Online Course Manual

By Craig Pence

Module 12

Table of Contents

Instructions:

Click on any of the underlined titles in the table of contents to be directed to that section of the module. Click on the <**back**> symbol to return to the table of contents. Click on underlined words to be linked to the site that is referenced.

Module 12 Summary

I. Just-in-Time Inventory Control Concepts

A. Competitive pressures from foreign manufacturers have led to the creation of a new manufacturing environment in the United States. Production methods and organization structures have changed in order to improve efficiency and reduce costs, and these changes have resulted in new information needs and, therefore, new accounting and record keeping methods.

B. **Just-in-Time (*JIT*)** inventory systems lie at the heart of the new manufacturing environment.

1. Under *JIT*, products are manufactured when orders are received for them. Thus, JIT is characterized by "***demand-pull***" (or "*pull-through*") production.
2. Since labor, materials, and overhead costs are not incurred unless needed, waste is reduced and efficiency is improved.
3. Because products are manufactured as orders are received, the workers and the machinery on the production floor must be able to rapidly shift from the production of one item to the production of another, setting up and operating the machines needed to make the new item. This is called the concept of ***continuous production flow***.
4. A continuous production flow requires that workers be highly trained and given the authority to make many decisions that were once reserved for supervisors. It also requires changes in ***plant layout***, moving machines closer together to allow a single worker to more efficiently operate them, thereby reducing ***lead time*** (also called ***throughput time***).
5. Plant layouts may be ***product-oriented*** (organized around the production of specific products) or ***process-oriented*** (organized around specific processes).
6. Since production of an item occurs in response to a customer's order and then switches to the production of different items to fill other customers' orders, it is important that defects be eliminated from the production run to ensure the customer's satisfaction (and to reduce expenses). Therefore, JIT systems incorporate *total quality management (TQM)* philosophies in their design, the goal being to eliminate defects entirely while shortening throughput time.
7. The use of robotics has greatly improved efficiency and production quality in JIT systems, and will be adopted more and more heavily in the future due to the competitive advantage it provides.

<back>

C. Management practices and attitudes have changed in order to accommodate the new manufacturing environment, and accounting reports must give managers the information they need to manage effectively in JIT/TQM production systems.

Changing information needs involve two key areas:

1. Deemphasizing labor hours and labor cost information
   a. Traditionally, production supervisors have been concerned with supervising workers, the goal being to produce as much output per direct labor hour as possible. The emphasis was placed upon *productivity* (output per hour worked), and accounting reports reflected this emphasis.
   b. In a JIT/TQM system, characterized by fewer and more highly trained workers making critical decisions previously reserved for supervisors, the goal is *reducing throughput time while improving quality*. In these systems, the decision-makers who need the information and the information they need are different from those assumed in the traditional model. In this case accounting reports must emphasize processing time per unit rather than labor time per unit.
2. Deemphasizing inventory valuation information
   a. Traditionally, manufacturing accounting reports focused upon accurately determining the cost of the inventories of produced goods and the number of goods in inventory. The emphasis was placed upon inventory valuation with little regard for inventory control (managing inventory levels).
   b. In a JIT/TQM system inventories are kept at minimum levels or eliminated entirely, so inventory valuation is not a major issue. Instead, inventory control is critical and accounting reports must provide information that is useful in assessing inventory turnover and inventory levels.

<back>

D. ***Concepts underlying JIT production systems*** include simplifying processes and procedures to improve efficiency; maintaining and improving product quality; producing goods only when orders are received to reduce inventories and control costs; developing a skilled and flexible workforce; and minimizing nonvalue-added activities and functions (those that do not contribute directly to the production of the good or service). To implement a JIT operating system, the company must:

1. Minimize inventory levels, generating cost savings from the elimination of storage space, handling and storage costs, and the reduced risk of losses from inventory obsolescence.
2. Develop a *pull-through* production system (one in which production occurs only in response to customer's order) as opposed to the traditional *push-through* system (in which production is done in large batches with unsold inventories stored in warehouses).
3. Purchase high-quality materials in small lots from reliable suppliers in order to ensure customer satisfaction and to reduce the costs of carrying large materials inventory balances.

4. Be able to perform machine setups frequently since production will occur in small lots to fill the orders of individual customers. It is therefore necessary to complete setups quickly and efficiently. This is facilitated by the creation of flexible manufacturing ***work cells*** and the development of a ***multi-skilled, cross-trained work force***.
   a. ***Work cells*** are clusters of equipment and workers that can work on "families" of similar products. This differs from traditional manufacturing processes in which departments are dedicated to individual processes or products and can only be shifted to other uses after extensive modification.
   b. ***Cross-trained workers*** in work cells are capable of switching from the production of one product to another efficiently and properly. This requires that the worker be aware of the processes that must be applied with each product, is capable of doing machine setups, and can perform quality control measures as the goods are manufactured. This differs from the traditional view of workers as machine operators who specialize in a single operation and have no need of other skills or an understanding of the manufacturing process.
5. Be able to quickly produce goods to the customer's satisfaction in time to fill the order. Therefore, detecting defects and quickly correcting the problems that cause them is essential. A commitment to *quality control* ensures that quality products are manufactured with minimal waste and at a low cost.
6. Emphasize preventive maintenance measures as an important component of efficient production and quality control. When possible, the operator of the machine performs routine maintenance procedures during slack times when the machine is not needed.
7. Provide for *continuous improvement* of the production process by encouraging workers to make suggestions for improvements in their work cells and sharing with them responsibility for the quality of the products manufactured in their work cells and the time required for their production.

<back>

E. The ***Costs of Quality*** can be divided into four types:
1. ***Prevention Costs*** refer to costs incurred in order to *prevent* defects from occurring. This includes preventive maintenance, proper employee training, purchase of quality materials, and so on.
2. ***Appraisal Costs*** relate to inspection and testing in order to detect flaws and assure quality in the finished good. When flaws are caught early in the production process, steps may be taken promptly to correct the problem before other production is ruined and before the defective units are produced further.
3. ***Internal Failure Costs*** refer to the cost of reworking or discarding defective goods prior to their delivery to the customer.

4. ***External Failure Costs*** refer to the cost of reworking or replacing defects under warranty contracts after they are delivered to the customer. Among them are the costs associated with displeasing the customer.

II. JIT Compared with Traditional Manufacturing Processes.

A. JIT and traditional manufacturing processes differ in regard to their approaches toward (1) managing product flow and (2) designing plant layout.

1. ***Product flow*** refers to the route taken by goods as they move through the production process and the activities that are undertaken during the production process.

   a. ***Value-added activities*** are those that add cost to the product but also add value to the product from the customer's point of view. That is, any activity that results in a change in the product that a customer would notice and that would cause the customer to be willing to pay more for the product is a value-adding activity.

      1. Examples would be milling, assembly, painting and packaging.
      2. Prevention and Appraisal costs (discussed in the section above) are each value-added costs.

   b. ***Nonvalue-added activities*** are related to production, but are not necessary in order to complete the product and please the customer. They result from errors, break-downs, inefficiencies and accidents.

      1. Examples would be wasting materials due to errors in machine setup, damage to goods due to accidents in their movement from work cell to work cell, reworking defective production to bring them into specification, and equipment repairs due to parts failures. Since the customer will not be willing to pay more for the product after these types of activities are performed, then they are nonvalue-adding activities.
      2. Internal and External Failure costs (discussed in the section above) are each nonvalue-added costs.

Example:
To illustrate the differences between value-added and nonvalue-added activities, consider the activities required in manufacturing a baseball bat. Turning a block of wood on a lathe to make a baseball bat is a value-adding activity, since the customer would be willing to pay more for the shaped wood than the block of wood. Varnishing the bat is a value-adding activity since the customer would pay more for a finished bat than an unfinished bat. However, re-milling completed bats to meet production tolerances, disposing of misshapen bats that do not meet specifications, replacing bearings in the lathe because they were improperly lubricated -- these are all nonvalue-adding activities, since the customer will not pay more for the baseball bat if these activities are

performed than he or she will if they are not.

c. In a JIT environment, the company's goal is to eliminate all nonvalue-added activities and to make as efficient as possible the value-added activities. The process of continually striving to eliminate nonvalue-adding activities and improve value-added activities is termed ***continuous improvement***.

d. The time frames involved in the production flow can be classified as follows:

   1. ***Processing time*** is the time spent actually working on the goods in question. This is a *value-added* activity.
   2. ***Inspection time*** refers to the time spent inspecting production to maintain quality and identify equipment problems. This is a *value-added* activity.
   3. ***Moving time*** is the time spent moving goods from work station to work station. This is a *nonvalue-added* activity.
   4. ***Queue time*** refers to the time the goods spend awaiting attention once they reach the workstation. This is a *nonvalue-added* activity.
   5. ***Storage time*** is the time the goods spend being held in materials, work-in-process, and finished goods inventories before they are delivered to the customer. This is a *nonvalue-added* activity.

2. ***Plant layout*** refers to the way that machines and workstations are arranged on the plant floor.

   a. Traditionally, plants were organized by production process, with machinery grouped by function in departments that specialized in a single type of operation. Goods were moved from department to department until completed.

   b. Inspection time, moving time, queue time, and storage time requirements are considerable with this kind of plant layout, however it was thought that this specialization allowed the company to produce goods in large quantities at lower labor and machine costs.

   c. Modern day companies adopting JIT production processes have found that the costs associated with nonvalue-added activities are greater than the labor and machine cost savings produced through departmental specialization.

   d. In order to minimize nonvalue-added activities, it is necessary to organize production in work cells, areas in which the goods are often taken all the way from raw materials to fully completed units. This allows the firm to eliminate moving time and queue time, and, by only producing goods that the customer has ordered and by having the worker provide quality control, minimizes inspection time and storage time.

e. Flexible manufacturing systems (FMS) are often employed in JIT environments. These are computerized machine operations that are often capable of fully completing units on a continuous basis without the assistance of a worker.

B. To summarize, traditional manufacturing is characterized by many nonvalue-added activities while, in contrast***, the goal in a JIT environment is to eliminate all nonvalue-added activities.***

<back>

III. Accounting Systems in JIT Environments.

A. In our discussions to date, we have used direct labor cost or direct labor hours to apply indirect overhead costs to production. In a JIT environment, characterized by increased automation and reduced labor time, direct labor hours are no longer an appropriate basis upon which to assign these costs for the following reasons:

1. Traditional methods of accounting for manufacturing operations have relied upon a strong relationship between direct labor hours and the units produced in order to assign overhead costs to the units produced. JIT has changed the relationship between cost behavior and many manufacturing activities, including in particular labor time.
2. Machine hours are normally more directly related to cost in a JIT system than labor hours.
3. Automation and computer-controlled operations make it easy to gather data about machine usage, in turn making it feasible to use machine hours and other measures rather than labor hours to assign overhead costs to production.

B. When process costing is applied in JIT systems, the conversion costs (direct labor and overhead costs) and the materials costs *incurred within a work center* (a work cell, department, or other unit) as a result of processing activities are charged to the work center. The account used is identical in concept to the Work-in-Process account, but is called ***Raw and In Process Inventory***. The other overhead costs that arise from inspection, moving, queuing, and storage activities *outside the work center* are debited to a Factory Overhead Account. Under a JIT system, these costs should be small in amount since nonvalue-adding activities are minimized.

Raw In Process Inventory	
Debited for Materials, Direct Labor, and Overhead costs incurred *within* the specific work cell.	

Factory Overhead	
Debited for OH costs arising from inspection, moving, queuing, and storage activities *outside* the individual work cells	

1. The *work order*, a detailed document used in traditional manufacturing operations to keep track of direct labor hours in each production process, is eliminated in a JIT/FMS system since (1) labor costs are no longer a predominant portion of total manufacturing cost and (2) direct labor hours are not used to apply overhead.
2. In JIT systems, machine hours or throughput time (the time required to move a unit of production through the entire production process) are more appropriate bases to use to apply overhead costs.
3. In JIT systems, many overhead costs that were previously treated as plant-wide indirect costs can now be traced directly to the work cell and recorded in the *Raw and In Process Inventory* account as part of the direct conversion cost incurred within the cell.
    a. These include repairs, maintenance, materials handling, supplies, utilities, supervision, and depreciation.
    b. Other indirect overhead costs that must be recorded in the Factory Overhead account and allocated to the work cell include plant-wide insurance, property taxes, and general building occupancy costs.

C. Other changes in management accounting have been caused by JIT and automation. Instead of focusing upon the *details* of operations (a *micro* view), managers in JIT environments are concerned with the *overall* operation of the production process (a *macro* view) and accounting reports must reflect this macro orientation.
1. Traditionally, management accounting reports emphasized the labor, materials, and overhead costs incurred in each step of the production process, with the goal being the minimizing of the *per unit* costs of production.
2. In JIT systems management information needs change, and accounting reports must reflect a broader view of operations. The overall goal is the production of a quality product in a timely manner to ensure the satisfaction of the customer, and profitability is achieved by minimizing nonvalue-added activities and improving throughput time. It is information about these activities that must now be reported to managers.

D. Because of the *macro*-oriented approach taken by management accountants in JIT environments, ***nonfinancial data*** must be reported *in addition* to the financial data that comprise traditional accounting reports. Examples include analyses of time requirements for storage, queuing, and inspection time within the work cell, and suggestions for improvements.

E. Traditional management accounting projections and performance reports are based upon *normal capacity*. In JIT environments, the goal is the elimination of *all* nonvalue-added activities. Therefore, the standard used in JIT systems is *theoretical capacity* (the output that could be achieved in the period if *all* nonvalue-added activity time were eliminated), an ideal that probably cannot be attained. However, in a JIT environment, characterized by a commitment to continuous improvement, the goal is to operate as close to the ideal as possible, so the standard is often set at the ideal level.

<back>

Note to the student:
The concept of *Total Quality Management* is not used in the text, but the term is very commonly encountered in the business world. Since you should be familiar with the concept, is is introduced and defined in the section below.

IV. **Total Quality Management (TQM)** is the integration of efforts in all business functions to achieve the greatest overall quality in the firm's products and/or services. To implement a TQM environment, it is necessary to identify and manage the ***costs of quality*** and to establish procedures that ensure for ***continuous improvement*** of production processes and products.

A. The *costs of quality* are composed of two types, the ***costs of conformance*** and the ***costs of noncomformance***.

1. The ***cost of conformance*** is the cost of ensuring that a successful, high quality product or service is produced. The costs of conformance are made up of:
   a. ***Prevention costs*** -- the costs of preventing defects.
   b. ***Appraisal costs*** -- the costs of measuring and evaluating products, processes and services to ensure adherence to quality standards.
2. The ***cost of nonconformance*** is the cost of correcting defects in order to produce an acceptable product or service. The costs of nonconformance are made up of:
   a. ***Internal failure costs*** -- the costs of correcting defects discovered before products are delivered to the customer.
   b. ***External failure costs*** -- the costs of correcting defects discovered after products are delivered to the customer.
3. High costs of conformance usually result in low costs of nonconformance, and vice-versa. Since it is management's responsibility to control the costs of quality, the incurrence of high conformance costs may often be justified as long as the nonconformance cost savings are large enough to reduce the overall cost of quality.
4. Some of the measures that are used to enhance quality are:
   a. CAD (computer-aided design) systems incorporate computer programs that are used to detect design flaws before production begins.
   b. Materials vendors are vital in maintaining quality in JIT environments, both through the provision of high quality materials that reduce product defects and (often) through their participation in the design of products and advice regarding production methods.
   c. Automated machinery in flexible manufacturing systems can be set up to provide in-process controls that form a continuous inspection system. Instead of identifying defects at established inspection

points in the production process, these machines can monitor production on a continuous basis to provide for quality control.

d. Customer acceptance measures may be accumulated to assess the customer's satisfaction with the product and identify problem areas. These measures may take the form of data regarding product returns and acceptance rates, customer complaints, and warranty claim information.

<back>

B. In order to foster an environment characterized by continuous improvement, an evaluation system must be created that will alert management to quality control problems early enough to prevent defective goods or services from reaching the customer. This may involve the use of ***cost of quality reports***, ***Pareto charts***, and other types of analyses that may be used to evaluate quality controls, identify and control nonvalue-added activities, and measure overall effectiveness. Data can be provided from the following kinds of sources:

1. Reports concerning customer satisfaction should focus upon the number and types of customer complaints and the number of sales returns and allowances and their causes.
2. Product line profitability reports should focus upon the costs of manufacturing the product, selling expenses, and delivery costs.
3. Product contribution reports should identify not only the traditional contribution margin information discussed above, but also identify and incorporate traceable fixed costs into the analysis of product profitability.
4. Operating effectiveness reporting should concentrate upon the reduction of time spent with nonvalue-adding activities, and upon the control of value-adding activities. The information needs in this regard are concerned with inventory turnover, monitoring throughput time, machine downtime, waste control, and so on.
5. Asset management reports should focus upon machine maintenance, downtime and its causes, manufacturing capacity, and space utilization.

C. The quality of the services provided by a service firm may be measured and analyzed in the same manner as product quality.

<back>

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