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Productivity Methodologies, Tools, and Techniques

Just-in-time



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The term “just-in-time (JIT)” was created by Kiichiro Toyoda, founder of Toyota Motor Company, and is one of the most important guiding principles in the Toyota Production System. It implies that only the required products or parts should be made and supplied at the required time and in the required amount, which can reduce production lead times with high flexibility and avoid overproduction and unnecessary inventory of products or work in progress. In other words, JIT is “customer pull”-based manufacturing and therefore can achieve higher service levels to customers in terms of quality, cost, and delivery. JIT is also an important guiding principle for lean manufacturing implementation in various manufacturing industries.

The practical implementation of JIT includes the following activities:

- ▶ Establishment of flow manufacturing;
- ▶ Quick changeover of the equipment and parts in case of multiple model production using the same manufacturing line; and
- ▶ Implementation of a JIT parts supply system.

Flow manufacturing deals with actual manufacturing processes for the making of products or parts. In principle, products or parts go through the manufacturing process one by one (single-piece flow) from the first operation through the final one and are made ready for the customer, which minimizes the production lead time and work in progress in between the process steps. Flow manufacturing systems work based on the relationship between “takt time,” the pace of manufacturing according to the customer’s requirements, and “cycle time,” the unique time needed to process one piece at each step. Once the process steps for the production, takt time, and cycle time of each step are given, it is possible to define how the manufacturing system functions, including estimation of the required number of operators (Figure), assignment of tasks to each operator, and layout.

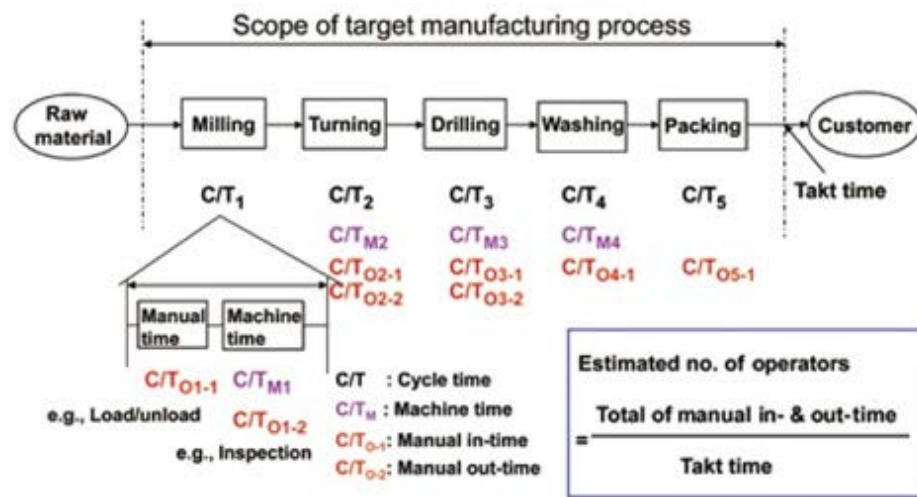


Figure. Driving mechanism of flow manufacturing.

When different models of parts or products are produced in the same manufacturing process, in order to reduce the lead time and inventory of parts or products and to cope flexibly with customer requirements, production lot size must be reduced, which requires a quick changeover of the equipment, especially in part production using machine tools. The essence of changeover is to return the settings of machines to the identical position at which the same product was produced previously. Thus a method for remembering the identical position for every changeover and being able to set the machines to the correct positions are crucial. Also, categorizing changeover activities into "in-time activities" that must be done while machines are stopped and "out-time activities" that can be done while machines continue to turn out products (e.g., preparation of tools) is another important effort because changeover time is a period for in-time activities. The ability to reset machines accurately and the categorization of changeover activities contribute to rapid changeovers of 10 minutes or less.

A JIT parts supply system is especially effective in assembly operations in which varieties of in-house manufactured and/or outsourced parts are required. It allows workers to maintain neatness on the assembly line and in its surroundings, enhances assembly efficiency because of convenient handling of parts by operators, and ensures that the necessary parts are available while minimizing unnecessary inventory. Furthermore, through proper use of information technology, the administrative costs for part purchasing and logistics can be reduced.

Practical mechanisms applied in JIT parts supply typically include the kanban system, two-bin system, sequence supply, and kit parts supply. The kanban system is for medium- to high-cost parts that need to be supplied frequently with a short supply lead time. The two-bin system is for low-cost parts that need to be supplied frequently with a short supply lead time. Sequence supply is for bulky and heavy parts to be provided according to the sequence in which they are used on the assembly line. Kit parts supply involves providing a kit of parts for assembly as a set for each product in a parts box or on a trolley that moves with the products along the assembly line. It is important to keep in mind that these mechanisms assume stable parts requirements with small fluctuation. In addition, the parts supplied using the above JIT mechanisms must be defect free.



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