THE IMPACT OF JIT PRODUCTION ON PRODUCT COSTING INFORMATION SYSTEMS

ELLEN HARRIS
Department of Accounting and Information Systems, Weber State College, Ogden, UT 84408-3803

The change by many companies to JIT production, along with the factors that have precipitated those changes, have caused management accountants to reexamine product costing information systems. Many have stated that traditional product costing information systems will not be useful in the new manufacturing environment, and have predicted areas in which changes will occur.

According to Jamrog [10], the ultimate objective of JIT is "the creation of a smooth and rapid flow of all products from the time the raw material is received to the time the final product is shipped to the customers—with zero defects [p. 22]." This requires: (1) small batch sizes (therefore, reduction of machine setup times [9, 10, 17], (2) revised equipment layout to allow direct flow of the product through the equipment [9, 10, 17]; and (3) total quality assurance by workers during production [10, 17].

The need to shorten the product cycle time leads to a reorganization of the factory into product family flow lines or focused factories. These flow lines can include not only the production facilities and workers, but also the support functions such as maintenance, purchasing, and accounting [9, 10]. This will then allow direct charging of costs which under traditional manufacturing methods were allocated [4, 9].

With the shorter product routings through flow lines the production process is more visible, therefore current and prospective problems or difficulties can be spotted and corrected before quality problems are manufactured into the product [17]. Better visibility of prospective problems will allow continuous improvement of the production process which will, in turn, increase customer satisfaction [4, 17]. With greater visibility of the production process, activities that do not add value to the product can be eliminated and the process can be simplified in an iterative process of continuous improvement [4].

The JIT philosophy leads to small batches of product completed in a short period of time in a focused product family line with very high quality. These changes allow very small levels of inventories of finished goods, goods in process, and raw materials to be maintained.

Because the JIT philosophy and methods differ so significantly from traditional production philosophy and methods, it would seem reasonable to expect that product costing information systems for JIT production would also differ significantly from those for traditional production methods. Changes which should be reflected are:

> (1) Labor is becoming a minor part of the total product cost, and accountants should devote less time to identifying labor costs with jobs or products. (2) The distinction between production and service department is disappearing as more service functions become part of the production process, e.g., production workers do machine maintenance. (3) A simplified factory only needs a simple accounting system. (4) Detailed and elaborate accounting controls become unnecessary and wasteful when workers are made a part of the management team [1, p. 1].

PRODUCT COSTING

Product costing is an integral part of a company's cost accounting system. It should provide information for three broad purposes:

- Internal reporting to managers for use in planning and controlling routine operations.
- Internal reporting to managers for use in making nonroutine decisions in formulating major plans and policies.
- External reporting to stockholders, government, and other outside parties [8].

Kaplan [12] states that cost systems are context specific and are used for performance evaluation, product costing, and inventory valuation and reporting requirements. Kaplan's concept of product costing corresponds to Horngren's [8] purpose of providing information for use in making nonroutine decisions, and includes all the costs, both manufacturing and nonmanufacturing, that are associated with the development, production, and selling of a product. Horngren defines the cost of product as including those elements that constitute the dollar values assigned to manufactured products for inventory valuation and external reporting. Under this definition, product cost consists of three major elements: direct material, direct labor, and manufacturing overhead.

Problems with Product Costing

Most companies that changed to JIT found that their old product costing information systems were not useful in the new manufacturing setting, but in spite of the new information needs some companies have not changed their product costing information systems. This has resulted in several problems:

- A production manager who was interviewed about the product cost data at an IBM location that had changed to JIT stated: "Your cost information is nice, it's history, and it's too late to do anything with. We need more timely information. I really don't use your cost information to manage the business. . . . [13, p. 3.17]."
- At Stanadyne, Holbrook [7] concluded that the old cost accounting system measured the wrong things. It failed to measure the critical success factors of lead time, actual costs, quality costs, service levels, and schedule performance, and it concentrated on machine utilizations rather than on "real" product cost.
- At a Hewlett-Packard (HP) location, an analysis of the cost accounting system in association with a change to JIT resulted in significant changes in the cost system. Neumann and Jaouen concluded that "traditional cost accounting data is obsolete in a repetitive manufacturing environment" and that "cost accounting's dual purpose of planning and control must be redesigned [14, p. 132]."
- Kaplan's study [11] of four firms that had changed to new manufacturing technologies found none of the old product cost systems to be adequate.

In addition to measuring the wrong things and being too late to be useful, traditional product costing information systems provide misleading information [2], emphasize separate departmental efficiencies [3, 9], and are too complex. JIT production simplifies the manufacturing process and hence requires different kinds of information for managers.

EVIDENCE FROM CASE STUDIES

Published case studies report mixed results concerning changes in product costing information systems when production methods have been changed. Various degrees of change are reported both in the production methods and in the product costing information systems.

Hewlett-Packard

Two separate studies of changes to flow manufacturing systems at two HP production facilities have been conducted to document and describe the concomitant changes in the product costing information system. In both cases, a single product or product family line was physically separated from the remainder of the production in the plant and organized into a cell which worked on the pull principal; each station could perform work only if its output was needed by a subsequent station. Workers who were at a station that was idle could either wait until additional output was needed or help at other stations that were busy. Product was manufactured on the line only if a demand for the product existed. In both cases, significant changes that resulted in simplified procedures were made in the product costing information systems when the changes were made in the manufacturing methods.

The site studied by Neumann and Jaouen [14] produced data storage devices. Reported changes included a reduction in inventory accounts from three (raw materials, work-in-process, and finished goods) to two [raw and in-process (RIP) and finished goods]. Purchases of materials were debited to raw and in-process and removed when units were completed. Also, direct labor was no longer tracked through inventory accounts, but was included in manufacturing overhead and expensed monthly. For inventory valuation purposes, base amounts of labor and manufacturing overhead were maintained in RIP and finished goods inventories. Manufacturing overhead costs were accumulated into three cost pools, each allocated separately: (1) direct material costs are now the base for procurement-related activity costs, (2) cycle times for production overhead, and (3) total direct costs are the base for indirect overhead. The primary benefit to the accounting department of the product costing information system change was the time saved with the reduced number of transactions for materials and labor.

The second HP site studied [15] reported three major adaptations. First, the division began using perpetual work orders to maintain consistency with the internal accounting of the remainder of the organization (which uses a job order system), and at the same time to be responsive to the needs of the very different JIT production methodology. These perpetual work orders were closed only at the end of accounting periods to facilitate the financial reporting function of the product costing information system, and then immediately reopened.

Second, the division switched to passive labor vouchering. Workers completed time cards only to record arrival time, departure time, and leave taken. The supervisor recorded line down time, and all other time was considered production time.

Third, the number of suppliers has been significantly reduced. Quality of delivered parts was greatly improved, deliveries were made just in time, and paper work regarding purchases has been reduced by using summary billing and recording of monthly transactions. These three adaptations have simplified the product costing information system at this location by significantly reducing the number of transactions and the amount of data recorded.

An additional cost accounting change that was documented concerns manufacturing overhead. This division, too, has chosen to maintain three overhead cost pools: (1) support manufacturing overhead, which included the costs of manufacturing engineering, quality assurance, manufacturing management, and electronic data processing; (2) production manufacturing overhead, which included the costs of direct labor benefits, direct labor supervision, indirect labor, supplies, and depreciation; and (3) procurement manufacturing overhead, which included the costs of purchasing, receiving, incoming inspection, stockrooms, material handling, production planning and control, and freight-in.

Again, the major advantage to the accounting department of these changes was time saved due to reduced transactions. The one issue which was of concern [15] was that the product costing information system was systematically withdrawing from the precise identification of individual units or batches and was reducing the fineness of its information structure.

IBM

IBM [13] introduced a new product on a JIT production line into a traditional multiproduct manufacturing facility and discovered that the existing product costing information system was no longer adequate. Consequently, several changes in the system were made to accommodate the new production process. Detailed direct labor reporting was discontinued and included in manufacturing overhead so that there were only two product cost elements: material and conversion. The factors which caused overhead costs to occur were identified, and overhead was charged directly to those factors rather than being allocated to product on some arbitrary base. Because this product moved through the system more quickly than actual costs were recorded, the location was using standard costs to record the production of individual units so that there were some recorded costs to match against recorded sales. Variances from this standard were then analyzed and charged to cost of sales at accounting closings.

In addition to the described changes to the traditional system, the new system was measuring four additional factors: volume of product flowing through the system, capital resources used in the JIT flow line, the time required for a build cycle, and asset utilization. Also, the cost accountants were involved early in the product development cycle because it is at this point that costs can best be controlled. The overall strategy for their cost systems was to obtain simplified, location-driven methods and early involvement in product development.

Lotus

Lotus Development Corporation produces software and documentation for personal computers in a manufacturing process that involves two operations: disk duplication and assembly. This is a high-volume, low-technology operation providing products for a high-technology field, and problems were encountered as a direct result of the company's phenomenal success and growth.

In 1985, Lotus [16] changed its assembly operations to JIT to combat these problems. They discovered that work-in-process (WIP) became very difficult to track, and that production lot numbers created problems in reconciliation and inventory control. Their solutions to these problems were to discontinue tracking WIP and to eliminate production lot numbers. Because no WIP tracking was done, the product costing information system required only three sets of data entries: raw material entering the operation, finished goods going to shipping, and scrap being deducted from raw materials. These simple solutions eliminated 95% of the cost accounting transactions in the assembly operation.

Stanadyne Automotive Products Group

Stanadyne Automotive Products Group started out as a screw machine shop and operated in a typical job shop environment for 100 years. Then in the 1970s the division got involved with Oldsmobile's diesel engine fuel injection program. At that time they also supplied diesel fuel injection equipment to many agricultural and industrial manufacturers. This involvement in the automobile industry resulted in a growth rate that doubled sales every two years for the three- or four-year period when the price of gas was going up; then the price of gas went down and so did their sales. This led the division to look for new markets and new production methods [7].

The production changes included a rearrangement of the plant into machine cells for families of parts,

and each cell was made synchronous by having each operation within the cell make the same number of parts each day. The immediate measurable results of this rearrangement were that inventory decreased from $37 million to $16 million, production control reduced its staff from 32 to 3 people, and 75% of the storeroom space was no longer needed.

Stanadyne's product costing information system was also changed. The new system collected costs by machine cell. The total of all costs entering a cell within a given time frame (for example, maintenance, tooling, labor, materials, support services, etc.) was divided by the number of units exiting the cell during the same time frame to arrive at an actual unit cost. The only costs charged to the cells were those that were directly controllable by the cell manager; however, they included both variable and fixed costs. This direct charging to machine cells required the company to determine the cost of providing each service, labor hour, and material unit so that actual costs rather than allocated costs were used. Rather than allocate overhead costs, Stanadyne determined the actual cost of the overhead service and charged for it on a direct basis.

Additional changes that were planned for the cost accounting system included the measurement of factors that plant managers consider to be critical to success, such as lead time, quality costs, service level, schedule performance, and employee morale. Also the plant considered inventory to be a cost, not an asset, therefore future plans included further reductions of inventories and further reductions of data collection costs through additional simplification of the system.

Williams International

Williams International is the leading manufacturer of miniature gas turbine engines and the principal producer of cruise missile engines. Also produced are engines for military drones and remotely piloted vehicles and auxiliary units for aircraft [5, p. 6.13].

From 1985 to 1988 the production facility of Williams International, located in Ogden, UT, made a sequence of production method changes. "Process simplification and group technology are being implemented. So far, like machinery has been grouped and a one-operator, two-machine concept has been initiated, thus reducing the number of operators [5, p. 6.16]."

During the same period of time, gradual changes have also been made in the product costing information system to reflect the manufacturing changes. The primary product cost system change involved the manufacturing overhead cost pools and allocation bases. The company has replaced a single plantwide manufacturing overhead cost pool allocated on a direct labor base with three manufacturing overhead cost pools allocated on machine hours, cell time, and direct labor bases.

CONCLUSION

As JIT production simplifies and shortens the distance product travels, reduces inventories, increases quality, and changes the focus of managers, it has been predicted that product costing information systems will also change. Because the production system is less complex, the product costing information system can be simplified. There will no longer be a need for a work-in-process (WIP) inventory account classification [18]; direct labor reporting can be simplified [1]; and manufacturing overhead can be charged directly to product based on actual usage of overhead factors rather than allocated based on a surrogate activity such as direct labor hours used [4, 9]. Also, critical success factor measures need to become a part of the system [7, 9].

Case studies of companies that have made changes in their product costing information systems in response to changes to JIT production document actual system modifications. These studies show that changes have not been made by all companies, and that responses other than those predicted are also found.

The change in product costing information systems that was most frequently reported involves the method of accounting for manufacturing overhead. Three of the six sites increased the number of cost pools and allocation bases, and two companies now direct-charge overhead based on actual use. Four have simplified their direct labor reporting, and two report a reduction in the number of inventory accounts used. Three report a reduction in paper work or in the number of transactions recorded as significant benefits of the modified system. However, only two indicate that new factors are now being included in the product costing information system. The amount of change in the production methods of the firms studied was not assessed, nor were organizational factors that may have shaped the product costing information systems' responses studied. With further research in this area, the response of product costing information systems to production method changes can be better understood and more accurately predicted.

REFERENCES

1. Boer, Germain B., "AAA—Management Accounting Section Chairperson's Report," *Management Accounting News and Views* (Spring 1987).
2. Cooper, Robin and Kaplan, Robert S., "How Cost Accounting Distorts Product Costs," *Management Accounting* (April 1988), pp. 20–27.
3. D'Amore, Robert, "Just-in-time System," *in Cost Accounting, Robotics, and The New Manufacturing Environment,* Capettini, Robert and Clancy, Donald K., eds., American Accounting Association, Sarasota, FL (1987), pp. 8.1–8.29.
4. Foster, George and Horngren, Charles T., "JIT: Cost Accounting and Cost Management Issues," *Management Accounting* (June 1987), pp. 19–25.
5. Frescoln, Leonard, "Cost Accounting at Williams International," *in Cost Accounting, Robotics, and The New Manufacturing Environment,* Capettini, Robert and Clancy, Donald K., eds., American Accounting Association, Sarasota, FL (1987), pp. 6.1–6.20.
6. Harris, Ellen, An investigation of factors that influence the decision to change product costing information systems, unpublished doctoral dissertation, University of Utah (1990).
7. Holbrook, William G., "Accounting Experiences in a JIT Environment," *in Cost Accounting, Robotics, and The New Manufacturing Environment,* Capettini, Robert and Clancy, Donald K., eds., American Accounting Association, Sarasota, FL (1987), pp. 4.1–4.16.
8. Horngren, Charles T., *Cost Accounting, A Managerial Emphasis,* 5th ed., Prentice-Hall, Inc., Englewood Cliffs, NJ (1982).
9. Howell, Robert A., "World Class Manufacturing Controls: Management Accounting for the Factory of the Future," *in Cost Accounting, Robotics, and The New Manufacturing Environment,* Capettini, Robert and Clancy, Donald K., eds., American Accounting Association, Sarasota, FL (1987), pp. 2.1–2.22.
10. Jamrog, Mark R., " 'Just-in-time' Manufacturing: Just in Time for U.S. Manufacturers," *Review,* Price Waterhouse, No. 1 (1988), pp. 17–29.
11. Kaplan, Robert S., "Accounting Lag: The Obsolescence of Cost Accounting Systems," *California Management Review* (Winter 1986), pp. 174–199.
12. Kaplan, Robert S., "Regaining Relevance," *in Cost Accounting, Robotics, and The New Manufacturing Environment,* Capettini, Robert and Clancy, Donald K., eds., American Accounting Association, Sarasota, FL (1987), pp. 7.1–7.29.
13. Kelder, Robert H., "Era of Cost Accounting Changes," *in Cost Accounting, Robotics, and The New Manufacturing Environment,* Capettini, Robert and Clancy, Donald K., eds., American Accounting Association, Sarasota, FL (1987), pp. 3.1–3.29.
14. Neumann, Bruce R. and Jaouen, Pauline R., "Kanban, ZIPS, and Cost Accounting: A Case Study," *Journal of Accountancy* (August 1986), pp. 132–141.
15. Patell, James M., "Adapting a Cost Accounting System to Just-in-time Manufacturing: the Hewlett-Packard Personal Office Computer Division," *in Accounting and Management Field Study Perspectives,* Bruns, William J., Jr. and Kaplan, Robert S., eds., Harvard Business School, Boston, MA (1987), pp. 229–267.
16. Rutigliano, Anthony J., "Manufacturing Overhaul at Lotus: (Almost) As Easy As 1–2–3," *Management Review* (September 1986), pp. 28–32.
17. Sadhwani, Arjan T., Sarhan, M. H., and Diringoda, Dayal, "Just-in-time: An Inventory System whose Time has Come," *Management Accounting* (December 1985), pp. 36–44.
18. Walleigh, Richard D., "What's Your Excuse for Not Using JIT?" *Harvard Business Review* (March–April 1986), pp. 38–54.

About the Author—

ELLEN HARRIS is completing her PhD from the University of Utah. Her major field is management accounting and her minor fields are information systems and management. She has worked as a cost accountant and controller in manufacturing firms and her research interests are in cost and management accounting in the manufacturing environment. She is currently serving on the faculty of the Department of Accounting and Information Systems, Weber State College, Ogden, UT.