V. COST REDUCTION THROUGH VARIANCE ANALYSIS

1. Introduction

1.1. Possibilities for reducing manufacturing costs arise at a number of points in the operation and use of a standard cost system. Cost reduction is accomplished, for instance, by setting the standards carefully in the first place, so that they do represent good performance. When a new or proposed standard is set, it is compared with the current actual cost to determine what cost savings are likely to be. The act of setting a new standard is thus often a step in the direction of cost reduction.

1.2. The aims of cost reduction are likewise supported by telling the employees what the labour standards are, so that they will know what they have to do to meet the standards. In many factories standard times are put Oil the job tickets before they are issued to the workmen for that purpose. The aims may be even further supported by educating the supervisor how the standards for the factory expense are put together and used to make it possible for them to plan their expenditure. Thus, if it appears early in the month that the volume of production will we low, the supervisor can scale his expenditures down accordingly while there is still time.

1.3. Providing for quick and frequent 'reporting of variances will also assist in the accomplishment of cost reduction. In this connection it should be noted that the first system of standard costs provides for analysis of variances monthly, which is after all not very frequent. The second system provides for analysis of materials and labour daily, if desired, from the requisitions and job tickets. Variance reports can accordingly be issued daily. As a matter of fact, requiring supervisors to sign excess piece requisitions and labour allowance tickets, as and when they are issued, puts cost control information in their hands with the ultimate frequency.

1.4. Providing for analysis of variances to determine the cause, and who is responsible, is the capstone of the cost reduction programme. Some of this analysis is accounting analysis; it involves setting up of classifications of accounts for variances; sorting invoice, job tickets, and requisitions down to the classifications; and calculating variances in Rupees and Paise. All standard cost systems comprise a regular series of variance reports which come under the heading of accounting analysis. They are prepared for supervisors of all levels, and they highlight off standard 'Conditions for the attention of the supervisors.

1.5. Another form of variance analysis is engineering or operations analysis. It involves going back to the actual working situation to determine the causes of the variances, and finding out what can be done to correct them. Analysis of this kind is likely to be pursued on a project basis. The accounting variances may point up a situation that needs to be investigated, and an engineering analysis may be started "to determine causes and remedies.

2. Accounting Analysis

2.1. A standard for materials or labour or factory expense is a performance measure based upon methods considered feasible during the period to which the standard applies. A standard does not necessarily represent the best possible performance. As a matter of fact in well-managed companies efforts are constantly made to find better ways of doing things and to reduce standard costs. The comparison of a new standard provides an element in the measurement of cost reduction. If the industrial engineer has devised a new method of performing a manual operation at a cost of 18 Paise per unit, whereas the old method cost 20 Paise, the labour saving is 2 Paise per unit. Obviously, such factor as the number of units to be produced, and the cost of training and equipment in changing the operation, has to be considered, but the comparison of the new standard with the old standard is the key point. When a change is under consideration, the industrial engineer will make a formal proposal to the management: If the proposal is accepted the change will be made:

3. Price Variance

3.1. The materials price variance report given below analyses price variance by class of materials into four major classes. The formula for price variance is:

Price variance = Actual quantities @ actual prices - Actual quantities @ standard prices

3.1.1. The report shows whether the major classes of material are being purchased at the prices which have been put on .the standard cost cards and presumably

provided for in the selling prices of the product. The rupee variance shows the amount of loss (or gain) due to the difference between actual and standard prices.

3.2. Standard prices are set by the purchasing agent at the beginning of the year. They represent his forecast of prices that will be paid during the coming year. The variance accordingly is a measure of the success of forecasting. They are not necessarily a measure of performance in the sense of securing the lowest possible prices during the period. Some companies think that price variances have limited usefulness in evaluating purchasing activities. A price variance may be caused by an emergency small quantity purchase at a price higher than the contract prices reflected in the standards.

Materials price variance report for the month of March 1968

Class of Materials	At Std. Prices	At Actual Prices	Price Variance
	Rs.	Rs.	Rs.
(A)	2,500	2,600	100
(B)	1,500	1,450	50*
(C)	2,800	2,870	70
(D)	22,500	22,800	300
Total	29,300	29,720	420

*Credit

3.3. The materials price variance report is prepared by recapping the purchase invoices. When the invoices are received, each invoice is rubber stamped to provide space for entering standard prices and extension of actual quantities and standard prices.

3.4. This information is entered in the invoice. The invoices are sorted by product class, the standard and actual values for each product class are recapped, and price variance report is prepared.

4., Quantity Variance

4.1. The materials quantity variance report below analyses the quantity variances by class of materials into four major classes. The formula for quantity variance is:

(i) Quantity variance=Actual quantities @standard prices - standard quantities allowed (for the production of the period) @ standard prices, or

(ii) Quantity variance= (Actual quantity used - standard quantity allowed) X Standard price

Materials Quantity Variances by Class of Materials for March 1968

(at standard prices)

Class of Materials	Actual quantities	Standard quantities	Quantity Variances
(A)	3,400	3,200	200
(B)	1,300	1,200	100
(C)	3,000	2,600	400
(D)	21,500	21,000	500
Total	29 200	28 000	1 200

4.2. Standard allowed quantity of each material per unit of product is set by the industrial engineer who works out the specifications for the materials that go into each product. The specifications are set with direct reference to the designed quality of the end-product and the quantity standards are then set to reflect satisfactory utilisation of materials in the manufacturing process. In some cases setting the quantity standard for a particular material is a matter of simple mathematics. Each unit of a certain product may require six units of one material and one unit of another material. In other cases, . as where the material is cut or sheared in the production operations, it may be necessary for the industrial engineer. to determine how the material is to be laid out for cutting and what sizes of particular materials are available.

4.3. The problem is to cut out the parts with the least waste of materials. A materials quantity variance means that more or less material was used per unit of product than the standard called for. Ordinarily a debit variance indicates an unsatisfactory performance in the utilisation of materials. It is possible, however, that an engineering or operation analysis of the variance may show that non-standard or defective materials are being used, or that the cutting or shearing operations are not being performed as set up when the materials of quantity standards were formulated, or possibly that the materials quantity standards were set incorrectly in the first place.

4.4. In some cases, it is possible to determine the cause of material quantity variance at the time excess pieces of materials are used. A coding scheme for the various causes may be worked out, for instance, 01 non-standard material, 02 defective material, 03 non-standard operation, 04 non-standard equipment, 05 trainee operator, etc. The supervisor who signs an excess piece requisition will indicate on it

the code number of the cause of the variance. From these coded requisitions, a quantity variance, by cause, report may be prepared as follows:

. **Materials quantity variances by cause for March 1968**

01	Non-standard· material	200-
02	Defective material	300
03	Non-standard operation	300
04	Nod-standard equipment	100
05	Trainee operator	300
	Total	1200

4.5. Control over current costs must obviously be exercised before the fact rather than after the fact. Preventive cost control depends upon actions taken at the point where losses and waste can occur, or where savings can be made. This type of control uses basic operating methods and times, preferred equipment and facilities. Such standards need to be current at all times, i.e., they must represent the methods which should be followed when the work is done.

4.6. Example: Daily materials meter age report given below is an· example of a materials quantity variance report in physical units (meters) used as a primary measure of performance. This report is used in the cutting room of a garment factory, but numerous other examples of quantity variance reports in physical units can be found. The meter age report is an extremely valuable report because of the large losses in piece goods that pile up if cutting is not controlled.

The formula for meter age variance is:

Meterage variance = Actual meters used - standards meters allowed for the .product units cut.

4.6.1. The daily report is prepared from the production orders completed by the cutting room each day. When the production order is issued by the production control clerk, it shows, among other things, the standard meters allowed for the quantity 'of the product indicated on the order. The cutting room foreman is thus made aware of the quantity standard he is supposed to meet, before the material is cut. After the material for the order is cut, actual meters used is entered on the cutting order. The daily materials meter age report is a summary of the production orders. The monthly report is a summary of all the daily reports for the month.

Daily materials average report for 10th March 1969

Product Class	Product units produced	Standard meters	Actual meters	Variance (in meters)
A	800	1,600	1,800	200
B	1,000	2,500	2,600	100
C	900	1,800	1,850	50
D	15,000	30,000	30,100	100
Total	17,700	35,900	36,350	450

4.6.2. Any large variance is investigated promptly for it may mean that the mark up man has done a poor job of laying out the patterns for maximum utilisation of the piece goods. Note, however, that the standard meters per dozen garments might be based upon an average size, and that the day's production orders of a certain product may show a preponderance of large sizes rather than a normal curve of sizes. The variance shown on the report would have to be interpreted in the light of the preponderance of large sizes.

4.7. When the standard item called for in the bill of materials is not available, a substitute material is someti1Jles used instead. A substitution of materials report is drawn to show the gain or loss on substitution. Thus if the standard bill of materials calls for 10 pieces of material at Rs. 2 and the substitution slip shows 10 pieces, material X at Rs. 2.50 the substitution variance would be a debit of Rs. 5. This debit is a cost of failing to have the proper materials on hand. In some cases, substitution of materials is a real cost factor, and formal analysis of the materials quantity variance balance is a necessary part of the cost reduction programme.

5. Labour Variance

5.1. A weekly Report of labour allowances make up overtime premium and piece work. Piece work report is typical for factories operating (a) piece work with. certain allowances, or (b) standard hours at base rate with certain allowances. Basically the report is a control on allowances made by the foreman. Since the allowances are made because of conditions beyond the control of the employee (conditions over which the management has. some control) the report is often. a valuable cost reduction tool.

5.2. The daily labour performance report on page 41 is prepared for the foreman.
It shows for each employee standard hours produced, actual hours worke d, and performance per cent (standard hours produced+actual hours worked). It is expected that

the performance percentages will be around 100. Above average performers will show percentages above 100, and below average performers percentages below 100. New inexperienced employees will show percentages less than 100, but the percentage for such employees is expected to rise during the training period (which is from 3 weeks to two months depending upon the operation in a particular case). In reading the report, therefore, the forman must take into consideration the length of time a trainee has been on the job.

Daily Labour Performance Report of Assembly

Dept.No.1,byoperator

Dec. 10, 1968

Employee Name	No.	Standard hours produced	Actual Hours worked	Performance per cent
Teneja	101	10	8	125
Murty	102	8	8	100
Basu	103	6	8	75
	Total Deptt.	260	240	108.33

5.3. In hourly-rated wage payment plans, it is possible to analyse labour variance into rate and time factors. The formula for rate variance is:

Rate variance = (Actual hours X Actual rate) - (Actual hours X standard rate)

The formula for time or efficiency variance is:

Time variance = (Actual hours X standard rate) - (Standard hours in operations completed X standard rate)

5.4. To illustrate the calculation of variances, assume that (Actual hours X Actual rate) = 1,100xRs. 1.10 = Rs. 1,210, and that (Standard hours in operations completed X Standard rate) = 1,000 X Re. 1 = Rs. 1,000 = Rate variance = Actual hours X Actual rate:

1,100 X Rs. 1.10

Actual hours X Standard rate: = Rs. 1,210 | Rs.110

1,100 X Re. 1.00 = Rs. 1,100

Time variance:

Actual hours X Standard rate 1,100 X Re. 1.00	= Rs. 1,100	Rs.100
Standard hours x Standard rate 1,000 X Re. 1.00	= Rs. 1,000	

Net Variance = Actual hours X Actual rate:

1,100 x Rs. 1.10		
Standard hours X Standard rate: 1,000 X Re. 1.00	= Rs. 1,210 =Rs. 1,000	Rs.210

5.5. If it is desired to analyse labour variances currently at the source, job tickets can be designed to provide for entry of standard time allowed for the operation covered by the ticket (to be shown when the ticket is issued) standard rate, actual time taken and actual rate. If a job ticket is issued for each operation on which each man works during the day, variances can be analysed down to the individual man and the individual operation Daily reports can be issued showing the efficiency of each man and the net efficiency of each department. Reports can also be issued covering rate variances. Such variances can exist where it is possible for a foreman to assign a man who has a relatively high wage rate to an, operation with a relatively low standard rate. Rate variances can also arise when actual wage rates are changed (say by reason of a new contract) during the period for which standard cost cards have already been set. Assume that standard wage rates reflected on the standard cost cards are the same as actual wage rates in effect at the beginning of the standard cost period, but that actual wage rates will be increased at the middle of the period. If the standard wage rates are not changed at that time, there will be a debit rate variance during the remaining period. Actual hours X actual rate for the remaining period will be different from actual hours at standard rate.

6. Spoiled Work

6.1. In some business, the cost of spoiled work is significant. Reports on such costs may be obtained in a standard cost system by costing the inspector's spoiled work tickets and summarising them with the desired frequency. It is necessary for the inspector who rejects the job to write the number of the last operation completed on the ticket. The cost man then costs the ticket at the cumulative standard cost through the last operation completed. The costs are reported to the management where the jobs are large, and it may be desired to list them separately, and to have the foreman or the industrial engineer indicate the cause of spoilage in, each case (defective material, faulty machine tools, operator error, etc.)

7. Factory Expense Variances

7.1. There are two plans for analysis of factory expense variance: the two-variance plan and the three-variance plan. The two-variance plan and the three-variance plan are illustrated below on the basis of a single set of data. The flexible expense budget shows:

Per cent of capacity	80	90	100
Standard Hours	8000	9000	ɒɒlɒɒ
Variable expense	4000	4500	5000
Fixed expense	4000	4000	4000

7.2. Assume further that the volume for the coming period was estimated at 8,000 standard hours and the standard expense rate therefore Rs. 4,000 + Rs. 4,000 = 8,000 = Re. 1 per hour.

Actual performance was:

Per cent of capacity	Rs.	90
Standard Hours produced	Rs.	9,000
Actual Hours	Rs.	9,200
Variable expense	Rs.	4,700
Fixed expense	Rs.	4,000
Total actual expense	Rs.	8,700

The variances calculated under the two-variance plan are:

Controllable variance:

Actual expense	Rs. 8,700
Budget adjusted to current volume (9,000 std. hrs.)	Rs.8,500
Variance	Rs. 200

Volume variance:

Budget adjusted to current volume (as above)	Rs. 8,500
Standard expenses charged to process (9,000 std. hrs. @ Re. 1)	Rs. 9,000
Variance	Rs. 500*
Net variance	Rs. 300*

*credit

Under the three-variance plan, the following variances would be calculated:

Spending Variance:

Actual expense			
Budget adjusted to 9,200 actual hrs.	Rs.	8,700	
Variable expense 9,200 x Rs. 0.50			
Fixed expense	Rs.	4,600	
Total expense	Rs.	'4,000	
Variance	Rs.	8,600	
	Rs.	8,700 - 8,600	
	Rs.	100	

Capacity Variance:

Budget adjusted to 9,200 actual hrs.			
Actual hrs. @standard rate	Rs.	8,600	
	Rs.	9,200	Rs.600

Time Variance:

Actual hrs. X standard expense rate	Rs.	9,200	
Standard hrs. in operations completed @ standard expense rate 9,000 std. hrs. X Re. I per hour	Rs.	9,000	Rs.200
Net variance			Rs.300*

*credit

7.2. Note that the time variance for factory expense (above) is comparable to the time variance for labour. The latter represents the labour cost of taking more than the standard allowed hours for the month's output, and the former represents the factory expense cost of the same excess usage of hours.

8. Variance Reports

8.1. A list (l)f variance reports (suggestive) for a company which manufactures toys from sheet steel are given below :

(i) Materials price variance report showing separate variances for.

Sheet steel
Steel rod
Steel wire
Steel tubing
Paint

Miscellaneous (washers, cutter pins, nuts)

(ii) Materials quantity variance and scrap reports

Sheet steel Tonnage variance - Shearing Department

Scrap report " ,, - Punch

Paint quantity variance Press Department

Substitution of materials Spot Weld Department

- Painting Department

- Assembly Department

(iii) Labour variance:

Direct labour variances (hourly rated wage) - Shearing Department Direct labour variances (piece work, with allowances)-Punch Press Department.,-Spot Weld Department

Direct labour variances (group bonus) - Assembly Department Direct labour variances (hourly rated wage) - Painting Department Factory expense variances (controllable + volume variances)

Separate variance report for each department

General factory administration

Building maintenance and fixed charges

Shearing Department

Punch Press Department

Spot Weld Department

Assembly Department

Painting Department.

8.2. The list will be of interest because it illustrates what particular variances are set out in a typical situation, and how the variances are built into an integrated report structure.