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THE EFFECT AND IMPLEMENTATION OF JUST-IN-TIME SYSTEM FROM A COST AND MANAGEMENT ACCOUNTING PERSPECTIVE

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ABSTRACT
In today's highly competitive work environment, companies have to find ways to be able to compete effectively with their competitors. They have to find ways to reduce cost, improve quality, and increase customer satisfaction. Just-In-Time production system is among the tools that companies can use to become competitive. The implementation of Just-In-Time manufacturing system will provide companies with competitive advantage; however the system requires companies to change radically. Cost accounting is among the areas that are affected by the implementation of Just-in-Time production system. The aim of this paper is to discuss the effects of Just-in-Time production system from cost and management accounting perspective.

Key words: Just in time, cost accounting, accounting change, new manufacturing environment.

ÖZET
Günümüzün yüksek rekabet altındaki çalışma ortamlarında, işletmeler daha iyi rekabet edebilmek için çeşitli yollar bulmak zorundadırlar. İşletmeler maliyetleri düşürmek, kaliteyi ve müşteri tatminini artırmak için birtakım arayışlar içinde olmaktadırlar. Tam Zamanında Üretim (Just in Time) Sistemi (TZÜ) işletmelerin rekabet gücünü artırabilecek yöntemler arasında bulunmaktadır. TZÜ Sisteminin bir işletmede yerleştirilmesi, o işletmenin daha iyi rekabet edebilmesini sağlamakla birlikte, sistem, o işletmede ciddi değişiklikler de gerektirmektedir. Örneğin, maliyet muhasebesi TZÜ Sisteminin kullanılmasından en çok etkilenen alanlardan biridir. Bu çalışmanın amacı, TZÜ Sisteminin maliyet ve yönetim muhasebesi açısından etkilerini tartışmaktır.

Anahtar Kelimeler: Sıfır stokla üretim (Just in Time), muhasebe değişimi, yeni üretim ortamı.

Introduction

In an intense competitive environment, companies try to find ways to be able become competitive. Just-in-Time (JIT) production system has been used as a response to increasing competition. Taicchi Ohno initiated the basic idea of JIT production system, and Toyota Company, which needed to produce different types of cars by using the same production process, first used JIT production system. After the use by Toyota Company, the system was employed by other Japanese companies (Yükçü, 2000:18). The JIT production system then became widespread in many companies in Japan in the late 1970s, and began to be known abroad (Yui, 1997:1).

Today JIT system is well known throughout the world. The reason why the system is so popular today is a result of its advantages realized by the manufacturing companies. For instance, the use of JIT production system leads to better production quality, less inventory, and shorter product lead times (Swenson and Cassidy, 1993:39). The use of JIT production system, therefore, increases customer satisfaction by providing them with high-quality product on time. But these gains require some changes. When a company implements JIT production system, major physical, psychological, and organizational changes occur in the organization's work environment. The company implementing JIT production system develops closer relationships with suppliers; significantly reduces its inventories; and implements simplified manufacturing procedures. The JIT concept also helps reduce the number and type of the accounts used in journal and ledger entries. The concept simplifies accounting records and reduces accounting costs. On the other hand, a reduction in the level of all kind of inventories will minimize inventory-related costs and significantly eliminate inventory-related procedures. The implementation of JIT production system is, therefore, of concern to management accountants. They must modify their cost accounting procedures when changes in manufacturing processes cause changes in the demand for accounting information (Lynn and Adrian, 1991:1). For example, as finished goods are sold immediately, there is no need to transfer the finished products to finished-goods inventory. Instead they can be transferred to the cost of goods sold account directly when sale takes place.

The purpose of this paper is to discuss the changes that a JIT production system causes in the cost accounting system employed. In other words, changes in cost accounting procedures that should be made during and after the JIT production system is implemented will be discussed in this paper. In this sense, this paper will be divided into two sections. The first section explains the JIT production system and the second section discusses the effects of JIT implementation on cost accounting.

1. Jit Production System

In this section JIT production systems will be discussed in detail. After the meaning and importance of a JIT system is explained, necessary tools and steps for implementation will be the main concern of this part.

1.1. Meaning of the JIT Production System

JIT production system is a system that enables companies to produce products in required amounts and just when demanded (Tanış, 1992:100; Yükçü, 2000: 19). By using the system, companies intend to offer products on time. If companies finish final

products on time, they will be able to minimize the raw material, work-in-process and finished-goods inventories. How these reductions can be achieved may be described as follows: raw materials are purchased when needed for production, work-in-process inventories are not produced until they are needed by the coming production process, and finished products are offered to customers immediately after they are produced. In other words, in JIT setting demand triggers each step of the production process: starting with a customer demand for a finished product at the end of the process and working all the way back to the demand for direct material at the beginning of the process (Horngren et.al., 2000: 726). When customers order a party of products, they will not wait very long to receive their orders, because these products can be produced in a very short period of time under a JIT setting. This means that, lead-time is very short. In addition, as products are produced without any stoppage, there will be no wasted time spent for inspecting and correcting the defective products. Thus, products can be ready to deliver on time.

Application of JIT will lead to a decrease in inventories, waste reduction, employee involvement and customer satisfaction (Bailes and Kleinsorge, 1992:29). Therefore, employing the system will cause a company to save money and increase the number of the customers. In short, use of JIT production system will eliminate waste (Horngren et.al, 2002:23).

1.2. Necessary Tools for JIT Implementation

A JIT production system, as explained above, aims at minimizing work-in-process and finished-goods inventories, reducing lead-time, and increasing product quality. In order to achieve these by implementing a JIT manufacturing system, the following aspects and steps should be put into consideration and then operation (Hilton, 2000: 207, 462; Horngren et.al., 1999:735)

a. Getting the Commitment of Top and Middle Managers

Although top managers themselves will not initiate a JIT production system (Griffin and Harrell, 1991), their support must be obtained. As JIT will affect all parts of the organization there must be a high level of cooperation among functional areas. That is why, middle managers' commitment should also be obtained. The decision to introduce JIT procedures into the production environment is usually made by a firm's top management. Once this decision is made, the next step toward implementation is to gain an active support from the firm's middle managers and supervisors. Getting this support may not be very easy because these managers could be reluctant to support the implementation of JIT production system. Possible changes in production process, control procedures and performance measurement that would be required by the implementation of JIT may discourage middle managers from actively participating in the implementation of the system. In a JIT environment, everything must be perfect; there is no allowance for defective products and production errors because there must be no delay caused by those kinds of activities. These strict requirements brought by the JIT production system may discourage managers from voluntarily participating in the implementation of the system. Because the existing organizational slow down that the JIT concept wants to eliminate provides middle managers and supervisors with a cushion against the difficulties caused by defective raw materials, production errors, and

irregular supply and demand schedules. As a result, they may be reluctant to support the implementation of JIT concept (Lynn and Adrian, 1991:1). However, it is difficult to implement JIT production system without the support of middle managers and supervisors. Therefore, the motivation of middle managers and supervisors to support the implementation of JIT procedures is exceedingly important concept if this production system is to be implemented. In other words, managers must be motivated to participate in the implementation of the system.

For this reason, some researchers have conducted research about the motivation of managers in implementing JIT production system. For example, according to a research conducted by Lynn and Adrian (1991) about the examination of managers' motivation to implement JIT procedures; rewards associated with increased productivity in the new work environment, employment security which would be brought by the new manufacturing system, more challenging production standards and output goals associated with the JIT environment are the most attractive outcomes of implementing JIT production system. In this case, management accountants who advise senior executives regarding appropriate incentives for motivating the implementation of JIT procedures might advise publicizing those productivity rewards and employment security results for the implementation (Lynn and Adrian, 1991:5). In this case, managers can be motivated to participate in the implementation of JIT production system because they expect to get positive results from the implementation of the system.

b. Pull Method

As final products are produced only when they are demanded, operators will not put materials and components into production unless they are required. Therefore, parts and components that are produced by any operator should not be produced until the next operator demands them. When customer demands the product, production centers begin to produce the parts required by the following divisions in sequence. Under the pull method, goods are produced in each manufacturing stage only as they are needed (Hilton, 2000:207). Pull system differs from a push system in that machine operators do not produce according to schedule or material availability. Instead, production does not begin until parts are needed by the downstream operator (Swenson and Cassidy, 1993:43). When additional materials and parts are needed for final assembly, a message is sent to the preceding work center immediately to send the amount of materials that will be needed over the next few hours. Often this message is in the form of withdrawal kanban, a card that describes a part number, a quantity of parts, where parts are from, where the parts are to be delivered. That system can be compared to a system that takes place in the supermarket. If a customer wants to buy something, he pulls the good from the shelves. When the stock clerk realized the resulting empty shelves he receives the signal to replenish what has been sold. Therefore, kanban system restocks what has been purchased rather than using a system of estimated replenishments (DeLuzio, 1993:18). In this case, there is no allowance for the pile-up of work-in-process inventory through the production process because materials are not produced unless needed by a downstream operator.

c. Establishing Long-Lasting, Reliable Relationships With Few Suppliers

If the company wants to establish JIT production system, supplier must be able to provide high-quality raw materials, because in JIT setting there is no allowance for the stoppage resulting from poor-quality work-in-process inventory (Atkinson et.al, 2001:242). If raw materials offered by the supplier are defective, there will be problems in the production process due to poor-quality raw materials. In case of any stoppage, company will not be able to offer the product to customers on time. In other words, lead-time will be longer. Therefore, successful JIT production depends largely on assembling a few cooperative and reliable suppliers. Just-in-Time purchasing is the purchase of goods and materials such that delivery immediately precedes demand for use (Horngren et.al, 1999:737) Manufacturers implementing this system tend to make vigorous assessments of potential suppliers (Lee, 1997:3). Therefore, companies implementing JIT production system should make careful evaluation of suppliers while selecting the best one. In evaluating the suppliers, following characteristics must be considered in order to decide on:

- the supplier's ability to provide high levels of quality;
- the supplier's ability make frequent deliveries of small lots;
- the supplier's capability for continuous improvement;
- the supplier financial strength;
- price

To ensure that supplier provides high-quality raw materials, long-term and reliable relationships must be established with few suppliers. In addition, the JIT production system focuses on producing products in small lots frequently. Therefore, the supplier must be able to make frequent deliveries of raw materials in small lots otherwise production will not be done in a way that will enable the company to offer the product on time.

d. Standard Work Concepts

Standard work is one of the most comprehensive and powerful tools found in JIT (DeLuzio, 1993:15). Standardization is achieved when all the tasks necessary to perform the production process are made uniform. In other words, if the same tasks are performed every time a process is carried out, it means that the production process is standardized. Once the procedure is standardized, there will be no variation in the process. Therefore, a work procedure must define every detail as clearly as possible. Otherwise, each operator will perform the task in a way he likes. Also, if the work procedure is made clear, the worker will make high-quality parts with less variation (DeLuzio, 1993:16). Then the workers are able to finish products in shorter time because work is done in a standard sequential way. Also, if the procedure is standardized, the worker does not face any confusion because there is a known and fixed way of performing the job. Thus, any worker can carry out the task. This helps managers substitute the absent operator with the existing one to perform the task in case of employee absence. Therefore, possibility of delay caused by the absence of the operators is eliminated and products can be produced in the planned way. On the other hand, unless the working procedure is standardized different sequence of activities will

be followed every time when the product is produced. This will cause products not being offered on time because of the confusion caused by random production procedures.

e. Creating a Clean, Orderly Work Environment

In a JIT work environment production flow must be smooth. In other words, production should be done in a standardized way without variation. Also, work-in-process inventory should be moved smoothly in the production area because it is desired the production process be completed on time. In this sense, tools used in production should be put in order, machinery and the work place should be clean (Hayes, 1981:59). In a JIT environment, materials move through the factory very quickly in response to signals from the pull control system. Therefore, the work environment should be organized in a way that allows the movement of materials without any difficulty. Also, the workers should be able to reach the tools and other materials easily in the shortest time available. If work place is clean and tidy, and everything is in order, then there will be no chance for the occurrence of delay because tasks can be performed without any waste of time.

f. Quick and Inexpensive Machine Setups

As company applies JIT aiming at producing in small lots when demanded, operators should be able to setup the machinery in a very short time so that there is no wasted time while switching from one lot to another. In other words, manufacturing facilities must be able to produce different kinds of products without wasting time. Otherwise, if too much time is spent on setting up the machinery there will be delay in offering the product on time. Therefore, JIT production system must be based on advanced computer-controlled machines that are able to produce several product types without requiring a set-up.

g. High-quality finished products

In a JIT production system, finished-goods inventory is kept at minimum level. To achieve this, products that are produced in the system must be of uniform quality. Thus, a total quality control program should be applied in the JIT setting. In this case, everybody should be responsible for the quality of the final product. So, everybody in the organization should seek ways to continuously improve the production system. In traditional systems, inventories are pushed through the system undergoing quality inspections conducted by quality control personnel, whereas in a JIT setting teams are responsible for production and quality (Banker and Potter, 1993). An important characteristic of this production system is that once defective parts are discovered, production stops until the root cause of the problem is identified and solved. Otherwise, production in the upstream operation also stops because there is no pull from the producer of the defective part. In a JIT environment, everybody focuses on continuous improvement in order to prevent problems from taking place, and shutting down the production line that may then cause delay in offering the product on time. In other words, everybody should be responsible for the quality of the tasks for which he or she is responsible. One division should provide the coming division with defect-free work-in-process so that there will be no rework and wasted time through the production process. According to a study conducted in some UK and Japanese companies, firms

that adapted Total Quality Management and JIT simultaneously gained noticeable synergy (Yui, 1997: 2). Effective quality-control programs also help minimize work-in-process inventories because there is no need to establish huge buffer inventories to prevent the plant from disruptions that would be caused by poor quality. In other words, if company guarantees that all raw materials and work-in-process are of high quality, then it is ensured that there will be no problem caused by poor quality.

h. Flexible Facilities and Multi- Skilled Workers

Facilities in a JIT setting must be flexible so that they can produce various kinds of products without requiring frequent setups. As the system (JIT) aims at producing small lots of different kinds, facilities must be able to produce different kinds in small lots. Multi-skilled workers are also required in this environment to respond quickly to changes in demand and product mix. In addition to these, in a JIT setting workers must have multiple skills because in case of absence of an employee, one of the others must replace him so that there will be no stoppage and delay in offering the final product to customers on time. In other words, operators may be required to move among different machines, functions and areas. If they are not able to be flexible to work in different areas, company cannot be responsive to different demands on time. The JIT production system, therefore, requires highly skilled and highly dedicated workers and well-maintained equipment (Martin et.al., 1992:10; Hilton et.al., 2000:463).

Furthermore, one of the first steps that a company must take while implementing a JIT production system is to establish work cells. In a JIT environment, products are grouped into cells, and workers are assigned to these cells with each employee performing several functions (Banker and Potter, 1993:2). In the work cells, similar machines are grouped together to produce similar products. In these cells operations are moved together so that unnecessary and time-wasting transportation of parts between functional departments is eliminated. Parts are produced from a raw material stage to finished stage within the same cell (Deluzio, 1993: 14). As products can be produced in manufacturing cells in a short period of time without any stoppage, there is no allowance for the pile-up of work-in-process inventory.

All of the things explained above are necessary for the implementation of a JIT production system. When a JIT production system is implemented successfully, high productivity, high quality, shorter lead-time, and low levels of raw material and work-in-process inventories will be achieved. As there are only few reliable suppliers, raw material requirements are minimized through small and more frequent deliveries. JIT production system also emphasizes reduction in setup time that enables the company to produce the products in small lot sizes and to minimize the work-in-process inventory. In turn, shorter setup and less work-in-process inventories make the manufacturing cycle time shorter. Thus a manufacturer that is applying JIT production system becomes more competitive by shortening product lead times (Swenson and Cassidy, 1993: 39). For example, according to a research (Lee, 1997) conducted on small manufacturing firms in Korea, reduced inventory was the most significant benefit. Lee (1997:5) reports that 46 % of the responding firms stated that reduction in work-in-process inventory could be obtained in the early stages of the JIT implementation. The next most significant benefit the researcher discovers was quality improvement (28.6 percent); and the third shorter lead-time and greater flexibility. Therefore, although reduction in

inventories is the most significant benefit, quality improvement, shorter lead-time, and greater flexibility can also be realized outcomes of the JIT implementation.

2. Effects Of Jit On Cost And Management Accounting

Many changes brought by the JIT production system require alterations in the existing information systems and traditional accounting practices (Bailes and Kleinsorge, 1992:29). The application of a JIT production system will change the cost structure of a firm as well as cost allocation procedures and recording system. In addition, performance measurements and reporting systems must be changed in a JIT environment. The following paragraphs describe how JIT concept may affectively be used in cost management.

2.1. The Use of JIT as an Effective Cost Management Tool

Implementation of JIT in a company will lead to cost reductions in the production system. In fact, a JIT production system is very effective in eliminating mainly non-value-added activities and thus, non-value added costs. The non-value-added activities are the activities such as moving materials and parts from one place to another; setting up a machine; storing materials, parts and finished goods; inspection, rework and purchasing. These activities, although consume resources, do not add value to a product produced. Therefore, the JIT production system is quite helpful in this attempt because it minimizes the non-value-added activities as explained in the following sections:

Reducing Inspection and Ordering Costs: As discussed above, the use of a JIT system requires dealing with few dependable suppliers by establishing long-lasting, reliable relationships. Because high quality in production requires close relationships with vendors to ensure that the firm receives defect-free raw materials (Martin et.al., 1992:10). Working with dependable and reliable suppliers ensures the acquisition of high-quality raw materials and eliminates the need for inspection, because company can make sure that raw materials that particular supplier is providing are defect-free raw materials. In addition, as company deals with the same supplier, there is no need for a search for the best supplier, detailed paperwork, and the ordering process every time. That is why, cost of purchasing and ordering is minimized. According to a study conducted in Oregon Cutting Systems (a company producing chain saws, timber harvesting equipment, and sporting equipment), number of suppliers was reduced from seven to one after implementing JIT system (Bailes and Kleinsorge, 1992:31). Therefore, application of a JIT production system reduces the number of suppliers that company deals and the costs related to establishing relationships with these suppliers.

Minimizing Moving Activity: Machines producing similar products are grouped into production cells under a JIT setting. In these cells, machines are close to each other so that work-in-process does not need to move long distances (Hilton et.al., 2000:463). This decreases both the moving activity and its cost to a minimum level.

Minimizing Setup Activity: As technologically advanced machinery, —which can produce various products without requiring frequent, or no setups— is used in a JIT setting, cost of a setup will also be minimized. There is a positive relationship between

the percent of operations converted to JIT and the reduction in set up time (Swenson and Cassidy, 1993:46). This means that, application of JIT leads to a decrease in set up time and set up related costs such as cleaning and readjusting the machinery, etc.

Minimizing Storing Activity: Work-in-process inventory does not pile up in front of the operators since pull method is used in a JIT production system. Also, as quality improves, work-in-process inventory buffers can be reduced (Swenson and Cassidy, 1993:45). Emerging reductions in work-in-process inventory will bring the reductions in storage costs such as employee salaries and wages; rent, electricity and depreciation costs for warehouses; and in-factory transportation activity costs. In addition to reductions in work-in-process inventories, there will be reductions in finished goods inventories and similar storage costs attributed to them. Last but not the least, company that employs a JIT system will also save some resources tied up holding excessive inventories (Tanış, 1992:102).

Minimizing Rework Activity: As explained above, in a JIT environment there is no need to have large inventories to buffer the plant from disruptions caused by poor quality because of effective quality control programs in use. This means when an operator discovers a defective product, he pauses the process and only few parts are at risk of being scrapped. However, in case of having a large amount of work-in-process inventory, and parts from the previous operations that are determined as being defective, many more parts must be scrapped. As a result, a great amount of loss is likely to occur. On the other hand, when an operator reduces the number of defective units, he is able to reduce product costs since this reduction decreases the number of inspectors and employees doing rework. Also an increase in productivity is gained. It has been claimed (Hayes, 1981:63) "a 2% reduction in defects is usually accompanied by a 10% increase in productivity." Therefore, it can be said that rework costs and cost of lack of productivity are minimized in a JIT setting.

2.2 The Effect of JIT on the Cost Structures and Costing Procedures:

Under a JIT setting, production process is performed largely by machinery rather than by manual labor. The heavy use of machinery increases the proportion of machinery related fixed costs such as depreciation costs when compared to a traditional setting. Thus the cost of direct labor decreases because JIT production setting is capital-intensive. However, factory overhead costs increase as a result of working in a capital-intensive environment.

Factory overhead costs can be assigned to each flexible manufacturing cell as the first-level allocation, and then costs accumulated in the cells can be allocated to products produced in that cell. Traditional functional costs, such as maintenance, become focused on product costs because these costs are directly related to the cells in which specific products are produced (Bailes and Kleinsorge, 1992:30).

In a JIT setting, indirect labor cost also decreases because operators who are directly responsible for the cells now perform almost all of the tasks that were performed by employees outside the department. For example, employees who operate the machines in the flexible manufacturing cells, now also perform maintenance work that was previously performed by other employees from the maintenance department.

Another important difference in JIT is its treatment of accounting records. The concept helps reduce costs such as recording in accounting books. Traditional systems record journal entries starting from the purchases of raw materials and raw materials inventory. This requires several separate inventory accounts be used such as raw materials, work-in-process, and finished goods as well as direct labor and direct material accounts. Considering a manufacturing company in which hundreds of different products are produced, traditional recording methods will require thousands of journal and ledger entries when each item is purchased or used. Thus, the existing accounting systems will become expensive when compared to that of JIT. Because the JIT system reduces the number of entries and accounts used, it therefore facilitates the work done by the accountant. For example, as raw materials are given to production immediately after they are purchased, there is no distinction between raw material and work-in-process inventory. In this sense, it is preferable to record raw-material purchases directly to an account in which raw material and work-in-process are combined. This account is known as **Raw and In-Process Inventory (RIP)**. As work-in-process inventory is low, there is no need to use work-in-process account. Therefore under a JIT setting, actual factory overhead and labor costs are combined and transferred to an account called **Conversion Costs** instead of work-in-process inventory account.

When goods are finished, direct material costs are moved from RIP account to **Cost of Goods Sold** account rather than finished-goods inventory account. Because finished goods are not kept in the inventory, they are sold immediately after the production. In addition, conversion costs can be applied to cost of goods sold instead of work-in-process account because there is no need to use work-in-process inventory account in a JIT environment. Instead of transferring the finished products to finished goods inventory, they can be transferred directly to cost of goods sold account. This recording system is called **Backflush Costing**. Backflush costing is appropriate in a JIT environment, because in this environment work-in-process and finished-goods inventories are minimal, and goods are sold as they are produced. In Backflush costing system no effort is made to track materials and components from material warehouse through work-in-process and finished goods. Backflush costing system eliminates transactions to record the movement of raw materials to work-in-process inventory. In addition, movements of inventory are not reported until finished goods are produced. Work-in-process inventory is updated only after taking a physical count of the inventory on the shop floor (Swenson and Cassidy, 1993:43).

The following exhibit, which also identifies the difference between Traditional and Backflush costing systems, depicts journal entries under both systems. Assume that the following data is given for recording purposes under both systems:

a. $200,000 worth of raw materials are purchased on account.
b. All of the raw materials are put into production.
c. $50,000 worth of direct labor costs are incurred.
d. Actual factory overhead costs amount to $95,000.
e. Factory overhead applied is $100,000
f. Completed goods are transferred to finished goods inventory
g. Completed goods are sold

Exhibit 1: Traditional Costing System

a.	Raw Material Inventory	200,000	
	Accounts Payable		200,000
	Purchase of raw material		
b.	Work-in-Process Inventory	200,000	
	Raw Material Inventory		200,000
	Raw material requisitioned for Production		
c.	Work-In-Process Inventory	50,000	
	Wages Payable		50,000
	Direct labor costs incurred		
d.	Factory Overhead Control	95,000	
	Various Credits		95,000
	Actual manufacturing overhead costs incurred		
e.	Work-in-Process Inventory	100,000	
	Factory Overhead Applied		100,000
	Factory Overhead Application		
f.	Finished Goods Inventory	350,000	
	Work-in-Process Inventory		350,000*
	Products are completed		
	*** Direct material+ Direct labor+ FOH applied**		
g.	Cost of Goods Sold	350,000	
	Finished Goods Inventory		350,000
	Goods are sold		

Backflush Costing System

a and b.	Raw and In-Process Inventory	200,000	
	Accounts Payable		200,000

Purchase of raw materials

c and d

Conversion Costs (Actual)	145,000	
Wages Payable		50,000
Various Credits		95,000

Direct labor and actual manufacturing Overhead incurred

e. No Entry

f and g.

Cost of Goods Sold	350,000	
Raw and In-Process Inventory		200,000
Conversion Costs (Applied)		150,000

Goods are sold

Backflush costing system records the *purchase and requisition of raw material* combining to an account called **"Raw and In-Process Inventory"** as shown in the entry "a and b", because under a JIT setting raw materials are sent to production immediately after they are purchased. In addition, actual direct labor and factory overhead costs in the Traditional costing system are transferred to **work-in-process inventory** account. By contrast, direct labor and factory overhead costs are combined and transferred not to **work-in-process-inventory** account but to an account called **conversion costs** in Backflush costing system as shown in the entry "c and d", because work-in-process inventory account is not used in this system. Furthermore, whereas in Traditional costing system goods are transferred to **finished-goods inventory** account when finished, and to **cost of goods sold** account when sold; in Backflush costing system finished goods are transferred directly to **cost of goods sold** account as shown in the entry "f and g". This is because there is no finished-goods inventory in a JIT environment since completed goods are sold immediately.

As seen in the exhibit below, overhead cost is over-applied under both costing systems. Over-applied overhead costs should be closed only to the cost of goods sold account in Backflush costing because there are no work-in-process and finished-goods inventories at the end of the period, as follows:

<u>Traditional Costing System</u>

Factory Overhead Applied	100,000	
Factory Overhead Control		95,000
Cost of Goods Sold		5,000

Closing overapplied factory overhead cost

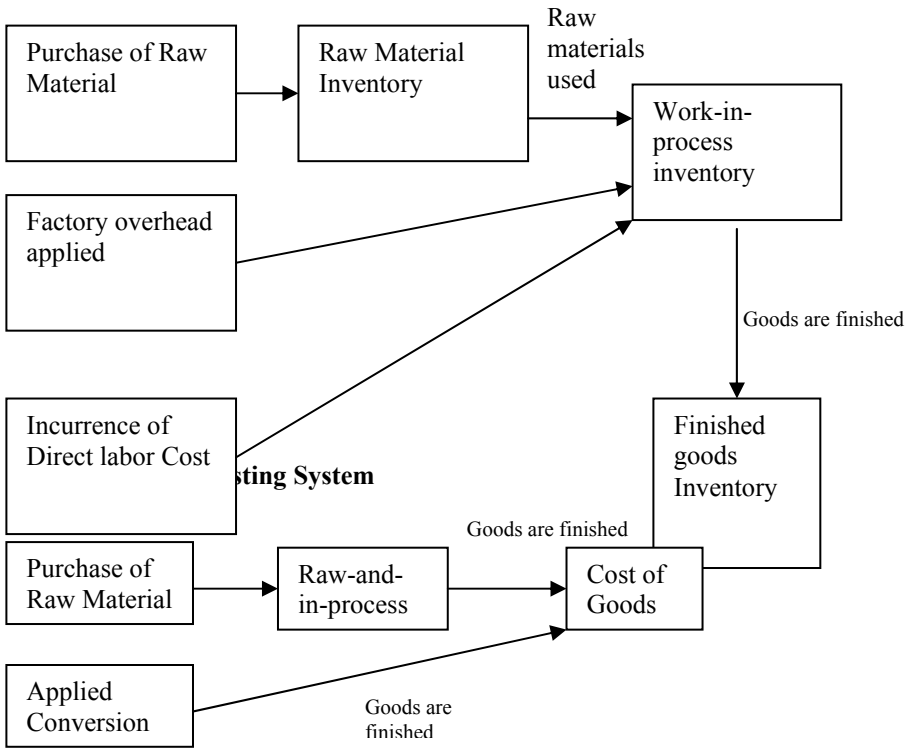
Backflush Costing System

Conversion Costs (Applied)	150,000	
Conversion Costs (Actual)		145,000
Cost of goods Sold		5,000

Closing overapplied conversion costs

In addition to the above explanations, cost flows under Traditional costing system and Backflush costing systems can be shown in the following diagrams:

Traditional Costing System



2.3. The Effect of JIT on Performance Measurement System

In a JIT environment, products are produced only when they are demanded by the customers. In this case, equipments only produce products when there is an actual demand for them. At other times equipments are idle. Thus, the use of equipments is not an appropriate measure in the JIT environment because the machinery and equipments will not run all the time. In the JIT environment, the aim is to reduce inventory, increase flexibility, and maximize customer satisfaction by reducing lead-time and increasing quality. Therefore, these (reduction in inventory, defect rates, lead and set up times, increase in quality) will be the appropriate performance measures applicable in a JIT environment. So, management accountants should take an active role in identifying and monitoring these types of critical and non-financial performance measures. Otherwise, the accounting function cannot help establish an effective operational control system. For example, a production manager who successfully implements a JIT work cell and shows significant improvements in quality, cycle time, and work-in-process inventory may be blamed for poor financial performance because of large volume variances and under-absorbed overhead (Swenson and Cassidy, 1993:44). If that manager is blamed for under-absorbed overhead because he does not use the fixed assets efficiently, this will lead to wrong decisions since in a JIT environment important thing is to produce the products only when demanded. In this case, traditional analysis for factory overhead variances is not appropriate in this environment.

As discussed above, employees are supposed to have multiple skills in a JIT environment. In other words, they are required to perform different tasks. Thus, employees should be compensated on the basis of "pay for knowledge" compensation plan. However, a plan based on piece work is exceedingly inappropriate in the JIT environment because employees are not required to be as efficient as possible, rather, they are required to produce only when needed. As a result, control systems used in the JIT settings should be changed with ones that encourage the appropriate performance required for this production system.

2.4. Performance Measures should be Reported to Workers in JIT Environment

In a JIT environment, workers are assigned to cells, and they are expected to perform several functions in these cells where they are also responsible for production and quality. Implementation of JIT requires employee involvement to the extent that the system puts the control of production in the hands of the worker. Therefore, successful implementation of JIT production system requires the employees to identify ways to improve the manufacturing process, reduce defects and ensure that manufacturing operations run efficiently. Workers are encouraged to work in teams to prevent problems on the shop floor; to pool their knowledge concerning the production process; come up with innovative approaches to improve productivity and quality; and to reduce lead-time (Banker and Potter, 1993:24). Since high level of quality is necessary for JIT production system, the responsibility of establishing this depends on the attempt of the workers. The workers are encouraged to solve problems and improve the operations. The workers are no longer assigned to highly programmed tasks with supervision from above; rather they are encouraged to be more flexible and active. In order for the workers to identify problems and opportunities, they should be provided feedback in the form of performance measures. According to a study that was conducted in forty

manufacturing plants in the United States, there is a positive relationship between the implementation of JIT and the reporting of performance measures to workers (Banker and Potter, 1993:24). Therefore, this shows that not only machinery and outside contracts for high quality raw materials delivery are necessary; but also establishing appropriate performance measures and high level of employee involvements will be crucial in the implementation and running a JIT system.

Summary And Conclusion

In today's competitive environment, companies have to find ways to be competitive. They have to maximize the customer satisfaction in order to be able to survive. JIT manufacturing system is one of the tools that can be used to become competitive. The use of this new production system reduces inventory related costs, increases quality, reduces lead-time, and reduces manufacturing costs by minimizing non-value-added activities and their costs. All these represent the benefits offered by the implementation of JIT production system. By reducing costs and reducing lead-time, company's response to customer needs increases.

JIT production system causes some changes in the company implementing it. One of the areas that are affected by JIT implementation is cost and management accounting. First of all, JIT has emerged as an effective cost management tool because it helps to achieve significant costs savings. In addition, the JIT system simplifies the cost accounting processes since it eliminates direct labor and inventory accounting. In a JIT environment there is little or no work-in-process and finished-goods inventories. Furthermore, use of JIT requires management accountants to change their performance measurement systems. Performance measures based on production efficiency should be replaced by measures based on lead-time reduction, setup reduction, increased quality and others that help the JIT system to function in the best way.

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