



## LEAN ACCOUNTING SERIES Costing by Value Stream

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Having defined the value stream as a separate organizational unit, it now becomes important to know how much it costs to operate the value stream and the cost of products shipped from the value stream. In providing these needs we need to look for a better tool than is provided by the standard costing method in place in most traditional manufacturers. While appropriate for traditional batch manufacturing, standard costing fails to support the goals of lean. This is due to the assumptions underlying this method.

One assumption of standard costing is that all overheads need to be assigned to the product and that these overheads relate (in most cases) to the amount of labor required to make the product. This leads to the distortion of product costs. Some products appear to cost more than they really do and other products appear to cost less. These costs mislead people and cause them to make wrong decisions relating to pricing, profitability, make/buy, and so forth.

Standard costing motivates non-lean behavior in operations. The key measurements used with a standard costing system include the personal efficiency of production workers, the utilization of machines & equipment, and the amount of overhead absorbed by production each month. It does not take long for production managers, supervisors, and operators to recognize that the best way to show good results on these key measurements is to use large batch quantities and build inventory. This is the opposite of lean manufacturing. Standard costing actively motivates non-lean behaviors.

Standard costing requires an expensive and wasteful data collection system. Traditional companies use standard costing as their primary method of maintaining control of production costs. To achieve this they must track the so-called "actual" costs at each stage in production. This leads to the development of complicated shop-floor data collection systems and the generation of huge quantities of wasteful and confusing transactions. This in turn leads to the implementation of wasteful and confusing computer systems.

This kind of data collection system is the opposite of lean thinking. Every transaction is wasteful. These transactions then lead to reports and meetings that are equally wasteful. The information is "hidden" inside the computer instead of providing dynamic visual management. The information is often reported too late to be useful. The reports rarely lead to the kind of on-going continuous improvement required by lean thinking organizations.

Standard costing does not provide the information required to support and motivate lean manufacturing. Waste is concealed within the standard cost itself. Instead of the accounting systems revealing waste, they hide the waste. The waste is tied up in the overhead allocations and is very difficult to unravel. An emphasis on reducing the standard cost will often lead to making changes in the process that do not reduce the true cost of the product and often increase it.

Lean manufacturing and lean thinking violate these assumptions. The cost of the product varies according to the product volume and the production mix. Overhead costs are related to the value stream as a whole and not to production labor time. Maximum profitability comes from creating the maximum flow of product through the value stream at the pull of the customer. The cost of any particular product is primarily dependent upon how quickly it flows through the value stream, particularly at the bottleneck operations within the value stream. We are much more interested in

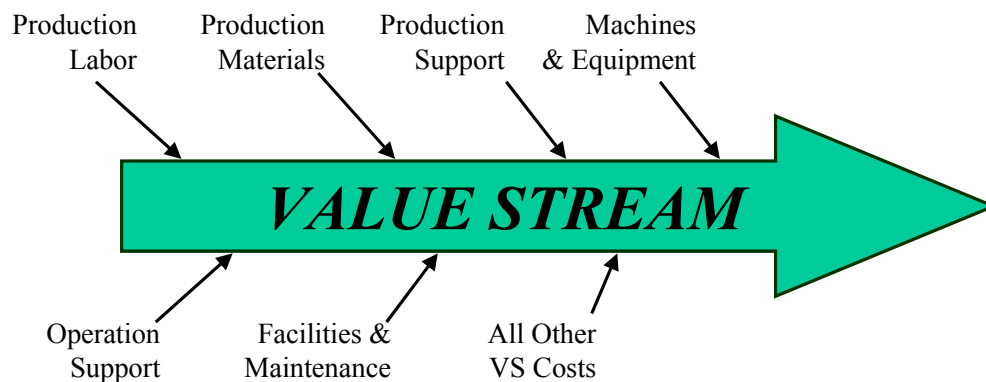
the rate of flow through the value stream than we are with the utilization of resources, people's individual efficiency, or overhead allocations.

A different method of costing based upon the characteristics of the value stream in the lean company is needed to fulfill the needs of the lean company. We call this method Value Stream Costing.

#### Making Value Stream Costing Work

The value stream cost is typically calculated weekly (bi-weekly or monthly) and it takes account of all the costs in the value stream. It makes no distinction between direct costs and indirect costs; all the costs within the value stream are considered direct. If there are costs outside of the value stream; we do not include them in our value stream costing.

Figure 1 shows the costs that make up the total value stream cost. These include all labor costs; both traditionally direct costs and traditionally indirect costs. If the people work in the value stream then they are included irrespective of whether they make the product, move materials, design the product, maintain machines, plan production, make sales, or do the accounting.



All labor, machine, materials, support services, and facilities directly within the value stream. Little or no allocation.

Figure 1. Costs Included in Value Stream costing

The production material costs are generally calculated from how much material has been purchased for the value stream during this week. Every time material is brought into the plant its cost is assigned to the value stream. The total value stream material cost is the sum of everything purchased this week. For this material cost to be valid there needs to be low raw materials and work-in-process inventories; and these inventories must be under good control. If inventories are low, then the materials brought in this week will be used quickly and will accurately reflect the material cost of the product manufactured this week.

Support costs like spare parts and soft tooling are purchased for the value stream (often using a purchase credit card assigned to the value stream so the costs are directly posted to the value stream cost/profit center). The costs of consumables, supplies, and other day-to-day expenses are similarly assigned to the value stream.



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The only allocation used regularly within value stream costing is a square footage (or square meters) cost for the facility. The reason is we want to motivate the value stream team-members to reduce the amount of space used by the value stream. The square footage cost typically includes the rent or lease cost of the building, utilities, and the maintenance costs for the building. The total facilities costs are divided by the total square footage of the building to get the cost per square foot.

The facilities cost assigned to the value stream will be the cost per foot multiplied by the amount of square feet used by the value stream. This square footage will include the production area, stockroom area, and the office space area used by the people working in the value stream. There is no attempt to “fully absorb” the facilities costs; only the square footage used by the value stream is included.

Occasionally the utilities cost are very significant and vary considerably between value streams. In which case, each value stream will be metered and the utilities costs are applied as direct value stream costs.

The value stream costs for a company we will refer to as "Electronic Components Inc." is shown in Table 1. Electronic Components is a manufacturer of controllers used in automated manufacturing machinery. The value stream depicted in the Component Products value stream.

|                               | Material Cost | Outside Cost | Employee Cost | Machine Cost | Other Cost | TOTAL COST |
|-------------------------------|---------------|--------------|---------------|--------------|------------|------------|
| Customer Service              | -             | -            | 12,109        | -            | -          | 12,109     |
| Configuration                 | -             | -            | -             | -            | -          | -          |
| Purchasing                    | -             | -            | 16,145        | -            | -          | 16,145     |
| Loop 1 SMT                    | 358,512       | -            | 17,080        | 16,956       | 20,000     | 412,548    |
| Loop 2: Hand Load/ Wave /Post | 25,608        | -            | 23,485        | 2,016        | -          | 51,109     |
| Loop 3: Test & Rework         | -             | -            | 17,080        | 3,528        | -          | 20,608     |
| Assemble & Burn-In            | 128,040       | -            | 10,675        | -            | -          | 138,715    |
| Shipping                      | -             | -            | 2,669         | -            | -          | 2,669      |
| Quality Assurance             | -             | -            | 8,073         | -            | -          | 8,073      |
| Mfg. Engineering              | -             | -            | 8,073         | -            | -          | 8,073      |
| Maintenance                   | -             | -            | 8,073         | -            | -          | 8,073      |
| Accounting                    | -             | -            | 8,073         | -            | -          | 8,073      |
| Human Resources               | -             | -            | -             | -            | -          | -          |
| Information Systems           | -             | -            | 4,036         | -            | -          | 4,036      |
| Design Engineering            | -             | 7,760        | 4,036         | -            | -          | 11,796     |
| Test Engineering              | -             | -            | -             | -            | -          | -          |
|                               | \$ 512,160    | \$ 7,760     | \$ 139,606    | \$ 22,500    | \$ 20,000  | \$ 702,026 |

Table 1: Value Stream Costs for the Component Products Value Stream--Electronics Components, Inc.

The total value stream cost for the month amount to \$702,026. Note that these costs include materials used in production, labor used in production processes (“Loops” 1,2 and 3 and “Assembly”), the cost of outside processing and the costs of supporting the production process. During this month in question they shipped 2,134 units of product. The average cost of the product is \$328.97.



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Value stream costing is simple because we do not collect the detailed (so called) actual costs by production job or product. The costs are collected for the total value stream and are summarized over the weekly period. Labor costs are not collected using any kind of tracking or backflushing of labor hours “earned”. They are simply the sum of the wages and direct benefits paid to the people working in the value stream. This is derived from the payroll system.

Material costs are also collected in summary over the week. Once the company’s inventory is low and under control the material costs of the value stream will be the cost of the materials purchased for that value stream. All purchases are assigned to the cost center for that value stream. The same is true for supplies, tooling, and other costs. They are applied simply to the value stream cost center, or they are derived from the Accounts Payable process.

A further aspect of the simplicity of value stream costing is the reduction in cost centers. It is no longer necessary to have a huge number of departmental cost centers broken down into all kinds of cost elements. The costs are collected by value stream and each value stream has very few cost centers.

The information on the value stream Income Statement is “real”. It comprises what actually happened that week (or month). The revenue is the real amount of invoices processed for products manufactured in that value stream. The labor costs are what we actually spent on labor. Similarly for the material costs and other costs.

The elimination of overhead allocations means that the information provided is not complicated by unnecessary application of costs outside the control of the value stream managers. This makes the cost and profit information “real” and understandable to the people working in the value stream and their managers.

In an earlier section of this article, we discussed that there are some people in the plant or organization who do not work in the value streams. These are people who do tasks unrelated to the value streams (financial accounting, for example) or they do work that crosses all value streams (ISO9000 or ISO14000 support, for example). The costs and expenses associated with these non-value stream tasks are not allocated to the value streams. They are treated as sustaining costs of the business. They are budgeted and controlled, but they are not allocated. There is no need for full absorption costing. The purpose of the value stream costing is to provide relevant, accurate, and understandable cost information to the people managing the value streams. To absorb into the value stream costs that occur outside the value stream does not provide anything helpful for managing or improving the value stream processes.

The non-value stream costs are inevitably small because most of the work of the organization will be associated with value streams. These costs will be reported on the plant or company P&L as sustaining costs (or a similar description) and people within these areas will be responsible for the elimination of costs and improvement of the processes.

### **Reporting Value Stream Profits**

The results of this simple approach to cost accounting are used to create a value stream P&L and a value stream performance measurement. Table 2 shows the P&L for the Electronic Components’ Component Products Value Stream.

| <i>Electronic Components Inc.</i>       |                    |
|---|--------------------|
| <i>Controller Products Value Stream</i> |                    |
| <b>Revenue</b>                          | <b>\$1,280,400</b> |
| <b>Material Costs</b>                   | <b>\$512,160</b>   |
| <b>Conversion Costs</b>                 | <b>\$184,380</b>   |
| <b>Value Stream Profit</b>              | <b>\$583,860</b>   |
| <b>ROS</b>                              | <b>45.60%</b>      |
| <b>Inventory</b>                        | <b>\$593,008</b>   |

Table 2: P&L for the Electronic Components, Inc.--Component Products Value Stream

Lean companies provide P&L information to the Value Stream Managers. The Value Stream Manager is accountable for increasing the value created by the value stream, removing waste, and increasing profits for his/her value stream. A typical value stream P&L is shown in Table 2. This information is gathered - usually weekly - from the value stream costing. If necessary, the P&L can show an additional breakdown of the information, but it is always best to keep these reports as simple as possible.

The report does not take account of the changes in inventory level when calculating the value stream profit. The reason for this is that we want to provide the right motivation for the value stream team. If the value stream reduces inventory by selling more than it makes, the value stream P&L will show a higher profit and a lower average unit cost. Conversely, if inventory is increased this will show bad results in the P&L. Table 3: Electronic Components, Inc. Division P&L

| <i>Electronic Components Inc.</i> |                            |                             |                                |                               |                         |
|-----------------------------------|----------------------------|-----------------------------|--------------------------------|-------------------------------|-------------------------|
|                                   | <i>Value Streams</i>       |                             |                                |                               |                         |
|                                   | <i>Controller Products</i> | <i>Vertical Positioners</i> | <i>New Product Development</i> | <i>Admin &amp; Overhead</i>   | <i>Division P&amp;L</i> |
| <b>Revenue</b>                    | <b>\$1,280,400</b>         | <b>\$2,048,640</b>          | <b>\$0</b>                     |                               | <b>\$3,329,040</b>      |
| <b>Material Costs</b>             | <b>\$512,160</b>           | <b>\$614,592</b>            | <b>\$12,766</b>                |                               | <b>\$1,139,518</b>      |
| <b>Conversion Costs</b>           | <b>\$184,380</b>           | <b>\$313,445</b>            | <b>\$678,574</b>               |                               | <b>\$1,176,399</b>      |
| <b>Value Stream Profit</b>        | <b>\$583,860</b>           | <b>\$1,120,603</b>          | <b>(\$665,808)</b>             |                               | <b>\$1,038,655</b>      |
| <b>Value Stream ROS</b>           | <b>45.60%</b>              | <b>54.70%</b>               |                                |                               |                         |
| <b>Employee Costs</b>             |                            |                             |                                | <b>\$44,355</b>               | <b>\$44,355</b>         |
| <b>Expenses</b>                   |                            |                             |                                | <b>\$27,943</b>               | <b>\$27,943</b>         |
|                                   |                            |                             |                                | <b>Prior Period Inventory</b> | <b>\$1,788,549</b>      |
|                                   |                            |                             |                                | <b>Current Inventory</b>      | <b>\$1,252,432</b>      |
|                                   |                            |                             |                                | <b>Inventory Change</b>       | <b>-\$536,117</b>       |
| <b>Division Gross Profit</b>      |                            |                             |                                |                               | <b>\$438,287</b>        |
| <b>Division ROS</b>               |                            |                             |                                |                               | <b>13%</b>              |

The P&L for the Plant or Division of the company is made up of all the value streams within the division. The example in Table 3 shows the P & L for the Electronic Components, Inc. division as a whole, with 3 value streams; the Controllers value stream, the Vertical Products value stream, and a New Products Development value stream. The fourth column shows the administrative and "business sustaining" costs that are outside the value stream.

The division P&L information shown in column 5 is summed across from the previous columns. The division level P&L will require adjustments to take account of the change in inventory over the period so as to state the Divisional Gross Profit correctly for external reporting. Other adjustments may also be necessary to bring the Divisional P&L into line with full accrual accounting.

### Using Cost Information to Manage the Value Stream

The P&L information is shown in the Scorecard for the Components Products Value Stream in Table 4, used to manage the value stream.

|                           | Last Week<br>4-Oct | This Week<br>11-Oct | Planned Future State<br>31-Dec |
|---------------------------|--------------------|---------------------|--------------------------------|
| Units per Person          | 36.16              | 42.05               | 51.39                          |
| On-Time-Shipment          | 98.00%             | 94.00%              | 98.00%                         |
| Dock-to-Dock Days         | 23.58              | 20.50               | 16.50                          |
| First Time Thru           | 46%                | 42%                 | 50%                            |
| Average Product Cost      | \$388.46           | \$348.66            | \$316.91                       |
| AR Days                   | 34.5               | 37.0                | 35.0                           |
| Productive                | 9.3%               | 10.8%               | 11.9%                          |
| Non-Productive            | 63.7%              | 54.8%               | 49.3%                          |
| Available Capacity        | 27.0%              | 34.4%               | 38.8%                          |
| Revenue                   | \$1,101,144        | \$1,280,400         | \$1,408,440                    |
| Material Cost             | \$462,480          | \$512,160           | \$535,207                      |
| Conversion Cost           | \$250,435          | \$231,884           | \$208,696                      |
| Value Stream Gross Profit | \$388,228          | \$536,356           | \$664,537                      |

Table 4: Scorecard for the Electronic Components Inc.-- Component Products Value Stream

The purpose of the Scorecard is to provide the Value Stream Manager (and his/her team) a succinct view of the value stream's performance. The value stream performance measurements are shown in the upper section. A simplified value stream P&L is shown in the lower section. And the current capacity usage is shown in the center section.

The Scorecard is usually reported weekly and shows several weeks of prior history as well as this week's results. The right hand column is often used to show the goals the value stream team has set for each of the measurements. These goals do not come from wishful-thinking or by establishing "stretch" objectives. They come from the plans the team has in place for on-going lean improvements. The value stream team (or the continuous improvement teams within the



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value stream) will have a specific plan for kaizen events and continuous improvement projects to reach these objectives.

The Scorecard format is also used to document the expected benefits of major lean improvements.

The average cost is sometimes calculated using just the conversion costs. This is done when the material costs vary significantly from one product to the next but the conversion process is more consistent. The Average Conversion Cost for Electronic Components Inc. is \$88.97 (\$189,866 / 2134).

Occasionally the average cost is calculated for an attribute of the product rather than the full product. For example, we have a client that machines hydraulic connectors. The connectors have either 2, 3, or 4 ends, and are machined from castings. The mix of products varies considerably from one week to the next. The average cost is reported per end rather than per unit, because this is the primary driver of the product cost.

### Product Costing

If costs are collected and reported by value stream and the average product cost calculated then we do not know the cost of individual products. The question to ask is why is the product cost needed?

Standard costs are typically used for the following reasons:

- Pricing decisions
- Profit decisions
- Performance measurement of the factory (using efficiency measures, utilization measurement, cost variance, and absorption)
- Encourage process improvement through analysis of the product costs and variances
- Make/buy decisions
- Product and customer rationalization
- Inventory valuation

When using value stream costing it is not necessary to know the cost of specific products to make decisions on these issues. Pricing decisions for lean organizations are never made with reference to the cost of the product. Lean organizations focus on the value created for the customer or the market. It is customer value that determines the price. Customer value has no relationship to product cost.

Stating that prices are market driven only begs another question; "Are we making a profit on this product if we sell at this price?" Once again it is unhelpful to determine profitability by referencing the product cost. The right approach is to look at the potential order and work out the effect on the value stream profitability.

A decision relating to make/buy is again addressed with reference to the profitability of the value stream as a whole, not the individual product. Using a standard cost to determine the make/buy status of an item is very dangerous. The standard cost will almost certainly lead to the wrong decision. If the value stream has the capability of making an item and has capacity to make it,

then there is no (financial) reason for making outside. The cost of doing it in-house is virtually nothing because the cost of the machines, the people, and the facility is already being paid for.

Standard costs are not required for valuing inventory providing the inventory levels are low and under control. When lean manufacturing is introduced into a value stream the level of inventory falls substantially. If the inventory level is low then the valuation of the inventory is far less important than when inventory is high. If, for example, a value stream has 3 months of inventory then it is very important to value this inventory in a detailed way like the use of standard costs. If the inventory is less than 5 days then the materiality of the inventory value to the calculation of the company's profits and financial position is low.

When inventory is low and under control there are several methods of valuing inventory. These run from the use of average costs, the use of direct material costs but adjusted for the labor & overhead required to bring the valuation up to full absorption, through to a simple calculation based upon the number of days of inventory and the estimation of a day's cost-of-sales amount.

Lean manufacturing creates low and consistent inventory. This in turn enables very simple approaches to inventory valuation. A standard cost is not required for inventory valuation. Indeed a perpetual inventory quantity for each item is no longer required.

#### **Implementing Value Stream Costing**

For value stream costing to work effectively the following must be in place:

- Reporting needs to be by value stream and not by departments
- The people in the company must be assigned to value streams with little or no overlap
- Few (or no) shared services departments and few monuments
- Production processes must be reasonably under control and low variability
- There must be thorough tracking of "out-of-control" situations and of exceptions like scrap, rework, etc.
- Inventory must be reasonably control, relatively low, and consistent

Introducing value stream costing has a maturity path just like any other aspect of Lean Accounting. It is introduced once the company moves into the management of value streams. In the early stages of lean manufacturing, when you are working just on local production cells, there is no need to change the costing system. But once you move to working by value streams, then value stream costing becomes the best way to collect the costs and report the value stream profitability.

#### **Summary**

Lean organizations manage their business by the value streams. The value streams are where the value is created and the money is made. The value streams are also where the waste & delays can be identified and eliminated. Continuous improvement teams are established by value stream because it is important to make improvements from an understanding of the value and the flow. We need a team of people within each value stream whose sole focus is to grow the value stream, increase customer value, and make more money.

As lean manufacturing matures within the company it becomes increasingly necessary to manage the value streams. Performance measurements are reported by value stream. Value stream managers are appointed. The managers have P&L responsibility for the value stream. Growth



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and improvement strategies revolve around the value stream. The value stream focus greatly simplifies the management of the organization.

The change to value stream management is another part of the maturity path. There is no need to make management changes when the lean improvements are restricted to pilot cells. But when lean manufacturing (and other lean initiatives) are widespread in the plant, we begin to manage by value stream. This does not require dismantling the company's departments; there can be a matrix approach where people work in the value stream but still report to a functional manager. Over time, however, it usually becomes clear that reorganizing the company around the value streams is the best way to run a lean operation.

As a company matures with lean manufacturing it will move from just applying lean thinking to individual production cells to viewing the flow through the entire value stream. When a company moves to value stream management the simple methods of value stream costing become much more useful than traditional standard or detailed actual costing.

Value stream costing is simple because the cost information is collected in summary form across the whole value stream and is collected weekly (or monthly). The value stream costs contain (almost) no cost allocations because all the value stream costs are directly applied. Value stream costing provides better information because the information is the real, direct cost of the value stream. Value stream costs are easy to understand because the cost collection and calculations are simple; everyone can understand them.

Value stream costing provides excellent performance measurements and provides a P&L statement for each value stream. These value stream P&L's are combined to provide a plant-wide or company-wide P&L statement.

Standard costs can be eliminated in favor of value stream costs because there is no longer a need to use standard costs for such decisions as order profitability, make/buy decisions, or inventory valuation. These decisions are made with reference to the overall profitability of the value stream.

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