement the complete Kanban process. The secret of the Kanban's success is its requirement that each part of an organization be totally interdependent (Morris, 1992: 20).

Japanese-management-related elements of Kanban are methods that are either imported directly from or highly conditioned by Japanese management (Kupanhly 1995: 63). Included in that category are the following techniques which are interlinked:

- Breaking of administrative barriers (BAB) as achieved by the Kanban
- Team-Work, Quality Circles and Autonomation (decision by worker to stop the line)
- Continuous improvement
- Housekeeping

### **3-1 KANBAN FOCUSES ON THE INDIVIDUAL WITHIN THE TEAMWORK CONCEPT**

The Kanban places great emphasis on the individual within the team framework. Workers frequently have a great deal of input about the product they manufacture, and most companies using the Kanban provide lifetime employment (Eaton, 1995: 27). People who work in a factory using the Kanban are very important. Management and workers believe that productivity and quality comes from people rather than systems.

The Quality Circle (QC) concept is a crucial component of the Kanban system. QCs provide for dynamic centers where employees are able to discuss and find solutions to various problems within the team's boundaries of production (Eaton, 1995: 28). Within this framework, the Kanban process is run by workers who make a large percentage of the decisions traditionally made by supervisors and quality control inspectors. Morris (1995: 21) notes that it is often the people who are producing the product or supplying the service who are in the best position to make positive changes. In addition, modular and cellular production concepts increase the scope of the team's work. Such industrial re-engineering concepts encourages modular organization of work, where members of a team are responsible for the completion of any one stage in the production process (Briggs, 1992: 28). This further encourages multi-skilling which is achieved via job-rotation and on the job training procedures.

Traditional companies believe quality is costly, defects are caused by workers, and the minimum level of quality that can satisfy the customer is enough. Companies practicing the Kanban believe quality leads to lower costs, that systems cause most defects, and that quality can be improved within the Kaizen framework (Bernstein, 1984: 48).

The simplicity of the Kanban system supports Stoddard's argument that "It's organization, not hardware that needs to be changed. People want a high-tech solution, some wonderful

magic bullet." (quoted in Cook, 1984: 66) Kanban is not a magic bullet, it is rather an organizational shift towards decentralization of responsibility.

### **3-2 KANBAN AND KAIZEN**

Kaizen is the Japanese term for continuous improvement. "It is both a rigorous, scientific method using statistical quality control (SQC) and an adaptive framework of organizational values and beliefs that keep workers and management alike focused on zero defects."(Morris, 1995: 21) It is a philosophy of never being satisfied with what was accomplished last week or last year.

The Kaizen cycle has four steps:

- 1 Establish a plan to change whatever needs to be improved.
- 2 Carrying out changes on a small scale.
- 3 Observe the results,
- 4 Evaluate both the results and the process and determine what has been learned.

The link between Kaizen and the Kanban process is clear. Quality Circles within the team framework decentralize responsibility for improving processes. It is the teams responsibility to improve current systems and procedures, including the Kanban. Kanban, like any other management theory will improve with time, and it is the primary responsibility of the individual worker within the team to continuously improve it within the Kaizen model.

### **3-3 HOUSEKEEPING AND KANBAN**

In order to facilitate the logistic process of quickly moving material to numerous work stations on the production line, a clean and well organized environment is required. Roos (1992: 83) notes that such a workplace increases safety, employee well-being, and productivity. In addition to the duties directly related to working on the line, team members should be responsible for keeping their stations neat and clean and keeping tools in good condition. Production down time is often dedicated to housekeeping activities.

More importantly, the factory layout should encourage and ease the housekeeping process, which Toyota refers to as Siiton (Ettlie, 1994: 14). All movable items, such as material boxes should have dedicated positions on line indicated by symbols or lines on the ground. Kanban cards should be kept on in-going and outgoing racks.

### **3-4 THE IMPORTANCE OF THE KEIRETSU**

(Morgan et al. 1991) notes that the Keiretsu system ensures loyal suppliers and customers. Naturally, this is a crucial component to the Kanban process. Long-term relationships, technology transfer, and fixed production schedules increases dependence between suppliers and major manufactures, but also enhances mutual trust. In such an

environment, stock levels can be kept at minimum and Kanban can work at its optimum performance.

The savings realized through Kanban, however, are not necessarily passed on to (Japanese) suppliers. In fact, the suppliers encounter much of the cost for ensuring on-time delivery of precise quantities of components and materials. Yet few of these companies care to discuss the system's negatives. Their reluctance seems to be motivated by fear. Fear of doing or saying anything that might disrupt the close relationships they have developed with their customers (Cook 1984: 6).

## **4-0 THE APPLICABILITY OF THE JAPANESE JIT PROCESS IN AUSTRALIA**

As mentioned, the Kanban process is believed to be the most 'exportable' of all Japanese management theories (Briggs, 1992: 29). On the contrary, Taiichi Ohno, who set-up the Toyota Kanban system more than three decades ago, believes that Kanban may not be right for everybody in any nation (Schreffler, 1987: 74). Many factors have to be taken into consideration, including firm size, cultural differences, and the external dimension of a nation's business environment. This section will closely examine the applicability of implementing typical 'Japanese style' Kanban in Australian firms.

### **4-1 EXTERNAL CONCERNS**

The external business environment in Australia is very different from that of Japan. This is caused by a range of external forces, however, the Industrial Relation's structure, and geographic concerns are most applicable in this discussion.

#### **4-1-1 INDUSTRIAL RELATIONS**

The Industrial Relation's structure in Australia has been dominated by the adversarial relationship between the major unions, the state, and employers. In-house unions are not very common and Enterprise Bargaining has only recently been introduced. The Kanban process requires team-work and multi-skilling of employees. Presently, Demarcation barriers make it difficult for employers to introduce multi-skilling, job rotation practices, as well as the team-work concept. Furthermore, low morale at the work-place undermined by the adversarial relationship between workers and management impacts negatively upon "housekeeping" and related activities.

Perhaps more importantly, frequent industrial disputes make the integrated Kanban process very vulnerable. If a Supplier cannot guarantee on-time delivery of components, the corporation has to carry higher stock-levels to reduce the risk unscheduled production interruptions. High inventory levels translates into higher costs. However, the use of the simple Kanban process can still increase the efficiency and accuracy of the internal logistics process (Roos, 1992: 80).

#### **4-1-2 GEOGRAPHIC LIMITATIONS**

Roos (1992: 17) identifies one of the factors behind the Japanese success story as geographic proximity and that suppliers are often clustered around the major corporations. This significantly reduces logistics barriers and costs. The success of Integrated Kanban in Japan can be attributed to the proximity of main assembly plants to parts suppliers, "a characteristic of almost all Japanese industry due to the smallness of the nation" (Schreffler, 1987: 74).

Australia, on the other hand, has suppliers scattered all over the nation. This logistics barrier seriously undermines the effective implementation of an integrated Kanban process. Long lead-times of supplies and economies of scale factors in distribution increases the need for large safety stock levels. In-house manufacturing of components, as employed by several Japanese multinationals in Australia, represents an excellent way to employ a somewhat modified integrated Kanban system in this nation.

#### **4-2 LIMITED APPLICATION TO SMALL FIRMS**

Most Australian manufacturing firms are relatively small in comparison with their global competitors. Taiichi Ohno notes that small and medium-sized firms may find the prospect of running delivery trucks 10 or 15 times each day cost prohibitive (Schreffler, 1987: 74). Furthermore, manufacturers that do not have to make immediate changes in their production plans probably are wise not to adopt it (Sandras et al, 1990: 53). Furthermore, In the absence of an Australian Keiretsu concept, it is difficult for small firms to develop favorable relationships with suppliers. An integrated Kanban system is therefore extremely difficult to achieve.

A simple Kanban system, on the other hand, can reduce costs by smoothing the production process and thereby reduce excess inventories. It can also enhance quality and reduce work in process. Significant savings, however, can only be achieved by implementing an integrated Kanban process (Cook, 1984: 67). Likewise, Kanban works best in a large scale mixed-production environment. Most small companies specialize in a very narrow product range on a small scale.

#### **4-3 CULTURAL DIFFERENCES**

Cultural barriers may hinder the implementation of Kanban. Briggs notes that "the success of module production is dependent on a social organization the production process intended to make workers feel 'obligated' to contribute to the economic performance of the enterprise" (1992: 28). The Japanese positive attitude towards labor, reflected by longer hours worked per week and shorter vacations do not exist to the same extent in the 'western' world (Japanese industrial workers average 42 hours per week, while workers in Germany and in the USA average 38.3) (Briggs, 1992: 28).

One of the biggest problems encountered by Toyota in Kentucky, USA was the concept of Kaizen in improving Kanban processes. Since people liked things the way they were, change was not comfortable. Employees found it very difficult to understand why Toyota wanted to keep changing, moving machines and racks continually. They asked, "Don't

you guys know how to do this? I thought you were experts! Aren't we done yet?" (Purchasing, 1992: 63). In fact, a couple of employees even left, not caring for all the change.

Within the concept of Kanban teamwork, Graham (1995: 35), observed workers at the Subaru-Isuzu Automotive plant in Tennessee. Graham encountered that under non disruptive conditions, it was a matter of pride for a team member to complete his or her share of the work. However, evidence of resistance emerged in various individual and collective forms. Individual resistance was expressed through silent protest when workers refused to participate in company rituals. For instance, team members protested unfair company policies by refusing to participate in team meetings (Graham, 1995: 37). At the team and group levels, resistance took the form of direct confrontation when workers refused management requests. Some collective resistance was also expressed through jokes and humor, team members making light of kaizen. When the line stopped, a team member might say, "I guess they kaizened that!" (Graham, 1995: 39). Sabotage even occurred when workers discovered how to stop the assembly line without management tracing their location. These signs of resistance clearly demonstrate lack of commitment to the company, which may seriously undermine the success of implementing the Kanban process (Graham, 1995: 41).

Yet another major cultural difference that may have negative impact on implementing the Kanban process in Australia is the adversary relationship between employees and management. Australia is a nation where people work because they are forced to. On the contrary, Japan is a country where workers often refer to their company as uchi-home. Here, "Lifetime" employment at the same large firm has been a national ideal and a reality for about one fifth of the work force (Schonberger, 1993: 37).

## **5-0 'IMITATING YOUR COMPETITOR MAY BE COMPETITIVE SUICIDE'**

Stainer (1995: 7) warns 'western' managers that, "by imitating yesterday's Japanese model, they are missing today's challenge." The same phenomenon may apply to imitating the Kanban process. Once you have achieved a sensible balance of just-in-time arrivals, others will catch up, and no further gains are possible in that dimension. In addition, you are forced to further develop and 'fit' Kanban to the organization.

The simplicity of Kanban alone, work in favor of it. Simple Kanban, which can be internally implemented everywhere has the potential of increasing manufacturing efficiencies. Naturally, obstacles triggered by cultural differences and logistics barriers have to be overcome for a successful implementation. The Integrated Kanban, on the contrary, is more complicated to implement successfully. In the case of Australia, the absence of the Kieretsu, poor Industrial Relations, the adverse relationship between management and workers, and geographic factors seriously undermine the potential for such an implementation. However, several Japanese subsidiaries in Australia have employed in-house production of components, in order to fit the somewhat modified integrated Kanban process into the Australian environment.

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