THE FUTURE OF VARIABLE COSTING UNDER A JIT AND AUTOMATED MANUFACTURING

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ABSTRACT

The emergence of JIT and automated manufacturing have raised a question about the relevance of variable costing. Although most accountants agree with the decrease of important of variable costing, some do not. White some say that absorption costing would become the only meaningful costing method, others argue that, by a few adjustments, it is possible to keep the variable-costing format as a useful managerial tool.

Introduction

Since its introduction in the midst of 1930's, variable costing has always been in the state of controversies. As it is generally known, the classical controversies is about its theoritical propriety for external reporting. Proponents of variable costing maintain that the fixed part of factory overhead is more closely related to the capacity to produce than to the production of specific units. Opponents of variable costing maintain that inventories should carry a fixed cost component because both variable and fixed manufacturing costs are necessary to produce goods; both of these costs should be inventoriable *(Horngren*, 1987, p. 56).

As a result, at least in the United States, neither the public accounting profession nor the Internal Revenue Service has approved of variable costing as a generally accepted method for inventory valuation. However, althought absorption costing is much more widely used than variable costing, the advantages of variable costing for internal reporting is undeniable. As stated by *Hansen* (1990, p. 261), income statements and inventory valuations using variable

costing provide valuable insight for internal purposes. That is why, for instance, the growing use of contribution approach in performance measurement

and cost analysis, has led to increasing use of variable costing. A survey of Fortune 500 industrial corporations indicated that 35% of the companies that use standard costing have adopted standard variable costing *(Chiu and Lee*, 1980, p. 239).

Regardless of the above classical controversies, there are now new emerging controversies on variable costing. This new controversies is primarily about the relevance of variable costing under a Just-In Time (JIT) and automated manufacturing which emerge significantly in the last two decades. As stated by *Lee* (1987, p. 54), the decrease of variable cost percentage in the total manufacturing cost has made variable costing become less important. Absorption costing, according to Lee, is becomes the only meaningful costing method in the new environtment of managerial accounting.

Although most accountants agree with the less important of variable costing, but not all of them come to the same conclusion. When emphasizing the use of full costing for long run decisions, *Howell and Soucy* (1987b), still see the relevance of variable costing for short run decisions. Almost the same conclusion comes from *Hansen* (1990, p. 540) which stated that by treating the nonvolume-based assignments as traceable costs, it is possible to continue using the variable-costing format as a useful managerial tool.

Since these new controversies relate to the future of variable costing, it is a very important subject matter and a throughout discussion. The objective in this paper is therefore to cover the main relevant areas necessary in order to answer the question about **the future of variable costing under a JIT and automated manufacturing.** The first area of discussion would be about the nature of variable costing and its advantages over the absorption costing. Secondly, the discussion would be on the nature and general implications of a JIT and automated manufacturing. Finally, in order to draw conclusions, analysis of the implication of the JIT and automated manufacturing toward costs structure, and toward variable costing as a model in making decisions would be performed.

Variable Costing And Its Advantages

Variable costing was firstly introduced by Jonathan Harris through his article "What Did We Earn Last Month?" in January 1936. Although that article is now considered to mark the beginning date of variable costing, neither the 1936 date nor the identification of Jonathan Harris as the originator of variable costing is completely accurate. First, Harris was writting about a system that had been installed several years earlier in a company with which he was connected. Second, only about a year later G. Charter Harrison issued a series of pamphlets on the same subject as a reprint of material that had previously been privately circulated. Finally, there is some belief that at least one company, Mathieson Alkali, had been using an almost identical system since the late of nineteenth century *(Arnstein and Gilabert,* 1980, p. 1).

The Nature of Variable Costing

As previously stated, the main theoretical concept of variable costing is its stress on the difference between fixed and variable cost. While absorption costing assigns all manufacturing costs to the product, variable costing assigns only variable manufacturing costs which include direct materials, direct labor, and variable overhead. Fixed overhead is excluded from the product cost. This is because, under variable costing, fixed overhead is viewed as a period cost. In other words, all the fixed overhead of a period is seen as expiring in that period and is charged in total against the revenues of the period (Hansen, 1990, p. 254).

In addition, while absorption costing income statement classifies expenses primarily by management function, such as manufacturing, selling, and administrative expenses, the variable costing income statement features cost behavior as the primary classification scheme *(Horngren,* 1987, p. 57). The income statement, as can be seen in Table 1, is often called a contribution income statement instead of a variable costing income statement.

Note that the absorption costing income statemnet does not show any contribution margin. This raises analytical difficulties in the computation of the impact on net

income of changes in sales. The contribution approach, in contras, stresses the lump-sum amount of fixed costs to be recouped before net income emerges. This highlighting of total fixed cost helps to attract management attention to fixed-cost behavior and control when short-run and long-run plans are being made.

Table 1

Comparison of income Statements

Absorption Costing		Variable Costing		
Sales	$ 1,000	Sales		$ 1,000
Less cost of goods sold	600	Less variable exp:		
		Manufacturing	360	
		Selling	100	
Gross margin	400	Administrative	20	
Less selling and adm. exp.	300	Total var. exp.		480
		Contribution margin		520
Net Income	$ 100	Less fixed exp:		
		Manufacturing	240	
		Selling	120	
		Administrative	60	
		Total fixed exp.		420
		Net Income		$ 100

Advantages of Variable Costing

Most agree that separation of fixed and variable costs is a basic need for many of the planning, control, and decision-making activities. Income statements and inventory valuation using variable-costing, therefore, provide valuable insights for these internal purposes. According to *Hansen* (1990, p. 261), three major areas where variable costing offers its advantages are the following: (1) the evaluation of managerial performance; (2) the evaluation of segments, and (3) planning and control.

The Evaluation of Managerial Performance

The evaluation of managers is often tied to the profitability of the units they control. How income changes from one period to the next and how actual

income compares to planned income are frequently used as signals of managerial ability. If income performance is expected to reflect managerial performance then managers have the right to expect the following: (a) as sales revenue increases from one period to the next, all other things being equal, income should increase; (b) as sales revenue decreases from one period to the next, all other things being equal, income should decrease; and (c) as sales revenue remains unchanged from one period to the next, all other things being equal, income should remain unchanged. Income under variable costing always follows this expected association between sales and income.

The Evaluation of Segments

Managers themselves need to evaluate the activities over which they have responsibility. For example, managers must continually evaluate the profit contributions of plants, product lines, and sales territories. Implicit in an evaluation is an associated decision-whether to continue to operate a plant or not, whether to keep or drop a product line. The separation of fixed and variable costs is critical for making these evaluations accurate. Without a distinction between fixed and variable costs, the evaluation of profit making activities and the resulting decision may both be erroneous.

Reporting the profit contributions of activities or other units within an organization is called segmented reporting. Segmented reports prepared on a variable-costing basis produce better evaluations and decisions than when they used absorption costing, because it allows managers to focus directly on the real issues.

Planning and Control

Financial planning requires managers to estimate future sales, future production levels, future costs, and so on. Because sales forecats are not certain, management may wish to look at several different levels of sales to asses the range of possibilities facing the firm. Since fixed costs do not vary with volume

changes, so distinguishing between fixed and variable cost is essential to making an accurate cost assessment at the different possible sales and production volumes.

The financial plan, then, consists of the expected activity levels and the associated expected costs. This plan can be used to monitor the actual performance as it unfolds. If actual performance is different than what was expected, corrective action may be necessary. For this control process to work, though, cost behavior must be known. Here, once again, we see the importance of the distinction between fixed and variable costs. Since this distinction is basic to variable costing, we can now make a conclusion that variable costing is superior to absorption costing for internal purposes.

The Emergence of The JIT and Automated Manufacturing

The last two decades has become the witness of the emergence of the new manufacturing environment. The new environment which according to *Kaplan and Atkinson* (1989, p. 12), gives stress on the critical role of manufacturing operations, could be identified by at least the following six major trends: (1) the commitment to higher product quality; (2) the reduction of invetory levels; (3) the introduction of flexible flow lines; (4) the introduction of manufacturing automation; (5) the introduction of product line organization; and (6) the effective use of information *(Howell and Soucy*, 1987, p. 22).

The study of this fi'ew manufacturing environment and their effects on management accounting theory and practices is crucial for the future of management accounting. Although there are several factors behind this new environment, this paper focuses on two primary factors which is considered as playing significant role and having significant implication toward management accounting theory and practices. These two factors are: (1) the implementation of JIT manufacturing, and (2) the introduction of computer-integrated manufacturing.

JIT Manufacturing and Its Implications

JIT manufacturing is firstly implemented in Japan by Toyota. In contrast to the traditional manufacturing, which is classified as a demand-push system, JIT manufacturing is classified as a demand-pull system. The philosophy under-lying JIT is to produce a product when it is needed and only in the quantities demanded by costumers. Demand, then, pulls products through the manufacturing process. Each operation produces only what is necessary to satisfy the demand of the succeeding operation. No production takes place until a signal from a succeeding process indicates a need to produce. Parts and materials arrive just in time to be used in production (Hansen, 1990, p. 15).

Despite produces fundamental changes in the way production is organized and carried out, JIT manufacturing typically has the following two major implications: (a) reduces inventories to insignificant levels, and (b) increases the emphasis on quality control.

According to traditional view, inventories solve some underlying problem that can be classified as follows: (1) to balance ordering (or setup) and carrying costs; (2) to satisfy costumer demand; (3) to avoid shutting down manufacturing facilities; (4) to take advantage of discounts; and (5) to hedge against future price increases.

JIT, in the contrary, offers alternative solutions, which do not require inventories. First, by developing longterm contracts with suppliers and by reducing the times it takes to setup, JIT attemps to drive ordering costs and setup costs to zero. If ordering costs and setup costs become insignificant, the only remaining cost to minimize is carrying cost, which is accomplished by reducing inventories to insignificant levels. Second, JIT solves the problem of due date performance by dramatically reducing lead times, which is accomplished by reducing setup times, improving quality, and using cellular manufacturing. Third, JIT avoid shutting down manufacturing facilities by implementing total preventive maintenance, which is easier to attain in a JIT environment because of the interdiciplinary labor philosophy.

Finally, to take advantage of quantity discounts and hedge against future price increases, JIT negotiate long-term contracts with a few chosen suppliers located as close to the production facility as possible and to establish more extensive supplier involvement (Hansen, 1990, p. 520-527).

Regarding to the product quality emphasis, JIT solve the problem of defective parts by striving for zero defects. Because JIT manufacturing does not rely on inventories to replace defective parts or materials, the emphasis on quality for both internally-produced and externally-purchased materials increases significantly. The outcome is impressive: the number of rejected parts tends to fall by 75 - 90 percent *(Stoddard and Rhea*, 1985, p. 76).

Computer-Integrated Manufacturing

Automation is probably the most visible change taking place in the new manufacturing environment. According to *Howell and* Soucy (1987, p. 24), some large U.S. manufacturers in the automotive, aerospace, heavy equipment, and other high technology industries have invested heavily in automated equipment to increase quality and productivity. Since automation can produce a competitive advantage for a firm, more and more firms will be forced to do likewise.

There are three possible levels of automation: the stand alone piece of equipment, the cell, and the completely integrated factory, however, the ultimate goal of manufacturing automation is the installation of a computer-integrated manufacturing system (CIM). According to *Hansen* (1990, p. 15), CIM implies the following capabilities: (1) the design of products is done through the use of a computer-assisted design system (CAD); (2) a computer assisted engineering system (CAE) is used to test the design; (3) the products is manufactured using a computer assisted manufacturing system (CAM); and (4) an information system that connects the various automated components.

Although perfecting the CIM concept in practice is yet to materialize, a considerable portion of the idea is already a reality. A flexible manufacturing system (FMS), for instance, a particular type of CAM with the capability to

produce a family of products from start to finish using robot and other automated equipment under a control of a mainframe computer, has already been installed at about 50 U.S. companies (Lee, 1987, p. 4).

The availability of FMS-and eventually CIM-will bring fundamental changes to the manufacturing activities in several ways. The manufacturing will become so flexible that it will be able to: (1) produce a test copy of a product at a trivial cost; (2) changeover from one production run to another in a few minutes or seconds; and (3) adapt to changing market preferences on a very short notice. Accordingly, companies will be able to produce based on the order, instead on pure forcast. This will, then, shorten lead time and reduce inventory requirements dramatically.

Important to noted, in the relationship between JIT and automation, JIT is considered to be a prerequisite for automation. While CIM is best suited for automotive, aerospace, and electronic industries (Johansson, 1986), experience has indicated that about 80 percent of all benefits from CIM can be achieved simply by implementing JIT (Hronec 1986). Aniway, in general terms, it can be concluded that a JIT and automated manufacturing environment allows firm to reduce inventory, increase productive capacity, improve quality and service, decrease processing time, and increase operational efficiency.

Variable Costing Under A JIT and Automated Manufacturing

The emergence of the JIT and automated manufacturing has been creating significant changes in the manufacturing environment. These changes, as its have been discussed in the previous section, are dramatic. According to Hansen these changes are also having a correspondingly dramatic effect on management accounting. As described in details by *Hansen* (1990, p. 17), "product-costing systems, control systems, allocation, inventory management, cost structure, capital budgeting, variable costing, and many other management accounting practices are being affected because of the changing environment" (1990,17).

According to Hansen (1990, p. 528), this is happening because the classical management accounting system fails to provide the right kind of information for sound decisions in the new environment. Furthermore, many of the traditional control features such as variance analysis, may actually encourage inappropriate behavior. Consequently, management accounting is evolving and adapting to meet the needs of the new manufacturing environment.

The focus of this paper is on the implication of a JIT and automated manufacturing toward variable costing. Recall from section 1, the characteristics of variable costing can be summarized as follows: (1) the emphasis on the distinction between variable costs and fixed costs; (2) the exlusion of fixed costs from product costing and inventory valuation; and (3) the use of contribution approach in the preparation of income statement. It has also been discussed that the advantages of variable costing, in comparison to the absorption costing, are on three folds: (1) the evaluation of managerial performance; (2) the evaluation of segments; and (3) planning and control.

Based on the above variable-costings characteristics and advantages, and since the amount of inventory under a JIT manufacturing is reduced into insignificant level (the discussion about inventory valuation under a JIT and automated manufacturing is therefore become irrelevant), focus in this section is emphasized on the implication of a JIT and automated manufacturing toward: (1) the changes in costs structure; and (2) the use of variable costing as a model in making decisions.

Changing Cost Structure

Mosts agree that the percentage of variable costs in a JIT and automated manufacturing decreases significantly. This is primarily happening because of the significant reduction in the amount of direct labor costs. As stated by *Hansen* (1990, p. 219), "as firms implement JIT and automate, direct labor costs are reduced significantly". *Foster and Horngren* (1987), reports that in the Milwaukee plant of Harley-Davidson, the amount of direct labor cost were less than 10

percent of the cost of manufacturing motorcycles, simply after the adoption of JIT approach. According to Linnen (1983, p. 1), in many electronic products, direct labor accounts for only around four percent of product costs.

Moreover, as direct laborers become trained in multifunctions, the level of direct labor costs tends to stabilize as production fluctuates. Therefore, the outcome of implementing JIT and automation are: (1) direct labor cost decreases as a percentage of total manufacturing costs, and (2) direct labor costs changes from a variable to fixed cost. Since traditionally direct labor costs is an important part of variable costs, the reduction of direct labor costs percentage in total manufacturing costs, and changes in its behavior, directly reduces the amount of variable costs. The only significant component of variable costs left will be direct materials cost.

The Impact on Variable Costing

Although mosts agree that the decreasing amount of variable costs in the total manufacturing costs makes variable costing become less important, not all accountants come to the same conclusion. While *Lee* (1987, p. 54), concludes that absorption costing become the only meaningful costing method under a JIT and automated manufacturing, *Howel and Soucy* (1987b), proposes the opposittе: "The pattern of standard, full cost, process costing systems, used by many companies, must be turned upside down. Cost accounting systems must be de-signed to focus on actual costs, different layers of cost variability, and the individual product". That is, use more of a contribution methodology than the traditional product and or period distinction of financial reporting.

The most interesting explanation come from Hansen. Hansen (1990, p. 537-540), which stress the important role of increasing traceable costs under a JIT manufacturing, argue that it is possible to continue using variable-costing format as a useful managerila tool.

Segmented income statements, for instance, are still appropriate for improving decision making and control. By localizing many costs that were

formerly common to many products (e.g., maintenance, materials handling, and inspection), and by changing the behavior of some costs (e.g., direct labor), the number of traceable costs has been increased. Thus, responsibility for controlling these costs can be more readily assigned. Such decisions as whether to keep or drop a segment are also facilitated by the increased traceability of costs.

According to Hansen, in addition to improving the usefulness of variable costing in decision making, JIT manufacturing also simplifies its use. Recall that variable and absorption costing differ in the way they treat fixed overhead. Absorption costing treats fixed overhead as a product cost, whereas variable costing treats it as a period cost. Under absorption costing, if production exeeds sales, some of the period's fixed overhead can be inventoried and is not expensed until a later period; if production is less than sales, fixed overhead attached to inventory units from prior periods is expensed in addition to the current period's fixed overhead. How fixed overhead is treated by each method, then, leads to differences in the valuation of finished goods inventory and in reported income. In short, the only difference between income statements using the two systems would be how expenses are presented on the income statement: absorption costing classifies costs by function, and variable costing classifies them by cost behavior.

Conclusion

Although the implementation of JIT and automation are dramatically affecting the traditional management accounting practices, the superior of variable costing in compare to absorption costing for internal reporting is undeniable. This is primarily because variable costing stress the distinction between variable costs and fixed costs. This distinction is very important for making decision.

Many manufacturing costs formerly classified as indirect are directly traceable to the products being produced in a JIT system. JIT also attempts to structure the manufacturing process so that as many manufacturing costs as possible can be classiffied as direct product costs. This produces more accurate product costs and better information for decision making.

Furthermore, by treating the nonvolume-based assignments as traceable costs, it is possible to continue using the variable costing format as a useful managerial tool.

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