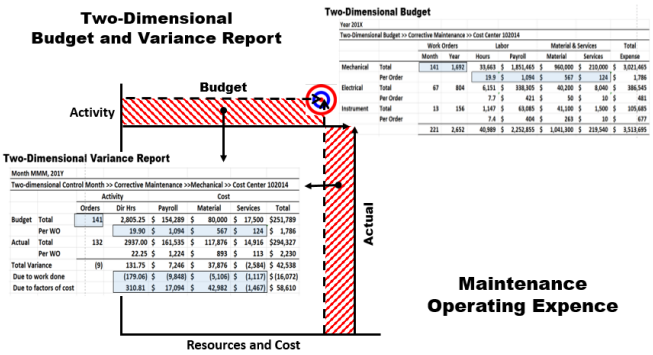

The Secret Is to Budget and Control Maintenance Opex Dimensionally

By Richard G. Lamb, PE, CPA, ICBB; Analytics4Strategy.com

It is hard to find senior managers who are fully confident that maintenance spending in their plants is what it must be to realize the best short-, middle- and long-term business performance. The reason is that the traditional one-dimensional budget and variance control practices cannot prove it nor assure it.

To prove and assure business-optimal maintenance spending, plants will need to break away from the traditional approach. This article will describe two-dimensional budget and variance control as the break away. By describing and comparing the one- and two-dimensional systems, the reader will be able to decide for themselves if it is possible to give senior management the proof and assurance they want from maintenance operations.

Budget and Control as a System

To begin with, we need to define the components of the budget and variance control system. They are mission, structure and derivation (computation).

Mission: Just as maintenance is a sub-budget in the plant's grand budget, there is a sub-budget for plant aggregate production. Consequently, the mission of the maintenance budget and variance control system is to allow the plant to connect work at all levels of the maintenance operation to the readiness of production assets to deliver the aggregate plan. It will concurrently allow the plant to connect work to staying abreast of plant deterioration, thus, protecting against being overridden by work to sustain readiness. Along with doing the work to assure readiness and counter deterioration, the third aspect of the mission is to cost effectively plan, manage and do the work.

Structure: There are two levels to any budget and variance control system—structure and derivation. The system must have a structure to which the details of budgeted and actual

spending are attached and from which variance is controlled. Figure 1 shows the choice of structure with respect to a grouped set of activities.

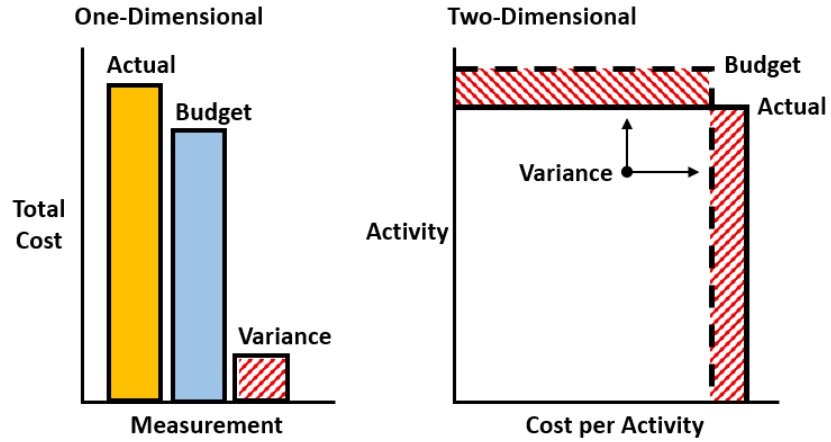

Figure 1: The contrast between one- and two-dimensional structures is a contrast in insight into true variances.

The one-dimensional structure shows only one dimension of information—total cost. The two-dimensional structure shows two dimensions of information—activity and cost per activity.

With only one dimension, there can only be a single net variance. With two dimensions, there is variance for each of the dimensions—variance due to activity and variance due to cost per activity.

The sections to follow will explain the structures much more deeply. It will be easily apparent that the contrast in insight is the difference of operating on misinformation or good information.

Derivational: The second level of the system deals with how we are to form the details of the budget. The question is ask and answered at each intersection of cost center, work type, cost type, craft type, asset type and components, condition of data, etc. The intersections are the "cost groups" on which the system will budget and report variances.

The choices for derivation range from zero-based budgeting to predictive-based budgeting. The term "range" is appropriate because every cost group will either be at an extreme of the range or somewhere in between. Invariably along the range, we build up from activities to resources to conduct the activities to direct and indirect costs of the resources.

A third choice, not on the continuum of the range, is the currently typical practice. However, it is not good business. Furthermore, it is a match to a one-dimensional budget and control structure because total cost is only a one dimensional derivation.

At one extreme, zero-based budgeting establishes named tasks for named equipment and their components. Zero-based would be more of a possibility for proactive and project (AKA, major) maintenance than for corrective (AKA, reactive) maintenance.

Predictive-based budgeting uses statistics-based methods and models to establish the expected number of tasks, and the resources and cost to do them for classes of assets and situations. However, in contrast to zero-based, it does not attempt to name in advance the tasks, equipment and components.

The choice is not an either-or situation. Which approach is applied will reflect the best approach for each of the many cost groups across the plant.

Partial or fully predictive-based derivation will be the most common case. This is because plants rarely have the perfection of computer systems, roles and data to make full zero-based derivation feasible. Furthermore, the budget details for proactive and project maintenance will require some degree of predictive-based derivation beginning at the resourcing and costing stages.

Predictive-based derivation also allows the plant to get around its limitations and weaknesses in historical data. Consequently, the plant can begin immediately to tap the benefits of two-dimensional budgeting and control. It will not need to first improve or enforce operational rules-of-conduct as needed to eliminate the limitations and weaknesses. Time is big money.

There is a third approach to derivation. However, it falls outside the range between zero- and predictive-based derivation. The budget is essentially a “spending allowance” rather than spending derived up from activity. The budget for each of the many cost groups is the total cost of resources to do the work—labor, parts, materials, services, etc. Because there is no dimension for activity, each total cost is one-dimensional.

So where do to the one-dimensional total costs come from? The totals are typically the past year projected into the budget year after adjustments. Very often they are the outcome of negotiations or some general challenge to spend less while doing more. Sometimes they are based on industry indexes such as percent of plant replacement cost. Most cases are the interplay of the adjusted history, replacement value, negotiation and challenges.

This article will not expand on the principles and practices of the derivational approaches. It is a big topic in its own right. Instead, the remaining article will expand on the two-dimensional structure and, with respect to the readily apparent immense business ramifications, contrast it with the one-dimensional structure.

The Two Dimensions of Budget and Control

In contrast to a one-dimensional structure, a two-dimensional structure complies with the core-most rule-of-gravity in cost accounting. All costs have two dimensions. Figure 2 shows the dimensions to be activity (job count) and factors of cost. Let’s look closer at each.

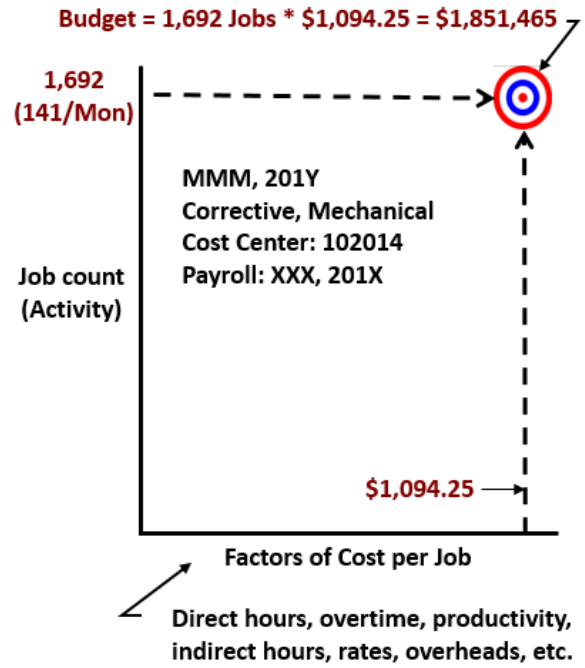

Figure 2: To be meaningful, budgets must be the intersection of two dimensions.

Activity Dimension: The anchor dimension is activity (AKA, workload) because everything starts at the direct work that needs to be done. For a maintenance operation, activity is the number of jobs for each cost group. As mentioned previously, all cost groups are bounded with respect to categories such as cost center, work type, craft discipline, cost type, asset type, accountability, etc.

It may not be possible to exercise zero-based budgeting to set the activity budget. If not, we would reach back into the historical data for occurring work orders. Time series analytics would be used to arrive at the activity dimension of the budget. From the modeled monthly forecast into the budget year, we would likely set a smoothed activity levels for a host of reasons.

The article, "Setting the Budget for Maintenance Workload," is a generalized description of the forecasting procedure. The article, "Explore What Did and May Happen With Time Series Questions," describes the types of time series questions a budget team would ask and answer of activity.

Factors-of-Cost Dimension: The other shoe to the activity dimension is to quantify the resources that will be engaged and consumed to execute the budgeted activity, and the direct and indirect costs of the resources. As shown in Figure 2, the dimension can be called "factors of cost." The factors of cost, as an extension of activity, are derived according to the nature of each cost group.

Whereas, the activity dimension ties back to the plant's aggregate production plan and staying abreast of its deterioration, the factors-of-cost dimension has its own connections to profit and ROI. First is the indirect connection to revenue through the adequacy of resources available to

deliver the budgeted activity. Second is the connection between plant fixed expense and the engaged and consumed resources that are optimized upon the activity budget.

The engaged resource, craft body, is the greatest, most determinate and controllable cost factor in a plant's maintenance expense. The work must be done for the plant to thrive and the consumables to the work are pulled along by the work.

However, it is easily possible to have a body of crafts that does not match the budgeted activity level. If shorted, we will quickly spot the failure to get the work done in a two-dimensional system. If over staffed, productivity is reduced as crafts are assigned to jobs in excess of what a job plan would specify.

Consequently, setting the body of crafts will entail some degree of predictive-based budgeting. If zero-based budgeting is possible for a cost group, predictive-based practices will still be called upon to simulate the craft hours that should not be included in a job plan. If zero-based is not possible, predictive-based will additionally be called upon to simulate the direct hours. In both cases, simulation will be called upon to translate hours to the plant's body of crafts.

Let's See It as a Budget Document

Let's step from concept to actual working document. Figure 3 compares the representative documents of the two- and one-dimensional budgets.

Two-Dimensional Budget

Year 201X

Two-Dimensional Budget >> Corrective Maintenance >> Cost Center 102014

		Work Orders		Labor			Material & Services		Total
		Month	Year	Hours	Payroll		Material	Services	Expense
Mechanical	Total	141	1,692	33,663	$ 1,851,465	$	960,000	$ 210,000	$ 3,021,465
	Per Order			19.9	$ 1,094	$	567	$ 124	$ 1,786
Electrical	Total	67	804	6,151	$ 338,305	$	40,200	$ 8,040	$ 386,545
	Per Order			7.7	$ 421	$	50	$ 10	$ 481
Instrument	Total	13	156	1,147	$ 63,085	$	41,100	$ 1,500	$ 105,685
	Per Order			7.4	$ 404	$	263	$ 10	$ 677
		221	2,652	40,989	$ 2,252,855	$	1,041,300	$ 219,540	$ 3,513,695

One-Dimensional Budget

	Payroll	Material	Services	Total
Mechanical	$ 1,851,465	$ 960,000	$ 210,000	$ 3,021,465
Electrical	$ 338,305	$ 40,200	$ 8,040	$ 386,545
Instrument	$ 63,085	$ 41,100	$ 1,500	$ 105,685
	$ 2,252,855	$ 1,041,300	$ 219,540	$ 3,513,695

Figure 3: The comparative guiding value of the budget structures is immediately apparent.

Both structures have two characteristics in common. Both are the same three cost groups of the many across the plant. Both present a total spending budget for three costs—payroll, materials and services.

However, the difference in transparency looms large for insight and decision-making. First, the activity dimension is added for each cost group. Second, average labor hours per job and total

hours are added. Finally, the averages per job for payroll, materials and service per job and totals are added.

In contrast to one-dimensional budgets, we are now presented with every natural detail of planned activity and spending. But wait, there is more! Behind the curtain of the shown detail are the immediately many thousands of replicable records, datasets and models by which the terms were developed. It follows that the budget team and management can drill down to them as needed for insight and consensus.

We can expect that the difference in insight would change immensely the discussion of budget. For activity, the discussion may be why the expectations are what they are, can select cost groups be reduced and earmarked for catchup when current business conditions improve and many other wide ranging strategic issues. For the factors of cost, the discussion is if the resources and associated costs are reasonable and where and how is it possible to better align and reduce them.

Dimensional Variances Tell the Story

With a one-dimensional structure, the plant has very little power to steer and control its monthly activity and cost—the whole purpose of budgeting and variance control. The immensity of what is lost is best demonstrated by what is gained when we operate with two-dimensional budgets and variance control.

Figure 4 is a conceptual depiction of what cost accounting calls “flexible” budgeting as compared to “static” budgeting. Single-dimension budgeting is neither case and is not considered to be good practice by the discipline of cost accounting.

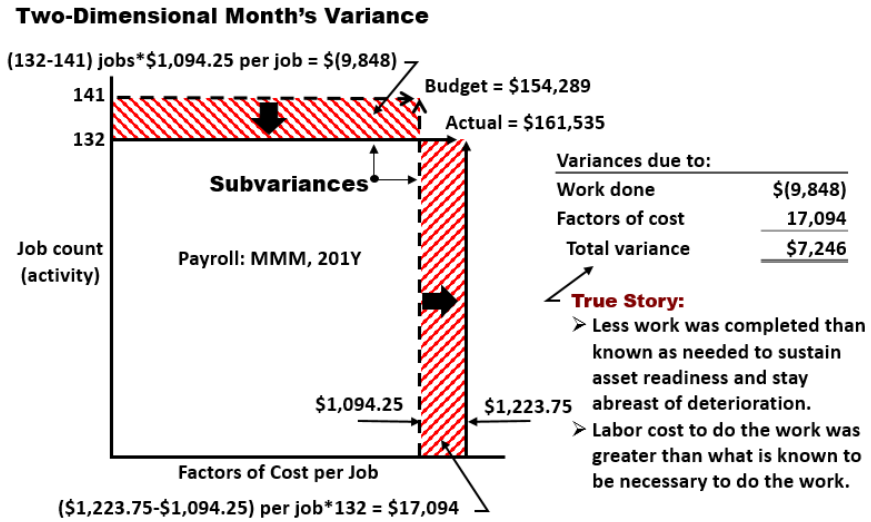

Figure 4: The true story of the month can only be known through dimensional subvariances.

Conceptually, flexible budgeting is the overlay of two rectangles—budget and actual. In a perfect world they would match each month throughout the budget period. Of course, they almost never do which is why there is variance reporting.

The cross-hatched areas are the variances to each dimension of the subject cost group. The calculation of the variances is straightforward and shown in the figure.

It is also important to note that the calculation cannot be made on the back of a one-dimensional budget. There is no baseline upon which to do so.

The figure's table of calculated variances dramatically demonstrates what is forfeited by the one-dimensional structure. The capability to make decisions and take actions in response to the true story is lost. Instead, plants are making decisions and taking actions on the gross misinformation that one-dimensional variances almost always are.

The table of payroll variance for the budgeted cost group tells the true story. In this case, actual payroll overran budget by $7,246. Note that this is the totality of all that can be known out of a one-dimensional structure.

The total net overrun is not huge. It is approximately 4.7 percent of the month's budget. However, when we pull back the two-dimensional curtain, the revealed true bad is 17.5 percent of the month's spending. The variance of both in a bad direction is significantly greater than the net variance.

The revealed true bad shows that total overrun is misinformation. Instead, we would find that the subvariance for activity bodes poorly for the plant's ability to deliver its planned aggregate production and stay abreast of deterioration. Less work was done then known by analytics behind the budget to be necessary during the period. We would also find that the cost to do the work that was completed is much greater than it should have been.

Let's See It as a Variance Report Document

Now let's step from the concept to the working report. Figure 5 shows, as contrasts, the two- and one-dimensional monthly variance report for a single cost group.

As seen in Figure 5, the one-dimensional variance report only reports the differences between the month's total budgeted and actual spending. However, the true, actionable story can only be known if the variances are reported through their dimensional sub-variances—variance due to work done and variance due to factors of cost.

In the figure, the subvariances are reported in the two-dimensional variance report. In contrast, they are conspicuously absent from the one-dimensional variance report.

Two-Dimensional Variance Report

Month MMM, 201Y							
Two-dimensional Control Month >> Corrective Maintenance >>Mechanical >> Cost Center 102014							
		Activity		Cost			
		Orders	Dir Hrs	Payroll	Material	Services	Total
Budget	Total	141	2,805.25	$ 154,289	$ 80,000	$ 17,500	$251,789
	Per WO		19.90	$ 1,094	$ 567	$ 124	$ 1,786
Actual	Total	132	2937.00	$ 161,535	$ 117,876	$ 14,916	$294,327
	Per WO		22.25	$ 1,224	$ 893	$ 113	$ 2,230
Total Variance		(9)	131.75	$ 7,246	$ 37,876	$ (2,584)	$ 42,538
Due to work done			(179.06)	$ (9,848)	$ (5,106)	$ (1,117)	$ (16,072)
Due to factors of cost			310.81	$ 17,094	$ 42,982	$ (1,467)	$ 58,610

One-Dimensional Variance Report

	Cost			
	Payroll	Material	Services	Total
Budget	$ 154,289	$ 80,000	$ 17,500	$251,789
Actual	$ 161,535	$ 117,876	$ 14,916	$294,327
Variance	$ 7,246	$ 37,876	$ (2,584)	$ 42,538
Actual per WO	$ 1,224	$ 893	$ 113	$ 2,230

Figure 5: The comparative ability of the variance structures to tell the true story is immediately apparent.

What is gained when all variances are presented is easy to see in the two-dimensional variance report. We can see in the report, the scenario of insight and misinformation that was described in the previous section and shown in its Figure 4.

Without a two-dimensional variance report, maintenance professionals can remember times that their plant's management inappropriately responded to one-dimensional totals. They zigged when they should have zagged.

Two-dimensional variance reporting is doubly exciting. It allows so much more than just to report subvariances. Because each variance is tied to an analytical workup, it follows that we can trace from the trailhead of each subvariance in the variance report to the outliers and systemic issues that caused the variances.

The ability to trace to the roots of variations gives us the deep insight on which to decide upon appropriate adjustments to planned spending as the year unfolds. It also sharpens the plant's ability to plan and control the next budget year. Just as exciting, reliability and maintenance practices professionals can find in the answers exactly where business profits and returns can most be advanced through surgically redesigned maintenance practices and processes.

Finally, we can summarize the contrast between two- and one-dimensional structures as it was well verbalized by a senior executive. He admitted, "Each month we have big questions about maintenance, but know we can't have an answer. And if we do get an answer, we know it is not a good one. Now we can get good answers."

Related papers: ROACE: Financial North Star to Maintenance and Reliability Operations | Setting the Budget for Maintenance Workload | Size Maintenance Craft Capacity on Forecasts, Not Backlog