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Analyzing Burden Variance for Profit Planning and Control

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Methods of determining variance differ with the accounting authority cited. The author suggests a method for finding the one best way, for any given set of facts, of—

ANALYZING BURDEN VARIANCE FOR PROFIT PLANNING AND CONTROL

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ANY STANDARD cost accounting text that contains a section on standard costs discusses how to analyze burden variance, the difference between burden applied to production and the actual burden incurred. However, the analyses of this variance differ from text to text.

It would seem that it should be possible to develop one best analysis of burden variance for any given set of facts. The purpose of this article is to examine each of the methods of analyzing burden variances and attempt, through a study of their results, to develop as comprehensive and useful a method of analysis as is possible. The approach taken is to assume a set of facts, prepare the usual analyses, and through criticism of their weaknesses attempt to develop a more valid analytical method.

In order to limit the problem to a workable scope, the discussion is concerned only with the information available in a flexible budget system. Since the flexible budget system is generally recognized as

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the most accurate because of its separation of fixed and variable costs, no sacrifice should result from this delimitation.

Criteria for evaluation

Before any attempt can be made to evaluate the various methods of calculating burden variance, the criteria of evaluation must be defined. The evaluations in this article are based on these premises:

1. Budget variation should measure the effect produced when actual costs incurred are higher or lower than those budgeted. It should be equivalent to the cost variance of the materials analysis.
2. Volume variation should measure the cost of unused facilities, the difference between actual volume and capacity.
3. Efficiency variation should measure the cost when actual hours used in production exceed standard hours for actual production.

With flexible budget data available, it would seem that these criteria would imply the following:

1. Budget variation should include the cost variations for both fixed and variable costs; distinction between them is neither desirable nor useful.
2. Volume variation as a measure of the cost of idle capacity should be measured only in terms of fixed burden cost. Variable costs, by definition, cannot be included among costs of idle capacity.
3. Efficiency variation, since it is a measure of the extra hours required for production, should be expressed only in terms of variable costs.

Assumptions

The flexible budget data assumed for a hypothetical Department A are shown in Exhibit 1 on this page. The only term in Exhibit 1 that requires discussion is capacity.

The selection of a "capacity" for use in cost accounting has long been a controversial topic. These are generally conceded to be the alternatives:

ASSUMED FACTS

Flexible Budget Data for Department A

Direct labor hours	50	60	70	80	90	100
Per cent capacity (based on 100 hours)	50%	60%	70%	80%	90%	100%
Budgeted burden: ($)						
Fixed	40	40	40	40	40	40
Variable ($.60 DLH)	30	36	42	48	54	60
Total ($)	70	76	82	88	94	100

Burden rate:

Fixed	$ .40
Variable	.60
	$1.00 [based on 100 DLH]

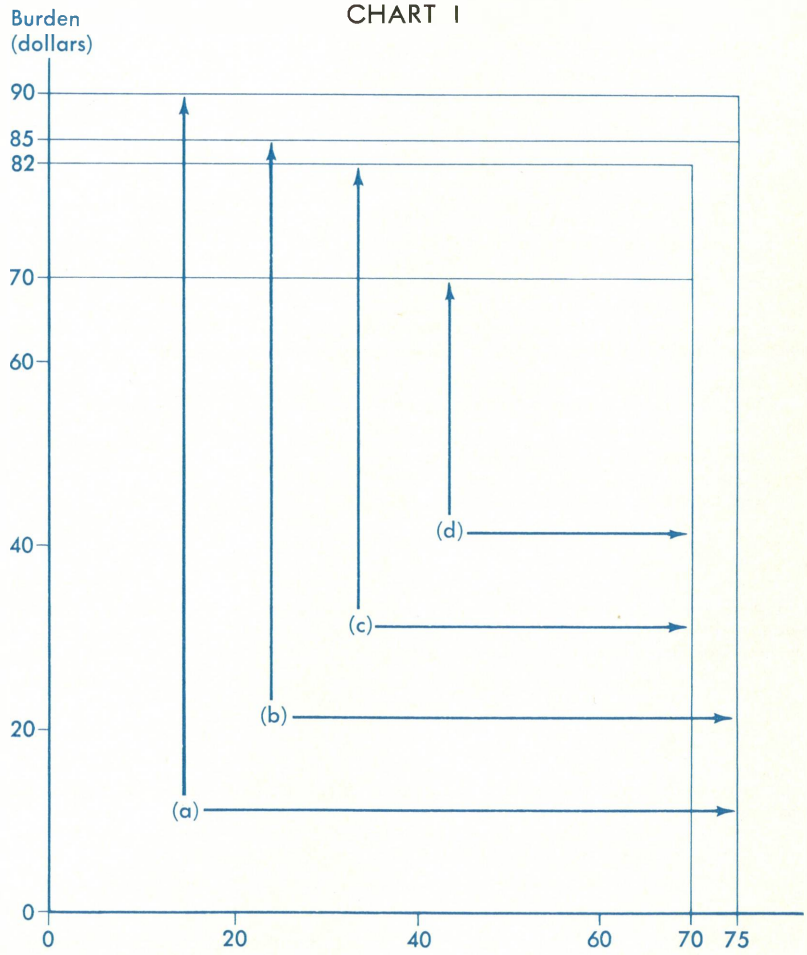
Actual Burden Incurred in Department A

Fixed	$42
Variable	48
Total	$90

Standard hours for actual production equal 70.
Actual hours worked in the department equal 75.

EXHIBIT 1

CHART 1



Budget variation	= b-a =	$85-90 =	$(5)
Volume variation	= d-c =	70-82 =	(12)
Efficiency var.	= c-b =	82-85 =	(3)
Total			$(20)

Note: Letters are defined in Exhibit 2.

EXHIBIT 2
BURDEN VARIANCE ANALYSIS BY THREE DIFFERENT METHODS

Method A: (See Chart 1)			
Budget Variation			
Budget at actual hours	(b)	$85	
Actual burden incurred	(a)	90	($ 5.00)[1]
Volume Variation[2]			
Applied burden (SHxBR)	(d)	$70	
Budget at std. hours	(c)	82	(12.00)
Efficiency Variation			
Budget at std. hours	(c)	$82	
Budget at actual hours	(b)	85	(3.00)
Total Variation			($20.00)
Method B: (See Chart 2)			
Budget Variation			
Budget at actual hours	(b)	$85	
Actual burden incurred	(a)	90	($ 5.00)
Volume Variation[3]			
(AHxBR) (75 x $1)	(c)	$75	
Budget at actual hours	(b)	85	(10.00)
Efficiency Variation			
Burden applied (SHxBR)			
(70 x $1)	(d)	$70	
(AHxBR)	(c)	75	(5.00)
Total Variation			($20.00)
Method C: (See Chart 3)			
Budget Variation			
Budget at std. hours	(c)	$82	
Actual burden incurred	(a)	90	($ 8.00)
Volume Variation			
(AHxBR) (75 x $1)	(d)	$75	
Budget at actual hours	(b)	85	($10.00)
Efficiency Variation			
(SHxFBR) (70 x $.40)		$28	
(AHxFBR) (75 x $.40)		30	($ 2.00)
Total Variation			($20.00)

In order to have the mathematical analysis agree with the graphic analysis the efficiency variation for Method C may be computed alternatively as follows:

Budgeted rate times standard hours	(e)	$70	
Budgeted rate times actual hours	(d)	75	
			$(5)
Subtract the difference between:			
Flexible budgeted standard hours	(c)	$82	
And flexible budgeted actual hours	(b)	85	(3)
			$(2)

[1]Parentheses will be used to indicate an "unfavorable" or a debit balance variance (burden underapplied).

[2]Another way of computing this same variation:

Fixed burden in budget	$40
Minus fixed burden applied (70 x $.40)	28
	($12)

[3]Sometimes the volume variation is computed a little differently, but with exactly the same result:

Total fixed burden to be allocated	$40
Minus (AHxFBR) (75 x $.40)	30
(BH-AH) x FBR	($10)

A moment's reflection will reveal these analyses are the same in essence. Still another variant of this same analysis would be:

Fixed burden rate budgeted	$ .40
Fixed burden rate for budget adjusted to actual hours ($40 ÷ 75)	.533
Deficiency not applied	$ .133
Multiplied by actual hours	75
Volume Variance	$10.00*

*Adjusted for rounding error.

1. Theoretical capacity: This is what engineers feel the plant can produce if everything operates at maximum efficiency.

2. Practical capacity: This is theoretical capacity reduced by normal inefficiency.

3. Normal capacity: This is practical capacity less marketing inefficiency. It represents the average utilization of plant over a two- to ten-year period, leveling out the effects of fluctuations in demand.

The effects of selecting each of these alternatives can be briefly outlined as follows:

1. Normal capacity will produce a volume variance that contains the effects of business cycle variations only (normal capacity less expected actual).

2. Practical capacity will produce a volume variance that reflects marketing inefficiency as well as cycle variations (maximum practical capacity less expected actual).

3. Theoretical capacity, when used in determining a volume variance, will reflect expected inefficiency as well as the other two variations (theoretical capacity less expected actual).

Preparing the analysis

The choice among these definitions of capacity will naturally affect the meaning of the idle capacity variance. This presents no severe problem, however, if the person preparing the analysis words the analysis report properly, defining his terms. An alternative solution would be to break down the idle capacity variance into its subparts—assuming that management would find this information useful.

One additional assumption is made: To provide the most detailed analysis possible, let us assume that burden is applied on the basis of standard hours for actual production. This will permit computation of an efficiency variation.

Analysis and evaluation

With the facts assumed in Exhibit 1, the burden variance is $20,

the difference between the actual burden incurred ($90) and the burden applied at standard hours ($70). This variance is analyzed by each of the generally used methods in Exhibit 2 on page 36. The first method is further illustrated in Chart 1 on page 35; the second, in Chart 2 on this page; and the third in Chart 3 on page 38.

Exhibit 3 on page 39 presents an analysis based on the criteria previously stated. The budget variation, volume variation, and efficiency variation calculated there may be supported as follows:

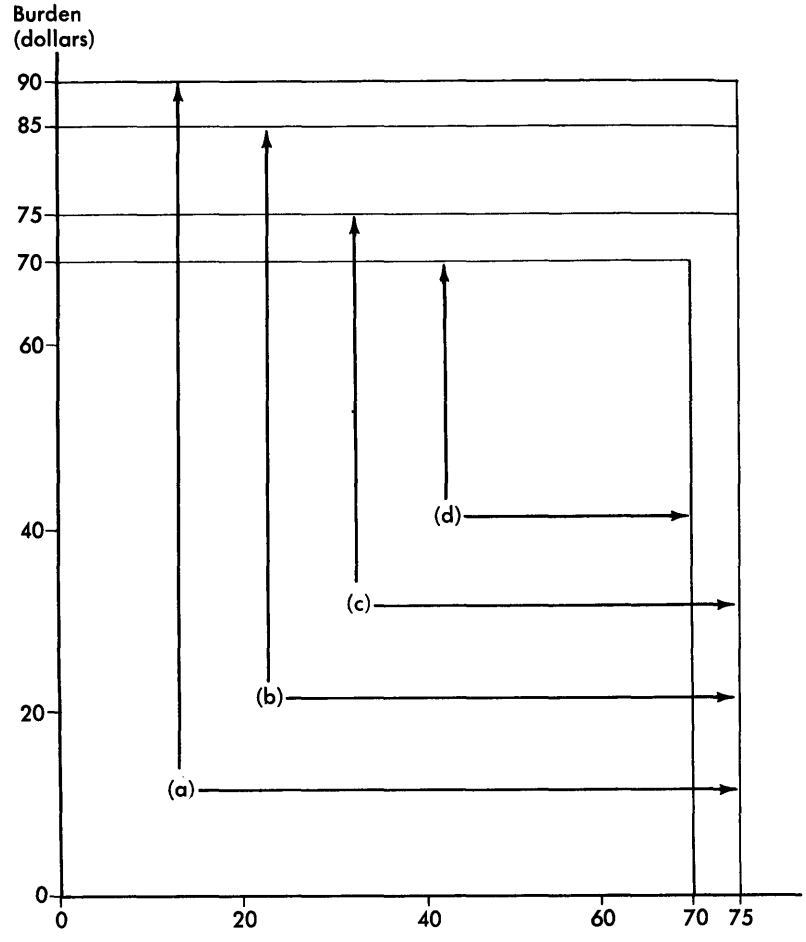
Budget variation

Budget variation should measure the effect of price differences only. In the present case it should equal:

Fixed cost budgeted	$ 40
Actual fixed cost	42
	($2.00)
Variable rate budgeted	$ .60
Variable rate incurred ($48 ÷ 75)	.64
Excess	$ .04
Actual hours	× 75
	(3.00)
Total cost variance	($5.00)

Thus, the budget variation analysis is supported by the assumed facts.

CHART 2



Budget variation	= b-a =	$85-90 =	$(5)
Volume variation	= c-b =	75-85 =	(10)
Efficiency var.	= d-c =	70-75 =	(5)
Total			$(20)

Note: Letters are defined in Exhibit 2.

Volume variation

Idle capacity (volume) variation should measure the cost of unused facilities. It is generally agreed that this cost can be measured by the fixed burden costs that were not applied because actual use of the plant was less than its capacity.

For the case under consideration, capacity was assumed to be 100 direct labor hours, and actual hours used were 75. Therefore, $10—or (100-75) × $.40—may be taken as a measure of the cost of unused facilities. Since variable costs, by definition, occur only in response to activity, it would seem extremely inappropriate to include the variable burden rate in any manner in this computation.

Efficiency variation

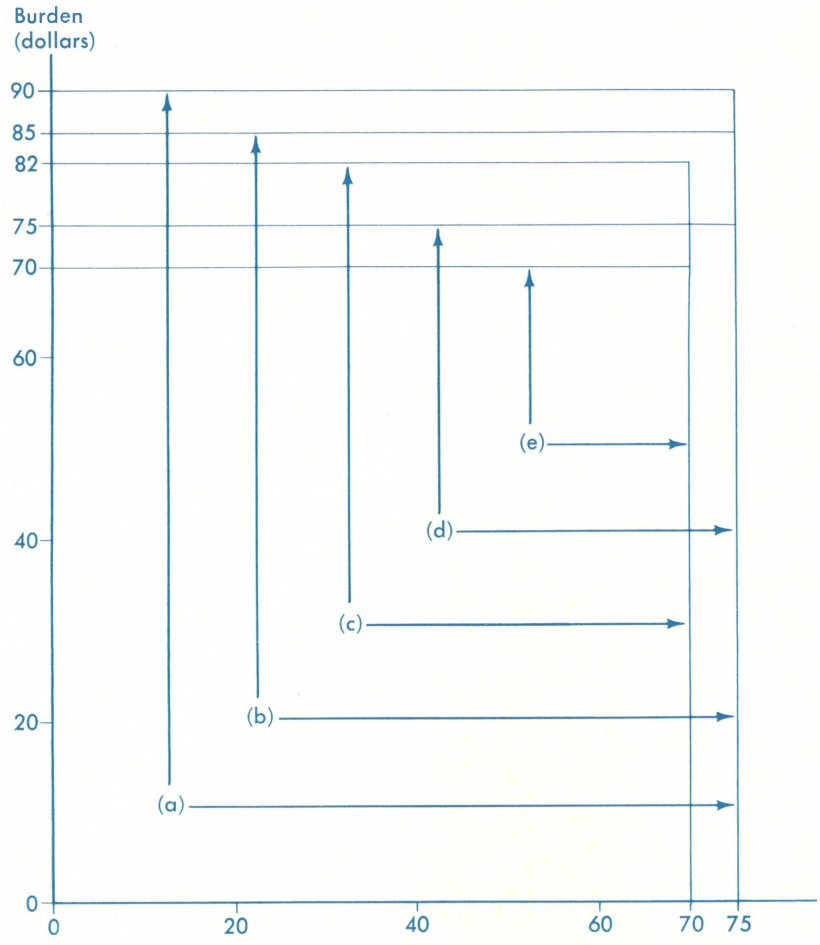
Efficiency variation is defined as the cost of using more productive capacity than the production standards call for. Because fixed costs are not increased as a result of this inefficiency, the variation should be computed with the use of variable costs only. Hence, for the assumed facts, efficiency variation is the excess direct labor hours costed at the variable rate:

Standard hours for actual production	70
Actual hours required	75
Inefficient hours	5
Variable burden rate	× $ .60
Cost of inefficient production	($3.00)

Volume-efficiency variation

In the analysis presented in Exhibit 3 a portion of the total variation, amounting to $2, is not accounted for. This discrepancy is the result of applying burden on

CHART 3



Budget variation	= c-a =	$82-90 =		$(8)
Volume variation	= d-b =	75-85 =		(10)
Efficiency var.	= e-d =	70-75 =	$(5)	
	– (b-c) =	85-82 =	(3)	(2)
Total				$(20)

Note: Letters are defined in Exhibit 2.

1. Budget variation should include the cost variations for both fixed and variable costs.

2. Volume variation should be measured only in terms of fixed burden cost.

3. Efficiency variation should be expressed only in terms of variable costs.

standard rather than actual hours. It can be computed as follows:

Actual hours	75
Standard hours	70
Excess hours	5
Fixed burden rate	× $ .40
Total	($2.00)

It is relevant at this point to ask whether this amount should be included in one of the previous three variances or whether it should be handled separately. If it is handled separately, we must ask ourselves what it measures in order to know its relevance.

Under Method A, this $2 variance was included under volume variation. Under Method B it was added to efficiency variation. Under Method C this amount appeared as the entire efficiency variation. It would appear, therefore, that there is some disagreement as to just what this variation is and what it means.

I suggest that the $2 variation has no hidden meaning or material significance other than what it is

mathematically—the amount of fixed burden that was not applied because burden was applied on standard rather than actual hours. If burden had been applied on actual hours (the so-called "half-standard" method), the $2 would have been included in inventory costs—as would the efficiency variance of $3.

If a name must be devised for this variation, then "volume-efficiency variation" seems fitting because elements of both variations are intermingled in its computation. It is efficiency variance in the sense that it would disappear if burden were applied on actual hours. It is volume variation as regards fixed costs that did not get applied. There is, therefore, a reason other than compromise for this name.

Budget Variation		
Budget at actual hours	$85	
Actual burden incurred	90	($5.00)
Volume Variation		
Hours budgeted	100	
Hours used	75	
Deficiency	25	
Fixed burden rate	x $.40	
Fixed burden not applied		(10.00)
Efficiency Variation		
Hours at standard	70	
Hours used	75	
Excess hours	5	
Variable rate	x .60	
Total		(3.00)
Total Accounted For		($18.00)

EXHIBIT 3

BURDEN VARIANCE ANALYSIS BASED ON EVALUATION CRITERIA

EXHIBIT 4

FOUR-PART BURDEN VARIANCE

Budget Variation			
Budget at actual hours	$85		
Actual burden incurred	90		($5.00)
Idle-Capacity Variation			
Actual hours	75		
Budgeted hours	100		
Unused hours		25	
Fixed burden rate		x $.40	(10.00)
Efficiency Variation			
Standard hours	70		
Actual hours	75		
Excess hours		5	
Variation burden rate		x $.60	(3.00)
Volume-Efficiency Variation			
Standard hours	70		
Actual hours	75		
Excess hours		5	
Fixed burden rate		x $.40	(2.00)
Total Variation			($20.00)

No reason for compromise

Because of the dual nature of this variance, there would appear to be no reason for compromising its significance by combining it with either of the other variations. It would seem more logical to compute and show it as a separate variation.

When adjustment is made in the three analyses under study for the $2 variation, only one other difference appears. Method C shows a budget variation of $8, as opposed to $5 for the other two methods and for the evaluation analysis. The $3 difference is clearly the efficiency variance because this particular budget variation is computed from budget at standard hours rather than budget at actual hours. This method is obviously not desirable because it violates the generally accepted definition of a budget variation.

Four-part analysis

A desirable analysis of the burden application, therefore, would appear to be as shown in Exhibit 4 on this page. This analysis may also be performed graphically. Just as Charts 1, 2, and 3 were graphic representations of Methods A, B, and C, Chart 4 on page 40 is a graphic representative of the four-part comprehensive analysis illustrated in Exhibit 4.

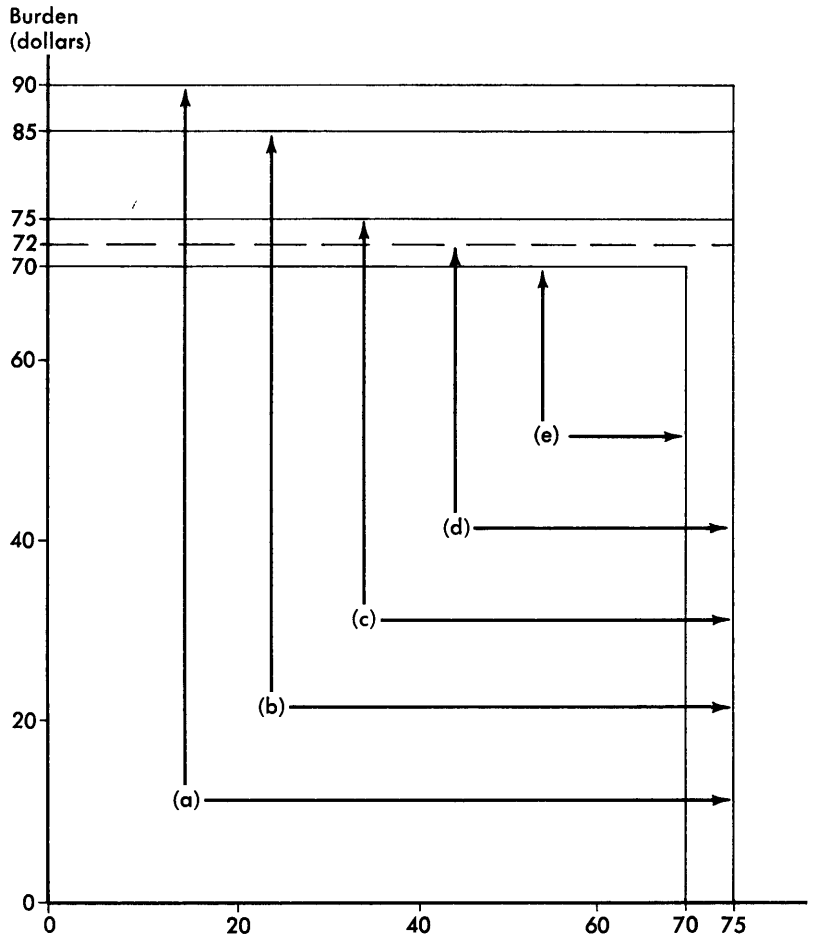
A report to management explaining this analysis might read as follows:[4]

1. The company encountered higher costs than expected during the month for general factory overhead. Actual costs exceeded budgeted costs by $5. Examination seems to indicate that there has been a price increase for certain purchased items and that the managers responsible for incurring the various costs have obtained the lowest costs possible under the circumstances.

2. The plant attained only 75 per cent of practical operating capacity in the last month. Based on a level of 100 direct labor hours, this un-

[4]Several assumptions are made in the report content to permit a presentation that is more realistic and more useful to management.

CHART 4



Budget variation	= b-a	=	\$85-90	= \$(5)
Volume variation	= c-b	=	75-85	= (10)
Efficiency var.	= d-c	=	72-75	= (3)
Vol.-Eff. var.	= e-d	=	70-72	= (2)
Total				\$(20)

Note: Letters are defined in Exhibit 2.

used capacity (25 DLH) cost \$10. Even after considering seasonal factors, it appears that plant capacity is not receiving maximum utilization. Action on this point is indicated.

3. The plant required five hours above standard to produce last month's output. As our standards permit achievement under normal operating conditions, investigation appears to be warranted. This excess time increased operating costs by \$3.

4. Because of inefficiency of operation, \$2 of plant capacity was used for last month's production above that which would have been required had production been accomplished in standard hours. While this does not increase operating costs, it does reflect unnecessary utilization of the plant above that which should have been required. In other words, had the actual production been manufactured in accordance with the predetermined standards, the cost of idle capacity would have been increased by this \$2.

Ultimately—at the highest level of organizational hierarchy—all costs are controllable. However, the term should properly be used to refer to a specific hierarchical level. In the case at hand, it is the manufacturing department level which is relevant.

Examination of the hypothetical report to management will reveal that at least two of the variances (efficiency variance and volume–efficiency variance) are controllable at the manufacturing department level. Budget variance may also be controllable by manufacturing. Volume variance is controllable only at a higher level of the hierarchy.

Refinements

The four-variation analysis, in my opinion, is a useful one for profit planning and control. However, refinements could be made that would increase its usefulness.

Schlatter and Schlatter, in their text on cost accounting, describe a "calendar variation" that appears to have significant merit.[5] These authors point out that while annual fixed burden costs are usually divided by twelve for allocation to months, the working capacities of the several months are not equal. For example, March, 1961, had 23 working days while April, 1961, had only 20. This amounts to a variation of approximately 15 per cent.

The effect of this difference is absorbed into the idle capacity analysis of the four variance methods. For a detailed analysis, assume, for the case at hand, this additional information:

Total annual direct labor hours:	
"Capacity"	1200
Monthly direct labor hours:	
1/12 annual "capacity"	100
Actual "capacity" in the month	91

The actual "capacity" on a monthly basis could be developed as follows:

[5]Charles F. Schlatter and William J. Schlatter, *Cost Accounting*, 2d ed., John Wiley and Sons, Inc., 1957, pp. 530 ff.

annual "capacity" × actual working days in a given month / total working days in the fiscal year

Other methods are also available for this determination.

With these additional assumptions, Schlatter and Schlatter would compute the idle capacity variance as follows:

Volume Variance	
Actual "capacity"	91
Actual DLH use	75
Deficiency	(16)
Fixed burden rate	× $ .40
Total	($6.40)

To this analysis they would add a "calendar variation":

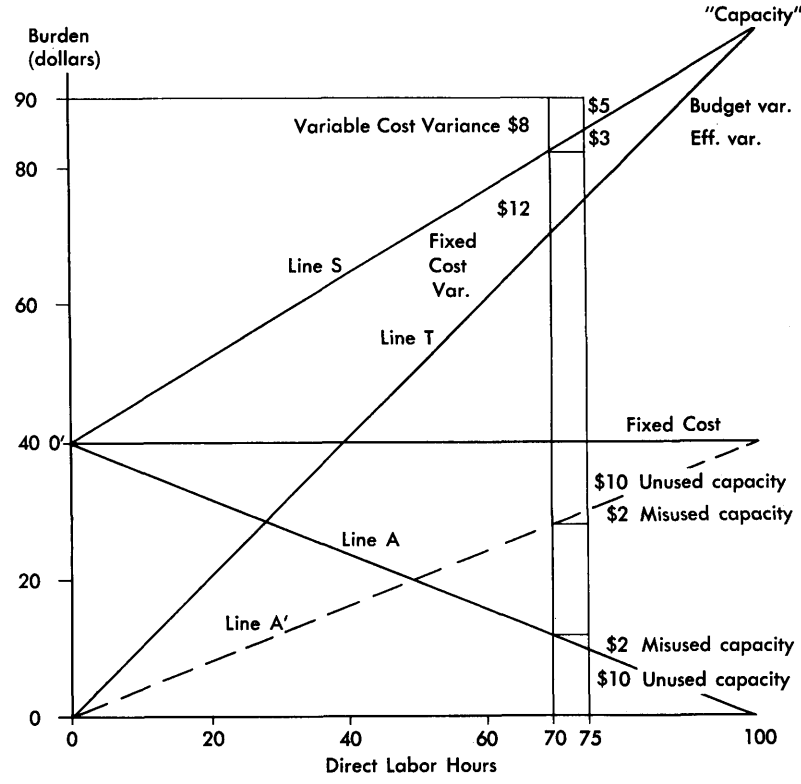
1/12 "capacity"	100 DLH
Actual "capacity"	91
Deficiency	(9)
Fixed burden rate	× $ .40
Total	($3.60)

The $3.60 is pulled out of the volume variance to show that this much of the idle capacity cost actually results from debiting the burden control for one-twelfth of the annual costs while only 98/1200 of "capacity" which could have been used to apply burden actually existed in the month.

The significance of this refinement is that it permits a more accurate determination of the cost of idle capacity. For example, using the assumed data, only 16 hours of unused capacity are shown to have actually existed as opposed to 25 hours indicated by the first volume analysis. Management is thus spared the ticklish problem of attempting to explain nine hours of idle capacity that really were not present.

By combining the advantages of each method discussed, it would appear that the most useful variance analysis for managerial control purposes would include the following:

CHART 5



(a) Cost variance—possibly controllable with respect to the manufacturing department	($ 5.00)
(b) Efficiency variance—controllable	(3.00)
(c) Volume-efficiency variance—controllable	(2.00)
(d) Idle-capacity variance—noncontrollable	(6.40)
(e) Calendar variance—noncontrollable	(3.60)
Total Variance	($20.00)

Another way to improve on this method is illustrated in Chart 5 on this page. Chart 5 represents a new approach that appears to offer significant advantages in classification of data as controllable and noncontrollable. The $12 "volume" variance is automatically separated into a $10 volume variance and a $2 volume-efficiency variance. (Either line A or line A′ will accomplish this.)

The procedure for preparing this graph is as follows:

1. Upon the prepared grid enter the budget estimate at the expected actual (budgeted) volume.
2. Enter a "fixed cost" line parallel to the abscissa.
3. Connect the budget point with the origin and the fixed cost value at point O′. These are lines S and T on Chart 5.
4. Draw lines A and A′ to their respective points as shown.
5. Draw two vertical lines at actual capacity and standard capacity.
6. Indicate the respective variances on these vertical lines as shown in Chart 5.

Chart 5 does have one limitation. It will not automatically pull out a calendar variance. However, since this can be determined mathematically and plotted without excessive difficulty, the limitation does not appear critical.

The five-way mathematical analysis outlined in this article, supplemented by the corresponding graphic technique (Chart 5), appears to hold great promise as a tool in profit planning and control. It remains for the management accountants of America to make the final decision through actual use.