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Dear Manufacturing Executive:

Prior to the accidental discovery of X-rays by Wilhelm Röntgen in 1895 and William Coolidge's invention of the X-ray tube at the turn of the 20th Century, the only way physicians could diagnosis injuries and diseases was through their ability to observe or otherwise detect symptoms on the body itself or by opening it up to observe the patient's bones and organs "up close and personal." Compound fractures and tumors on or near the skin's surface were observable symptoms, but hairline fractures, deep body tumors, accumulations of fluid, and other "invisible" conditions went undetected and, as a consequence, untreated. Many lives were lost, or at least shortened, due to this limitation on the practice of medicine.

The addition of X-rays to the physicians' kit of diagnostic tools enabled them to identify and treat injuries and afflictions they would not have otherwise have been able to address. Although many individuals were able to lead long and reasonably healthy lives in the days before X-rays, the ability of humans to live long and healthy lives has been greatly enhanced due to the widespread use of this quantum leap in medical science.

Most U. S. manufacturing companies in the 21st Century have either chosen to ignore the invention of X-rays or have remained ignorant of their availability. Simply because they've been able to remain in business, they assume they are in good health and that they have no "ticking time bombs" lurking inside that could end their existence at any moment. Their misplaced confidence in 19th Century medicine puts their very existence at risk, especially in today's ever more competitive, worldwide marketplace.

Direct labor-based costing models represent the era before X-rays. The over-generalized and superficial information they generate provide a manufacturing firm's decision makers with both inaccurate and incomplete information. As a consequence, the quality of their decisions suffers as decisions are based on economic fantasies, not economic facts. Inappropriate pricing decisions, wasted capital funds, and ineffective operating decisions lead to underachievement and, in the worst cases, failure.

The ability to clearly view and understand the inner workings of their company is readily available to manufacturers of all types and sizes. There are a wide-variety of methods available to incorporate 21st Century costing practices into the medical kit of any manufacturer. But first, they need to address the issue. Ignorance is not bliss.

The white paper that accompanies this letter, "The Shortcomings (and Dangers) of Direct Labor-Based Costing at Manufacturers," outlines many of the problems inherent in that obsolete method of costing. I hope you find it informative.

Very truly yours,

Douglas T. Hicks

Douglas T. Hicks, CPA, CMC
President

The Shortcomings (and Dangers) of Direct Labor-Based Costing at Manufacturers

Douglas T. Hicks, CPA, CMC

“People who shut their eyes to reality simply invite their own destruction.”

- James Baldwin

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The Shortcomings (and Dangers) of Direct Labor-Based Costing at Manufacturers

Douglas T. Hicks, CPA, CMC,

Executive Summary

- ❖ Direct labor-based costing models have retained their popularity among manufacturers in the 21st Century despite the major changes in both manufacturing technology and philosophy that have made them ineffective and their output misleading to decision makers.
- ❖ Cost models driven by direct labor fail to take into account the true nature of the processes whose costs are being measured and whose rates being determined. Common areas of failure include:
 - *Cells and lines* where each “focused factory’s” costs are unique and do not vary in proportion to the number of employees working in the cell or on the line,
 - *In-process movement and storage* whose costs cannot be linked to the appropriate products because they lie buried in direct labor-based rates and whose existence is made invisible to those seeking to improve operations and reduce costs,
 - *CNC equipment*, whose purpose is to both improve quality and reduce or eliminate direct labor, cannot have its cost accurately measured or assigned based on a resource it has been designed to eliminate.
 - *The cost of acquiring and owning purchased materials, components and outside manufacturing services* is also buried in direct labor-based rates – each purchased item’s “price” is treated as its “cost” – substantially distorting the true “cost” of purchases.
 - *Post-manufacturing costs*, most of which are not attributable to products, but to specific customers, are either ignored or incorporated in direct labor-based rates and spread arbitrarily among the company’s products
- ❖ Continued use of direct labor-based cost models greatly diminishes the quality of a manufacturer’s decision making processes and, as a consequence, negatively impacts its bottom line. For example:
 - Profitable business is lost and unprofitable business won because production costs have been inaccurately assigned to products, customer specific costs have not been assigned to customers at all, and other support costs have been arbitrarily spread over all products like peanut butter.
 - Lean and other process improvement initiatives are hamstrung as there is no cost data for most processes and those whose costs are measured are measured inaccurately.
 - Costly errors in insourcing, outsourcing and – most dramatically – offshoring products are made as a result of inaccurate and incomplete cost information.
- ❖ The answer is not to implement a new, costly and complex cost accounting system. Instead, the answer is to develop and use a valid decision costing model that can be populated with data from existing sources to arrive at the accurate process, product, customer and incremental cost information necessary to support the high-quality business decisions required to survive and grow in an ever more competitive, worldwide marketplace.

The Shortcomings (and Dangers) of Direct Labor-Based Costing at Manufacturers

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Introduction

As we begin the second decade of the 21st Century – over a quarter century into the “cost measurement and management revolution” – most U. S. manufacturers continue to base not only their day-to-day cost accounting systems, but the cost information they use to support critical management decisions, on cost models driven primarily by direct labor. These models, developed at a time when product and process variety were minimal and direct labor was a major cost of manufacturing, are simple, easy to use and explain, compatible with most ERP and other manufacturing software and, in a vast majority of cases, totally inappropriate.

The rapid evolution of manufacturing processes, the ever increasing demand for complexity and variety in manufactured products, and the addition of customer-required pre- and post-manufacturing services have pushed the realities of manufacturing far beyond the capabilities of “simple and easy to use.” Costing pioneer Alexander Hamilton Church wrote in the April 1910 issue of *Engineering*, “No facts that are in themselves complex can be represented in fewer elements than they naturally possess. While it is not denied that many exceedingly complex methods are in use that yield no good results, it must still be recognized that there is a minimum of possible simplicity that cannot be further reduced without destroying the value of the whole fabric. The snare of the ‘simple system’ is responsible for more inefficiency ... than is generally recognized...” In the 21st Century, direct labor-based costing has fallen far below the “minimum of possible simplicity.” It no longer provides a valid model of the economics that underlie a modern manufacturing organization and, as a consequence, should no longer be relied upon as a method of measuring a manufacturer’s product, process, or customer costs – especially when these costs are used to support critical management decisions.

Common Shortcomings

In its simplest form, a manufacturer will use a single, plant-wide overhead rate – expressed as either a percentage of direct labor cost or an overhead cost per direct labor hour – to be added to direct labor’s hourly cost. All non-manufacturing costs will then be assigned to cost objectives (products, customers, etc.) as an add-on percentage (known commonly as a “G&A rate”). This most rudimentary type of direct labor-based costing model is teeming with danger as the following “real life” example will show:

There was once a 90-year old company in Ohio’s Miami Valley that manufactured complex, geared assemblies for the aerospace industry. From its inception, it used a single, direct labor-based overhead rate for applying all of its indirect manufacturing costs to its products. The company’s processes ranged from machining that was performed on \$750,000 CNC Omni Mill to assembling products by hand in area equipped only with wooden tables and benches. One of

the company's largest and most profitable product lines was helicopter transmissions whose products were sold to the nation's major helicopter manufacturers.

Over an eighteen month period, this product line's customers stopped buying assembled transmissions from the company and began requesting that they be sent "kits" of parts instead. The customers would do the assembly themselves. Although they were disappointed with the change, the company was able to negotiate a revised price at a level that still showed a substantial profit on the kits based on its cost information.

Similar situations continued to arise over the next few years – customers chose to purchase only complex components from the company and take the lower-cost operations in-house – until after nearly a century in business, the company was forced to close its doors forever. The company's inappropriate costing methods had put it out of business.

Although the price it charged for complete assembled transmissions was competitive, the customers realized that they were getting overcharged for low-cost assembly activities while being undercharged for the high-cost machining work. By purchasing only kits and assembling them in-house, they were able to realize significant savings – at least until the company went out of business.

The company's single, direct-labor based overhead application method had made it appear that an operation where a worker sat at a bench and assembled transmissions cost exactly the same per hour as an expensive Omni Mill that devoured thousands of dollars of perishable tooling and consumed tremendous amounts of electricity. Its low-cost assembly operations were subsidizing its high-cost machining activities. Had it measured the cost of both operations using a cost model that accurately reflected to economics that underlay its operations, it could have continued to produce completed assemblies (remember, its price for complete assemblies was competitive) and it might still be a profitable business today.

Many accountants believe that if they segregate manufacturing into multiple cost centers and then develop separate direct labor-based overhead rates for each cost center, the problem will be averted. That is, unfortunately, not the case. A company using multiple direct labor-based overhead rates to apply indirect manufacturing costs and a traditional, company-wide, total-cost based "G&A" rate to assign non-manufacturing costs to products and customers will continue to experience shortcomings such as:

- *The cost of cells and lines will be misstated and, as a consequence, any products manufactured using these cells and lines will be costed inaccurately.* Cells and lines require a fixed amount of cost to operate regardless of how many workers are present. Occupancy and capital equipment costs are primary examples. The variable costs of operating cells and lines (utilities, perishable tooling and other consumables) are generally driven by the operation of the equipment, not the activity of a worker. Linking such fixed and variable costs to the hours worked by cell/line workers makes it appear as if these costs vary in direct proportion to those hours. A smaller crew attending the line implies that these costs are reduced when in reality they stay the same. A larger crew will imply that these costs increase when, in fact, they remain the same. The ramifications of this error are many; from industrial engineers miscalculating the impact

- *The cost of in-process movement and storage will be totally ignored.* The cost of moving, storing and financing work-in-process, semi-finished products/sub-assemblies and manufactured components will be spread among all products like peanut butter. Those products requiring these activities will not be assigned an appropriate amount of their cost. Instead, they will be subsidized by those products not requiring them. Worse yet, by burying these indirect costs in direct labor-based overhead rates, they will be invisible to individuals seeking to reduce operating costs, increase manufacturing velocity, cut inventories, and effect other operating improvements. Failure to measure these costs hides many of the benefits gained from a company's lean initiatives and often keeps companies from fully embracing a lean philosophy.
- *CNC equipment and any other equipment that requires only a partial direct worker, or perhaps no worker at all, will be costed incorrectly.* If a worker attends two machines, each machine's operation will appear to cost only one-half as much as it does when the worker attends a single machine. Obviously, this does not reflect reality. The equipment cost does not vary with the hours of direct labor; it varies with the equipment's hours of operation. The impact on pricing decisions should be readily apparent. The misstated savings from labor reductions or the impact of adding workers to improve equipment throughput time will also mislead management.
- *Any equipment whose attending crew size can vary based on the characteristics of the product being produced will be costed incorrectly.* As in the case of fractional workers, the equipment does not cost twice as much to operate simply because it requires two workers instead of one nor does it cost one-half as much when one worker is required as opposed to two. The pricing and cost savings implications are the same as with CNC equipment.
- *The price paid for purchased materials, components and outside manufacturing services will appear to be the total cost of those items.* The cost of purchasing, handling, quality, storing, financing, and other administrative activities required to support purchased (or customer provided) materials, components and outside manufacturing services will be buried in manufacturing overhead or G&A costs. The minimal support cost for off-the-shelf items will go unnoticed as will the much higher support cost of custom items. Slow-turning items will not be penalized for the extra space and financing they require while the benefits of fast-turning items will be invisible. No cost will be assigned to customer provided or consigned items even though they require support from many of the same activities as the company's purchased items. The major costs needed to support outside manufacturing services, including the extra inventory-related costs when items are sent outside in the midst of the manufacturing process, will be ignored. The cost benefits of high-volume items purchased in bulk and handled using mechanized systems will be lost while the extra cost required to support low-volume items requiring substantial handling and storage will be ignored. Perhaps most dramatic will be the total absence of support costs related to the purchase of items from overseas. Offshoring decisions will be made in total ignorance of the economics that underlie such a critical decision.

- *Post-manufacturing costs, like those related to finished goods storage, order picking, order processing, shipment preparation and logistics, will be invisible.* Because the cost of these activities lay buried in manufacturing overhead or the company's G&A rate, it is impossible to assign them to the customers that require them, thereby making accurate measures of customer profitability impossible. Instead, these costs will remain buried in manufacturing overhead or G&A and be spread like peanut butter to all customers in proportion to their product costs.

These are just a few of the common shortcomings inherent in direct labor-based costing at manufacturing firms. There are many others. Each manufacturer will have its own unique set of issues. Nevertheless, even with "band aids" applied to a direct labor-based cost model, the high-quality product, customer, and process cost information necessary for a manufacturer to make sound decisions and take effective actions will be non-existent. Instead, cost information will remain inaccurate and misleading.

What Difference Does it Really Make?

If the negative impact the distortions inherent in direct labor-based costing have on a manufacturer's decision making are not obvious, understanding the effect they have on pricing decisions should help make the connection crystal clear. There is a law of economics – known at my firm as *Hicks' First Law of Pricing* – that applies here. That law goes like this: *"A company will get a lot of business when it does not charge its customers for things it does for them, but it will not get much business when it attempts to charge its customers for things that it doesn't do for them."*

For example, one manufacturer has overall productivity that is about average for its industry and marketplace. Under normal economic conditions, the market will allow this company, whose costs are at the industry average, to charge a price that will enable it to recapture its cost and earn enough of a profit to ensure its continuing ability to supply the marketplace. If this company accurately calculates its "fully-absorbed" costs and adds a market-supportable profit margin on each of one hundred possible contracts, it should be competitive on those contracts and will earn its expected profit margin on any contract it is awarded.

This situation is shown graphically in Figure 1 in which the horizontal axis represents one hundred contracts bid and the vertical axis the percentage accuracy of its fully-absorbed cost estimates. The market prices shown provide consistent margins above the accurately determined costs. The area between the market price and the 100% accurate contract costs represents the profit on any contract awarded at the market price.

If this company uses an inappropriate, over-generalized methodology (such as applying overhead costs on the basis of direct labor hours/dollars) to estimate its costs, it will overestimate the fully-absorbed cost on approximately one half of the contracts bid and underestimate the costs on the other half. As a result, it will establish an *acceptable price* (quoted price) at levels that will be under the market for those contracts whose costs were underestimated and over the market for those contracts whose cost were overestimated. This situation can be seen graphically in Figure 2 in which contracts are sequenced from left to right starting with the contract whose cost was most underestimated and ending with the contract whose cost was most overestimated.

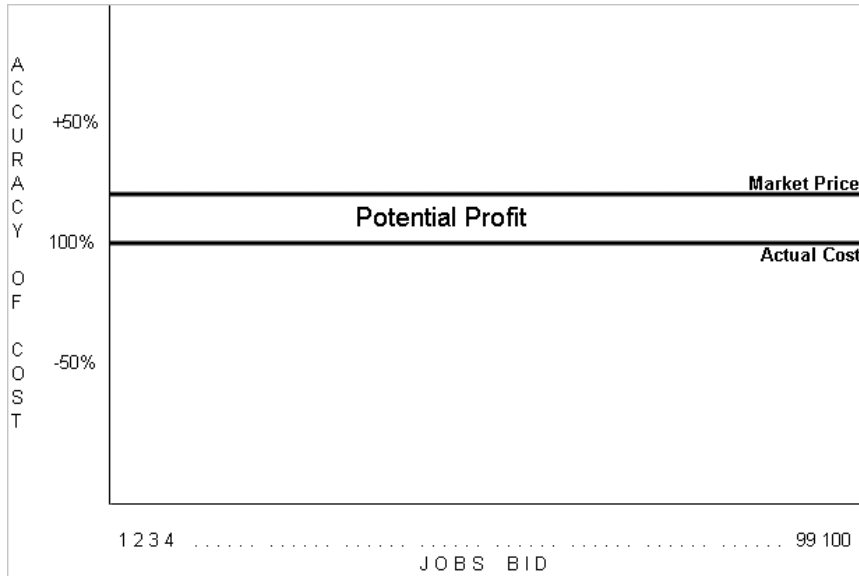


Figure 1 – Market Price/Profit Potential

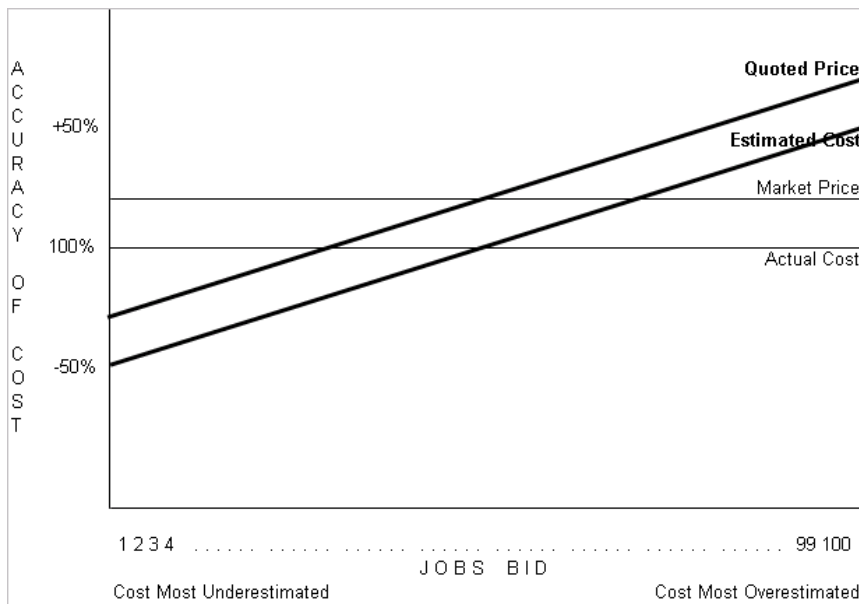


Figure 2 – Pricing Based on Over-Generalized Costs

Looking at the “Quoted Price” and “Market Price” lines, it is obvious that the company will be much more likely to be awarded contracts on the left side of the diagram – contracts bid at less than market price – for which it was “*not charging the customer for things it does for them.*” Conversely, it will not be awarded contracts on the right side of the diagram – contracts that could have been profitable at much lower prices – for which it was “*charging the customer for things it does not do for them.*” Unfortunately, actual costs do not care whether they have been over or underestimated; they will be *actual* either way. As Figure 3 clearly shows, if the company is awarded those contracts that were inadvertently priced below market, it has little or no change of

financial success. At the same time it will be missing out on the potential profits that could have been earned at the market price on those contracts its inaccurate costing methodologies caused it to overprice.

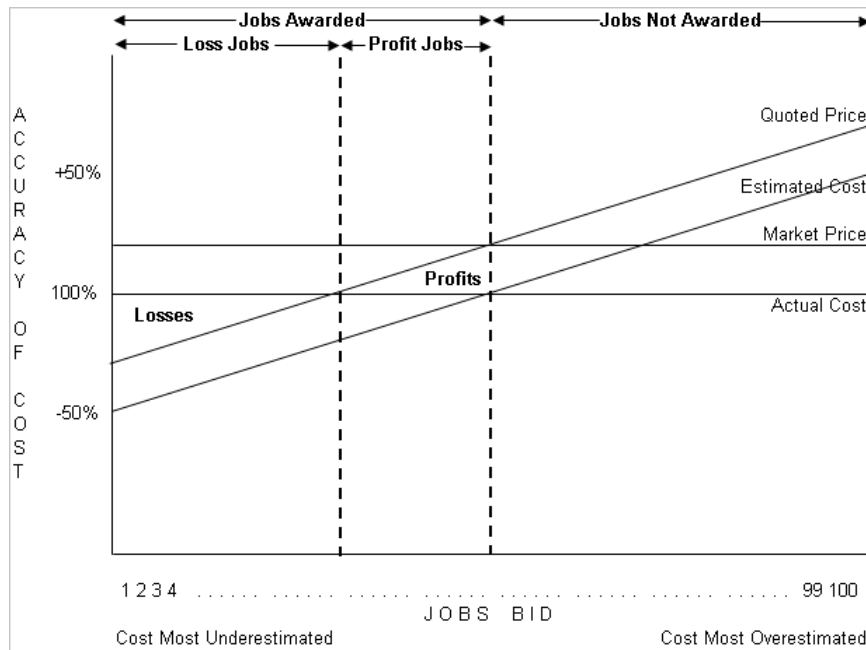


Figure 3 – Profitability Analysis of Contracts Won

Pricing is not the only area where distortions and problems lead to low-quality decisions. The savings from operating improvements are regularly miscalculated. One company added new controls to a piece of equipment that made it possible to reduce the number of workers needed to operate the machine from two to one. The anticipated cost reduction not only included the cost of one laborer, but it was estimated that the equipment’s variable operating costs – including perishable tooling and utilities – would also cut in half. The latter was not a savings they were likely to realize. At another company, I observed an industrial engineer working to reduce the labor minutes at a non-constraint operation in a manufacturing line. When I asked what benefit he expected the company would realize, he looked at me as if I was an imbecile and answered, “We’ll reduce labor cost by \$2.00 per hour plus, of course, the \$6.00 that will follow because of our 300% overhead rate.” Of course, none of the savings would be realized because no reduction in crew size would be effected – the worker would just have more idle time – and the overhead cost would remain the same.

Another major area where direct labor-based costing impacts a manufacturer’s decision making adversely is in insourcing and outsourcing decisions, particularly those related to offshoring. Consider the following list of costs and other sacrifices inherent in offshoring:

INBOUND FREIGHT

- General freight from overseas is approx. \$4,000 per 40,000 lb container
- Freight from West Coast to Midwest is approx. 1,000 per 40,000 lb container
- Emergency air freight from overseas is approx. \$250 per 20 lb package

PURCHASING, ENGINEERING & QUALITY

- Separating Engineering & Manufacturing hamstrings concurrent engineering
- Cost of no local presence; travel and lodging
- Cost of resolving product design, quality and delivery issues – different time zones, languages and cultures
- Confidence in compliance – potential liability problems
- Intellectual property risk

INTERNAL HANDLING COSTS

- Breakdown of container content
- Repackaging
- Labeling and Relabeling
- Redistribution from central receiving point

ADMINISTRATION COSTS

- Tracking foreign content
- The paperwork snake
- Additional part numbers if dual sourcing
- Fees and expenses; freight forwarder, customs broker, continuous bond, merchandise processing, harbor maintenance, letters of credit, duties, insurance

INVENTORIES

- Transfer of ownership point
- Need to manage container loads of goods
- Higher safety stocks due to long cycle times and unreliable delivery
- Higher obsolescence due to inability to adjust orders in the short term
- Payments made “sight unseen”
- Often entire order shipped at once

COST OF CAPITAL

- Deposits for letters of credit – “frozen money”
- Advance payment items
- Financing higher inventory levels

REMANUFACTURING & REWORK COSTS

- Return and replace cycle too long – must salvage parts
- Additional equipment and manpower

OTHER

- Supply chain interruptions
- Currency fluctuations
- Third-party representative costs
- Obstruction of competitive differentiation strategies based on customization
- Obstruction of lean initiatives
- Obstruction of JIT initiatives
- Obstruction of Mass Customization initiatives

How many manufacturers using direct labor-based cost models would consider even a fraction of these costs before chasing the apparent savings from resourcing material or components overseas? I know of one company that saved \$3 million annually in component prices by moving the manufacture of a group of parts to China. The only catch was that they spent \$3.5 million annually – all of which was buried in its manufacturing overhead and G&A costs – to achieve this savings. It's no wonder this company was out of business less than two years later.

The inability to link customer-related costs to the customers that require them also leads to poor pricing decisions and inaccurate measures of customer profitability. Consider the case of a manufacturer who sells the same product to two different customers at the same price. They produce 10,000 units in a single batch each week. 5,000 units are immediately shipped to one of the customers. The remaining 5,000 units are moved to finished goods inventory with 1,000 units being shipped to the customer each day. Do you suppose each of these customers generates the same amount of profit for the manufacturer? The company's direct labor-based costing model makes them appear equal in profitability.

Why Don't More Manufacturers Revise Their Costing Models?

This is a question that has puzzled those of us in the management accounting community for nearly three decades. Doesn't management realize that they are basing their decisions on flawed cost information? Don't accountants understand the impact bad cost information has on their company's ability to achieve financial success? Does management believe that the cost of making a change would require more resources than they can afford? Are the day-to-day demands on accounting too great to allow them the time to add some value to their organization? Whatever the reason, the fact remains that the need for quality cost information at a 21st Century manufacturer is greater than ever and cost information generated by a direct labor-based costing model is far below the level of quality necessary for a manufacturer to thrive and grow in an ever more competitive, worldwide marketplace.

Perhaps one of the major obstacles is the assumption that a change in the way a manufacturer measures its costs requires an expensive, complex and time consuming conversion or replacement of its existing cost accounting system. Fortunately, nothing could be farther from the truth.

Decision Cost Information ≠ Cost Accounting Information

One of the great philosophical mistakes in cost measurement and management is the belief that cost information for decision making must come from a company's cost accounting system. The purpose of cost information is insight; insights that will improve a company's decision making processes and enhance its bottom line. Cost accounting systems are designed to value the company's overall inventory and calculate its overall cost of goods sold for use in company-wide financial statements – not to determine the cost of the individual elements that comprise the company's operation. As a consequence, cost accounting systems incorporate too many generalities and shortcuts to provide accurate and actionable cost information.

Quality cost information that effectively supports decision making comes from a valid cost model – one that accurately reflects incremental, process, and individual product and customer costs – not from the cost accounting system. The reasons are many; from the architecture of the cost model or system to the definitions of cost (depreciation, cost of capital, etc.), from the static nature of cost accounting systems to the dynamic nature of cost models.

A manufacturer does not need a great cost accounting system to have high-quality cost information to support its decisions. It needs a valid economic cost model of its business. Fortunately, the creation of a valid cost model that provides accurate, actionable cost information requires only a fraction of the resources needed to implement a new cost accounting system. A fundamentally sound ERP or other manufacturing information system is still important – it provides much of the data necessary to populate the cost model – but it's the model that generates accurate, relevant and actionable cost information, not the system. Many manufacturers have created and used valid cost models to enhance their bottom lines without changing their day-to-day cost accounting systems.

Conclusion

A 21st Century manufacturing firm using a direct labor-based cost model to determine costs for use in supporting decisions is putting itself at considerable risk. Direct labor may have been an appropriate basis for developing cost information when competition was less, products were uniform, customers demanded few, if any, extra services and direct labor was the major factor in manufacturing. None of that is true today. Today's manufacturing environment requires high-quality cost information – information based on a valid economic cost model of the business – if the manufacturer is to thrive and grow in the future.

Fortunately, the development of such high-quality decision cost information does not require an overhaul of the existing cost accounting system. It requires the development and use of a decision costing model that encompasses all of the cost-critical processes of the organization. With such a model, the manufacturer can assure itself that the cost information used to support pricing, investment, sourcing, process improvement and other critical decisions is economically sound. Without it, management will continue to view the organization through distorted glass and the quality of its decisions will suffer accordingly. Even the best decision maker can't make good decisions if the cost information on which they are based is fatally flawed.

If you have questions or would like additional information, feel free to contact me by e-mail at dthicks@dthicksco.com or by phone at 248.761.3706. You can also check our website at: www.dthicksco.com.

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