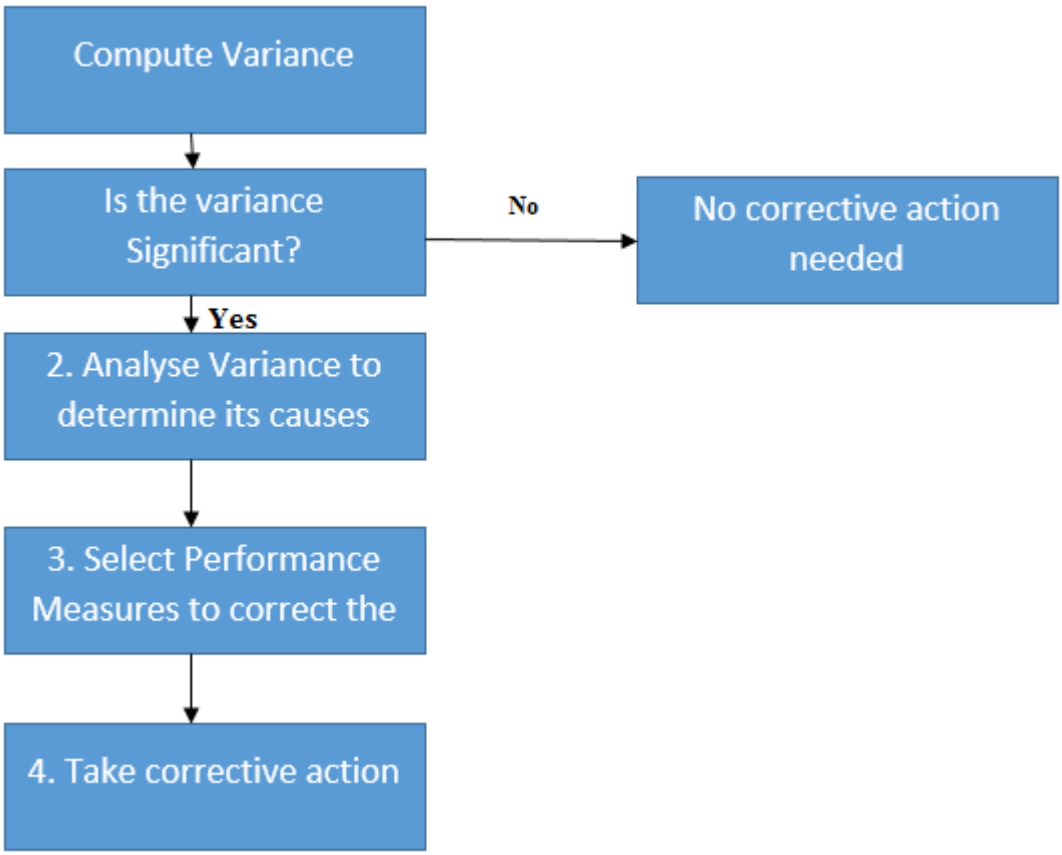
Chapter 8
Variance Analysis

Variance analysis is the procedure of computing the differences between standard costs and actual costs and recognizing the causes of those differences. Variance Analysis deals with an analysis of deviations in the budgeted and actual financial performance of a company. The causes of the difference between the actual outcome and the budgeted numbers are analyzed to showcase the areas of improvement for the company.

It helps to understand why fluctuations happen and what can / should be done to reduce the adverse variance. This eventually helps in better budgeting activity.



A variance in may be favourable (costs lower than expected or revenues higher than expected) or adverse (costs higher than anticipated or revenues lower than expected).

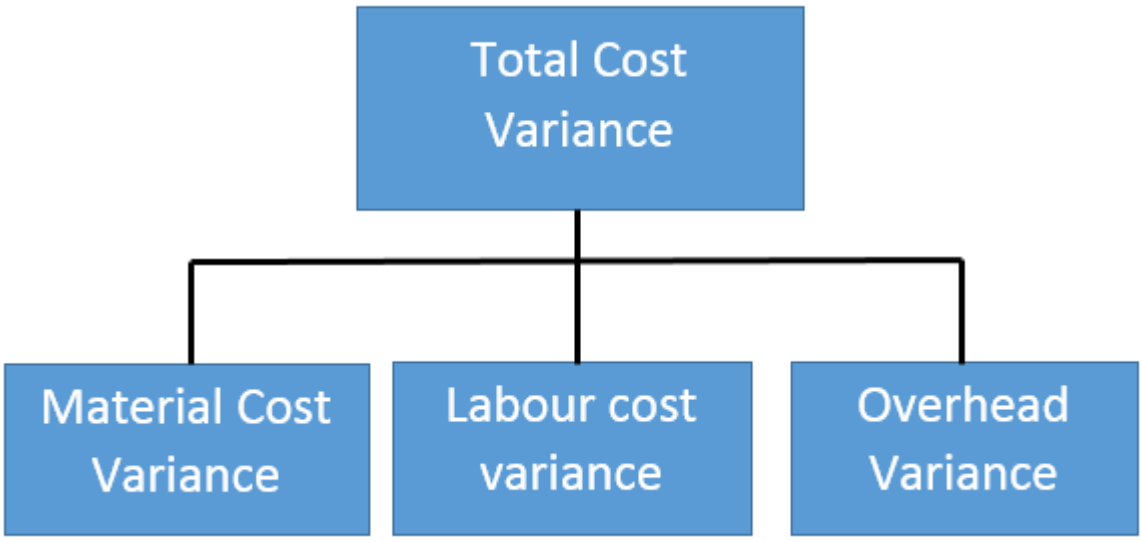
Types of Variances: Variances is categorized into two categories that include Cost Variance and Sales Variance.

Cost Variance: Total Cost Variance is the difference between Standards Cost for the Actual Output and the Actual Total Cost sustained for manufacturing actual output. The Total Cost Variance consists of:

I. Direct Material Cost Variance

II. Direct Labour Cost Variance

III. Overhead Cost Variance



Material Cost Variances: Direct Material Variances are also known as Material Cost Variances. The Material Cost Variance is the difference between the Standard cost of materials for the Actual Output and the Actual Cost of materials used for producing actual output. The Material Cost Variance is computed as:

$$\text{Material Cost Variance} = \text{Standard Cost} - \text{Actual Cost}$$

$$\text{MCV} = \text{SC} - \text{AC}$$

(or)

$$\text{MCV} = \left\{ \begin{matrix} \text{Standard} \\ \text{Quantity} \end{matrix} \times \begin{matrix} \text{Standard} \\ \text{Price} \end{matrix} \right\} - \left\{ \begin{matrix} \text{Actual} \\ \text{Quantity} \end{matrix} \times \begin{matrix} \text{Actual} \\ \text{Price} \end{matrix} \right\}$$

$$= (\text{SQ} \times \text{SP}) - (\text{AQ} \times \text{AP})$$

Causes for Direct Material Cost Variance

Direct material cost variance is caused due to the following reasons.

1. Change (increase / decrease) in the price of materials

2. Change (increase / decrease) in the quantity of materials used. This is happened due to

a. Change in the mix of more than one type of materials in the process of manufacture.
b. Change (increase / decrease) in the output.

Materials Price Variance:

A materials price variance occurs when raw materials are purchased at a price different from standard price. It is that portion of the direct materials which is due to the difference between actual price paid and standard price specified and cost variance multiplied by the actual quantity. Expressed as a formula,

Materials price variance = (Standard price –Actual price) x Actual quantity, or

MPV= (SP-AP) x AQ

Materials price variance is unfavourable when the actual price paid exceeds the predetermined standard price and vice-versa it is favourable variance. It is advisable that materials price variance should be calculated for materials purchased rather than materials used.

Material Usage Variance: The material quantity or usage variance is also known as material quantity variance. It's the results when actual quantities of raw materials used in production differ from standard quantities that should have been used to produce the output achieved. It is that portion of the direct materials cost variance which is due to the difference between the actual quantity used and standard quantity specified.

As a formula, this variance is shown as:

Materials quantity variance = (Standard Quantity – Actual Quantity) x Standard Price or

MQV/MUV = (SQ for actual output - AQ) x SP

A material usage variance is favourable when the total actual quantity of direct materials used is less than the total standard quantity allowed for the actual output.

Material usage variance or Material Quantity variance is further classified into mix variance and yield variance.

(a) Material Mix Variance:

For processing and manufacturing various products there may be different type of raw being used. The various types of grades of material being used is known as material mix. Material mix is an important operating variable, specific grades of materials and quantity are determined before production begins. A mix variance will result when materials are not actually placed into production in the same ratio as the standard mix. For instance, if a product is produced by adding 100 kg of raw material A and 200 kg of raw material B, the standard material mix ratio is 1: 2.

A mix variance may arise because of attempts to achieve cost savings, effective resources utilisation and when the needed raw materials quantities may not be available at the required time.

Materials mix variance is that portion of the materials quantity variance which is due to the difference between the actual composition of a mixture and the standard mixture.

It can be computed by using the following formula:

Material mix variance = (Standard cost of actual quantity of the actual mixture – Standard cost of actual quantity of the standard mixture)

Or

Materials mix variance = (Actual mix – Revised standard mix of actual input) x Standard price

Revised standard mix or proportion is calculated as follows:

Standard mix of a particular material/Total standard quantity x Actual input

Example:

Product Delta is made from two raw materials, material A and material B. One unit of finished product requires 10 kg of material.

The following is standard mix:

Material A –	20% –	2 kg @ ₹ 20	=	₹ 40
Material B –	80% –	8 kg @ ₹ 10	=	₹ 80
	100% –	10 kg @ ₹ 12	=	₹ 120

During a period one unit of product was produced at the following costs:

Material A –	8 kg @ ₹ 20	=	₹ 160
Material B –	4 kg @ ₹ 12.5	=	₹ 50
	12 kg @ ₹ 17.5	=	₹ 210

Compute the materials mix variance.

Solution:

Material mix variance = (Actual proportion – Revised standard proportion of actual input) x Standard price.

$$\text{Revised standard proportion} = \frac{\text{Standard proportion of a particular mix}}{\text{Total standard quantity}} \times \text{Actual input}$$

Revised standard proportion:

Material A = 2/10 × 12 = 2.40 kg.

Material B = 8/10 × 12 = 9.60 kg.

Materials mix variance:

Material A = (8 kg – 2.40 kg) × 20

= 5.60 × 20 = ₹ 112.0 (unfavourable)

Material B = (4 kg – 9.60) × 1.00

= 5.60 × 10 = ₹ 56 (favourable)

Total mix variance = ₹ 56 (unfavourable)

(b) Materials Yield Variance:

Materials yield variance explains the remaining portion of the total materials quantity variance. It is that portion of materials usage variance which is due to the difference between the actual yield obtained and standard yield specified (in terms of actual inputs). In other words, yield variance occurs when the output of the final product does not correspond with the output that could have been obtained by using the actual inputs.

The total of materials mix variance and materials yield variance equals materials quantity or usage variance. When there is no materials mix variance, the materials yield variance equals the total materials quantity variance. Accordingly, mix and yield variances explain distinct parts of the total materials usage variance and are additive.

The formula for computing yield variance is as follows:

Yield Variance = (Actual yield – Standard Yield specified) x Standard cost per unit 0r

MYV = (AY – SY) x SC per unit.

Example:

Standard input = 100 kg, standard yield = 90 kg, standard cost per kg of output = Rs 200

Actual input 200 kg, actual yield 182 kg. Compute the yield variance.

Solution:

$$\text{Standard yield for the actual input} = \frac{90}{100} \times 200 = 180 \text{ kg}$$

Yield variance = (Actual yield – Standard yield for the actual input) × Standard cost per unit (per kg)

= 182 – 180 × ₹ 200

= 2 × 200 = ₹ 400 (favourable)

The above yield variance can be computed by using another formula also, e.g.,

Yield Variance = (Actual Loss–Standard Loss on Actual Input)×Standard Cost per unit

= (18 kg – 20 kg) × ₹ 200

= ₹ 400 (favourable)

In this example, there is no mix variance and therefore, the materials usage variance will be equal to the materials yield variance.

The above formula uses output or loss as the basis of computing the yield variance. Yield variance can also be computed on the basis of input factors only. The fact is that loss in inputs equals loss in output. A lower yield simply means that a higher quantity of inputs have been used and the anticipated or standard output (based on actual inputs) has not been achieved.

Yield, in such a case, is known as sub-usage variance (or revised usage variance) which can be computed by using the following formula:

Sub-usage or revised usage variance = (Revised Standard Proportion of Actual Input – Standard quantity) x Standard Cost per unit of input

Example:

Standard material and standard price for manufacturing one unit of a product is given below:

	Standard material	Standard price
Material A	5 kg	@ ₹ 40
Material B	3 kg	@ ₹ 60

The actual production of the product is 400 units.

The actual material A 2,500 kg @ ₹ 39

B 1,000 kg @ ₹ 62.5

Calculate the materials sub-usage variance.

Solution:

Revised standard proportion of actual input:

Material A = 5/8 × 3,500 = 2,187.5 kg

Material B = 3/8 × 3,500 = 1,312.5 kg

Material sub-usage variance:

(Revised standard proportion of actual input – Standard quantity) × SP

Material A = (2,187.5 – 2,000) × 40

= 187.5 × 40 = ₹ 7,500 (unfavourable)

Material B = (1,312.5 – 1,200) × 60

= 112.5 × 60 = ₹ 6,750 (unfavourable)

Total materials sub-usage variance = ₹ 14,250 (unfavourable)

Or

$$(3,500 - 3,200) \times \frac{₹\ 1,52,000}{3,200}$$

$$= 300 \times \frac{1,52,000}{3,200} = ₹\ 41,250 \text{ (unfavourable)}$$

Materials yield variance always equal sub-usage variance. The difference lies only in terms of calculation. The former considers the output or loss in output and the latter considers standard inputs and actual input used for the actual output. Mix and yield

variance both provide useful information for production control, performance evaluation and review of operating efficiency.

Examples

MATERIAL	STANDARD			ACTUAL		
	QTY	PRICE	AMOUNT	QTY	PRICE	AMOUNT
A	90	12	1080	100	12	1200
B	60	15	900	50	16	800
	150		1980	150		2000

Material Cost Variance (MCV) = Standard cost for actual output – Actual Cost
= (1980) – (2000) = Rs. 20(A)
Material Price Variance (MPV) = (Standard Price – Actual Price) x Actual Qty.
A = (12– 12) x 100 = Rs. 00
B = (15– 16) x 50 = Rs. 50(A) Total 50(A)
Material Mix variance = (Revised Standard Qty. – AQ) x Standard Price Since Standard Mix and Actual Mix are same i.e., 150 units, hence Revised Standard Quantity and Standard Quantity will be same:
A = Rs. 12 x (90 – 100) = Rs. 12 x 10 = Rs. 120 (Adverse)
B = Rs. 15 x (60 – 50) = Rs. 15 x 10 = Rs. 150 (Favourable) Total = Rs. 30 (Favourable)
Also, MCV = MPV + MUV = 50 (A) + 30 (F) = 20 (A)

Example

MATERIAL	STANDARD			ACTUAL		
	QTY kg	PRICE	AMOUNT	QTY kg	PRICE	AMOUNT
A	30000	10	3,00,000	35000	9	3,15,000
B	40000	5	2,00,000	42000	6	2,52,000
C	50000	6	3,00,000	53000	7	3,71,000
	1,20,000		8,00,000	1,30,000		9,38,000

Material Cost Variance (MCV) = Standard cost for actual output – Actual cost
= Rs. 8,00,000 – Rs. 9,38,000 = Rs. 1,38,000 (Adverse)
Material Price Variance (MPV) = (Standard Price – Actual Price) x Actual qty.
A = (10 – 9) x 35,000 = Rs. 35,000 (F)
B = (5 – 6) x 42,000 = Rs. 42,000 (A)
C = (6 – 7) x 53,000 = Rs. 53,000 (A) Total Rs. 60,000 (A)

Material Usage Variance (MUV) = (SQ for actual output – AQ) x Standard price

A = (30,000 – 35,000) x 10 = Rs. 50,000 (A)

B = (40,000 – 42,000) x 5 = Rs. 10,000 (A)

C = (50,000 – 53,000) x6 = Rs. 18,000 (A) Total Rs. 78,000 (A)

Material Mix Variance (MMV) = (Revised SQ – AQ) x Standard Price

Where RSQ=

A = 1,30,000/1,20,000 x 30,000= 32,500 kg

B = 1,30,000/1,20,000 x 40,000= 1,30,000/3 kg

C = 1,30,000/120,000 x 50,000= 1,62,500/3 kg

MMV=

A = (32,500 – 35,000) x Rs. 10 = Rs. 25,000 (A)

B = (1,30,000/3 – 42000) 5 = Rs. 6,667 (F)

C = (1,62,500/3 – 53000) 6 = Rs 7,000 (F) Total = Rs. 11,333 (A)

QuesQ

Material sub-usage variance = (SQ – RSQ) × SP

A = (30,000 - 32,500) x Rs. 10 = Rs. 25,000 (A)

B = (40,000 - 1,30,000/3) 5 = Rs. 16,666(A)

C = (50,000 - 1,62,500/3) 6 = Rs 25,001(A) Total =Rs 66,667 (A)

Also, MCV = MPV + MMV + MSUV

= 60,000 (A) + 11,333(A) + 66,667(A) = 1,38,000 (A)

Also, MCV = MPV + MUV

= 60,000 (A) + 78,000 (F) = 1,38,000 (A)

Questions:

1. . What is variance analysis? Why it is called a tool of control for management?
2. How does variance analysis relate to the concept of management by exception? Explain.
3. Is it possible to control costs effectively through variance control? Discuss.

4. Why is analysis of variance needed? Enumerate the prerequisites for a good variance analysis system.

Numerical Questions

1.Following is the data of a manufacturing concern. From the figures given below, calculate (i) Materials Cost Variance, (ii) Material Price Variance, and (iii) Material Usage Variance. The standard quantity of materials required for producing one ton of output is 40 units. The standard price per unit of materials is Rs. 3. During a particular period 90 tons of output was undertaken. The materials required for actual production were 4,000 units. An amount of Rs. 14,000 was spent on purchasing the materials.

2 From the data given below, calculate: (i) Material Cost Variance, (ii) Material Price Variance, and (iii) Material Usage Variance.

Product	Standard Quantity (Units)	Standard Price Rs.	Actual Quantity (Units)	Actual Price Rs.
A	1,050	2.00	1,100	2.25
B	1,500	3.25	1,400	3.50
C	2,100	3.50	2,000	3.75

3 Calculate material mix variance from the data given as such:

Materials	Standard		Actual	
	Quantity (Units)	Price per unit Rs.	Quantity (Units)	Price per unit Rs.
A	50	2.00	60	2.25
B	100	1.20	90	1.75

Due to the shortage of material A, the use of material A was reduced by 10% and that of material B increased by 5%.

4 From the following data calculate various material variances:

	Standard		Actual	
Material	Quantity (units)	Price Per unit (Rs.)	Quantity (units)	Price Per unit (Rs.)
A	80	8.00	90	7.50
B	70	3.00	80	4.00

5 KSS Ltd. produces an article by blending two basic raw materials. It operates a standard costing system and the following standards have been set for raw materials:

Materials	Standard Mix	Standard Price per kg.
A	40%	Rs.4.00
B	60%	Rs. 3.00

The standard loss in processing is 15%. During April, 2017, the company produced, 1,700 kg. of finished output. The position of stock and purchases for the month of April, 2017 is as under:

Material	Stock on 01/04/2017	Stock on 30/04/2017	Purchased during April, 2017.	
	Kg	Kg	Kg	Cost Rs.
A	35	5	800	3400
B	40	50	1200	3000

Calculate the following variances:

(i) Material Price Variance; (ii) Material Usage Variance; (iii) Material Yield Variance; (iv) Material Mix Variance; (v) Total Material Cost Variance.