

## 7.3: Just-In-Time (JIT) Systems

Just-in-time (JIT) is a management philosophy that originated in the 1970s. Taiichi Ohno is credited with developing JIT and perfecting it for Toyota's manufacturing plants in Japan. The main goal of JIT is to eliminate anything that does not add value from the customer's perspective. Non-value-added activities are referred to as "waste" in JIT. Examples of waste include:

- Overproduction beyond what is needed to satisfy immediate demand
- Waiting time (work-in-process, customer waiting)
- Unnecessary transportation (material handling, customer travel through a facility, etc.)
- Processing waste (yield rates, start-up costs)
- Inventory storage waste (space, deterioration, obsolescence, etc.)
- Unnecessary motion and activity (waste in work techniques, etc.)
- Waste from product and service defects (rework, scrap, warranty, etc.)

There are three essential elements that contribute to the successful practice of JIT:

1. JIT manufacturing principles
2. Total Quality Management (TQM)
3. Employee empowerment

### JIT Manufacturing Principles

There are several JIT principles that are applied in a manufacturing setting. The following are some of these main principles:

- Inventory reduction to expose waste
- Use of a "demand-pull" production system
- Quick setups to reduce lot sizes
- Flexible resources
- Cellular layouts

#### Inventory Reduction to Expose Waste

Inventory covers up a lot of wasteful practices (poor equipment, weak vendors, bad quality, long setup times, etc.). By gradually lowering inventory, the weaknesses of the production system can be revealed and addressed one by one. Machines can be replaced or better maintained, vendors quality and delivery can be improved, machine setup procedures can be streamlined, quality practices can be implemented, and labor and equipment can be laid out more efficiently. These improvements allow the organization to operate with less inventory, less costs, and faster response times in meeting customer needs.

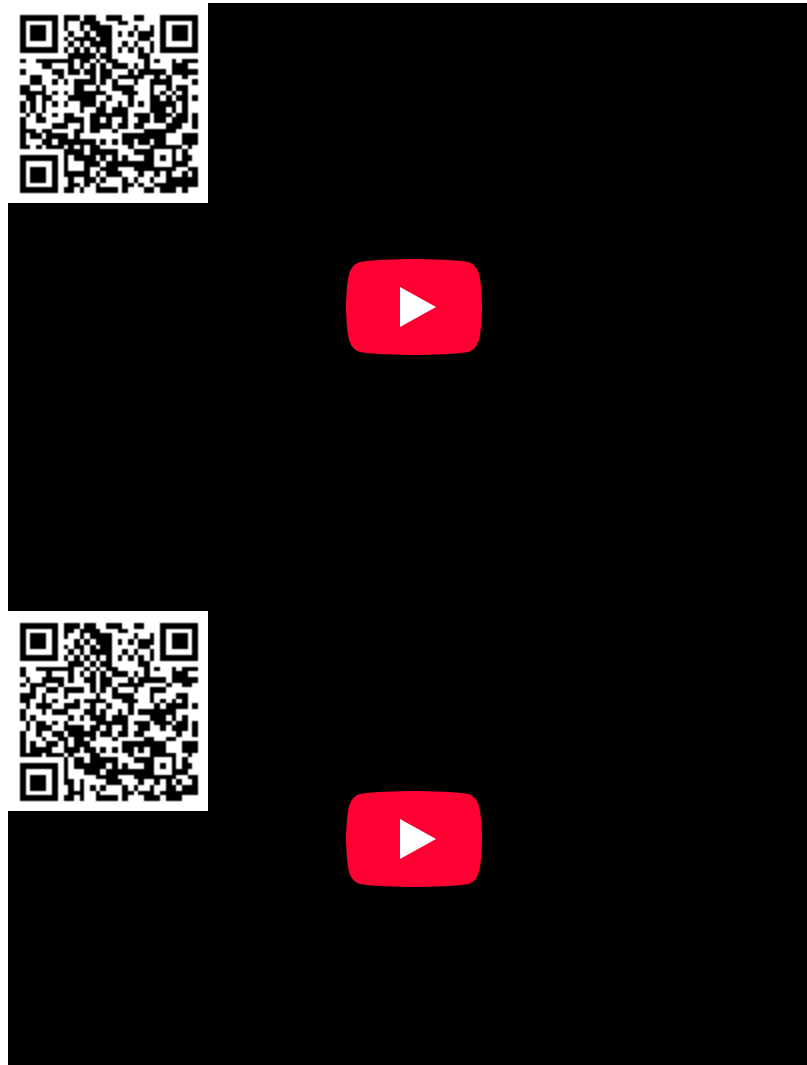
#### Demand-pull Production System

The traditional approach to manufacturing management promotes a strong focus on machine and labor utilization. The view was that if managers make sure that workers and machines are always busy, then surely, the factory will be productive and efficient. This approach is called the "push" system of manufacturing, where raw material and work-in-process are continuously pushed through the factory in the pursuit of high utilization. The problem with this approach is that it usually produces high levels of inventories, long lead times, overtime costs, high levels of potential rework, and workers who are competing with one another rather than working cooperatively.

In contrast to the push system, JIT applies a "demand-pull" system that operates on the rule that work should flow to a work center only if that work center needs more work. If a work center is already occupied with work activity, the upstream work center should stop production until the downstream work center communicates a need for more material. The emphasis on maintaining high utilization is removed in a JIT environment. The focus of a JIT environment is on addressing the challenges that affect the overall effectiveness of the factory in meeting its strategic goals (setup time reduction, quality improvement, enhanced production techniques, waste elimination, etc.), rather than allowing excess inventory to cover up inefficiencies that reduce the factory's competitiveness.

One of the tools that is used in JIT systems to facilitate the pull system and coordinate activities (such as picking up a new raw material or work-in-process or the production itself) between different workstations is called *Kanban*. *Kanban* is a ticket or signal that is given from one part of the process to another part to let them know that they are allowed to start their next activity. This supports the very concept of pull production and avoiding the waste by not doing things at the time that they are not needed.

*Kanban* is also a signboard which is used to organize what needs to be done, what is under progress, and what is done. This aspect of *Kanban* has been used in Agile workflow management systems. Watch the following videos to get a better sense of how the *Kanban* system works:



### Quick Setups to Reduce Lot Sizes

The longer it takes, and the more expensive it is to set up equipment and labor to produce an item, the greater the quantity of items that have to be produced in a given production run. Traditional production management philosophy promoted the notion that long production runs of the same item were the key to driving down unit costs. The problem was that large production runs created large quantities of WIP and finished goods inventory that far exceeded the demand. These items would consequently cause high levels of inventory costs, long lead times, high potential rework, low flexibility in responding to customer needs, etc.

Driving down setup costs and setup times are key to dramatically improving factory competitiveness in a JIT environment. In the 1980s, the 3M company converted a factory that made a few adhesive products in long production runs into a factory that made over 500 adhesive products in small production runs. To keep unit production costs under control, 3M studied the setups on its coating machines. Since the cost of chemical waste disposal was a major part of the cost of changing over a coating machine to make another product, 3M shortened the length of hoses that needed purging and redesigned the shape of the adhesive solution holding pan on the coating machine to be shallower. 3M also used quick-connect devices, disposable filters, and work teams to speed up setups. The result was that 3M could maintain low unit costs on its coating machines while producing small lots of hundreds of products to meet market demand quickly.

### Flexible Resources

The enemy of JIT is uncertainty. A JIT environment thrives on predictability in customer demand, production processes, suppliers, and workers. Of course, uncertainty cannot be completely eliminated in most organizational environments.

The defense against uncertainty that cannot be driven out is to implement flexible resources that can adapt easily to changing circumstances. General-purpose, moveable equipment that can fulfill a wide variety of production requirements is one way to improve flexibility. For example, drilling machines with quick-change bits, which can be wheeled into position to form new work cells, allow the factory to maximize efficiency while producing exactly what is needed to satisfy immediate demand. Another example is Toyota's use of paint canisters that attach to paint sprayers. Any car can be painted any color without having to purge hoses in switching from one color to another.

Multifunctional workers are another way to bring flexibility to the work environment. At Honeywell's heating and cooling controls plant, workers are trained to operate all the machines on their work line. The flexibility that comes from multifunctional workers changes the nature of how work gets done. Instead of workers being trained on one machine and working independently of one another, multifunctional workers have a "big picture" view of the production line, where every worker understands all aspects of the line and how to work together to meet quality and schedule goals regardless of the circumstances.

### Cellular Flow Layouts

Cellular layouts promote JIT goals by featuring unidirectional product flows, high visibility, and fast throughput times. Workers with multifunctional skills are assigned to individual cells and have responsibility and control of the products they produce. Workers in a cell environment tend to have a greater sense of ownership and pride in their work because they have a "big picture" view of the product as it is converted from raw material to a finished good. This deeper understanding of the production process increases the opportunities for workers to contribute ideas for process improvements.

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