The Institute of Finance Management

Accounting and Finance Department

Lecture Notes

Advanced Variances

BACC 3 and BAIT 3

Instructor: Dr Zawadi Ally

Material Mix and Yield Variances

1.1 Material Mix Variance

The material mix variance (MMV) measures the difference between the standard cost of the actual mix of materials used and the standard cost of the planned mix of materials for a particular level of output. It helps in assessing the impact of using different proportions of materials than those originally planned.

Formula for Material Mix Variance:

MMV= (AQ – SQ) SP

MMV=(AQ×SP) −(SQ×SP)

Where:

- AQ = Actual Quantity of Materials Used
- SQ = Standard Quantity of Materials for Actual Production
- SP = Standard Price of Material

A favorable material mix variance suggests that the actual mix of materials used is cheaper than the standard mix, while an unfavorable variance suggests the opposite.

This variance measures whether the actual mix is cheaper or more expensive than the standard**,** when more than one type of material goes into the making of a product, management may be able to control the proportions of each materials that go into the production mix. Adding a greater proportion of one material (and therefore a smaller proportion of different materials) might make the material mix cheaper or more expensive

Calculating the Material mix variance

- Find the standard proportions of the mix
- Calculate the standard mix of the actual material used.
- Find (in kg, liters etc. for each input) the differences between what should have been used and what was used.

Note: Value the variance using the standard price of the material

1.2 Material Yield Variance

A yield variance measures the efficiency of turning the inputs into outputs. If the yield variance is adverse, it suggests that the actual output is lower than the expected output. This could be due to labour inefficiencies, higher waste, inferior materials, or using a cheaper mix with a lower yield.

A material yield variance arises because the output that is achieved is different from the output that would have been expected from the inputs. So, whereas the mix variance focuses on inputs, the yield variance focuses on outputs.

For example, the yield variance is favourable, meaning that the inputs produced a higher level of output than one would have expected.

Hence: Yield Variance is the result of obtaining a yield different from what would be expected from the actual input

Calculating the yield variance

- Find the total standard of all materials in kg or litre etc. and their total standard cost per unit of output.
- To find the standard yield of output in units divide the total quantity of actual materials used for all materials by the total standard of all materials computed above
- Then the difference between the standard yield and actual yield in units is multiplied by the total standard cost per unit computed above
- The variance will be adverse if the actual yield is less than the standard yield and favourable if the actual yield is greater than the standard yield of output.

NOTE: Material Mix Variance + Material Yield Variance = Material Usage Variance

Example 1

A company manufactures product XA, using two materials X and Y. The standard usage and cost of one unit of product XA are as follows;

Material X	5kg @ Shs.2 per kg	Shs10
Material Y	5kg @ Shs.4 per kg	Shs20
Total	10	Shs30

Over the last month, 100 batches of sauce were prepared using the following ingredients

Material X	600kg
Material Y	900kg

Required to calculate

a) The materials Mix Variance
b) The material yield Variance
c) Material usage variance
d) Comment on their meaning above

Example 2

A company manufactures a chemical using two components, A and B. The standard information for one unit of the chemical is as follows:

Material X	10 kg at Shs 4 per kg	40
Material Y	20 kg at Shs 6 per kg	120
		160

In a particular period, 160 units of the chemical were produced, using 1,000 kgs of material A and 1,460 kgs of material B.

REQUIRED:

Calculate the material usage, mix and yield variances for each material.

Example 3

ABC operates a standard costing system. The standard direct material to produce 1,000 units of output is as follows:

Material grade	Input quantity (kgs)	Standard price per kg (Shs)
A	600	1.10
B	240	2.40
C	360	1.50

During April the actual output of the product was 21,000 units. The actual materials issued to production were

Material grade	Quantity (kgs)
A	14,000
B	5,500
C	5,500

REQUIRED:

Calculate the material mix variance for each material, and in total, and calculate the total material yield variance. Comment on the figures calculated

Example 4

BM Ocean Chemicals has one product, which requires inputs from three types of material to produce batches of XA. Standard cost details for a single batch are shown below

Material type	Standard quantity (kgs)	Standard price per kg (Shs)
A1	8	0.30
A2	5	0.50
A3	3	0.40

A standard loss of 10% of input is expected. The actual output was 15,408 kgs for the previous week. Details of the material used were:

Material type	Quantity (kgs)
A1	8,284
A2	7,535
A3	3,334

Required:

Calculate the individual material mix and yield and the total usage variance

1.3 Sales Mix and Quantity Variances

1.3.1 Sales Mix Variances

Sales Mix Variance measures the change in profit or contribution attributable to the variation in the proportion of the different products from the standard mix.

Hence, this variance measures the effect on profit of changing the mix of actual sales from the standard mix.

Formula

Sales Mix Variance *(where standard costing is used)*:

= (Actual Unit Sold - Unit Sales at Standard Mix) x **Standard Profit** per Unit

Sales Mix Variance *(where marginal costing is used)*:

= (Actual Unit Sold - Unit Sales at Standard Mix) x **Standard Contribution** per Unit

Explanation

Sales Mix Variance is one of the two sub-variances of sales volume variance *(the other being sales quantity variance)*. Sales mix variance quantifies the effect of the variation in the proportion of different products sold during a period from the **standard mix** determined in the budget-setting process.

Sales mix variance, as with sales volume variance, should be calculated using the **standard profit** per unit in case of absorption costing and **standard contribution** per unit in case of marginal costing system.

Illustration 6

ABC Inc. is a small company that specializes in the manufacture and sale of gaming computers. Currently, the company offers two models of gaming PCs:

- Deluxe - A professional gaming PC with a water-cooling system priced at Shs 2,500
- Standard - An entry level gaming PC with standard fan cooling priced at Shs 1,000

ABC budgeted sales of 1,600 units of Deluxe and 2,400 units of Standard in the last year. The standard variable costs of a single unit of Deluxe and Standard were set at Shs 1,500 and Shs 750 respectively.

The sales team at ABC managed to sell 1,300 units of Deluxe and 3,700 units of Standard during the last year.

Step 1: Calculate the standard mix ratio

40% Deluxe * and 60% Standard ** Standard mix ratio:

* 1,600 / (1,600 + 2,400) % = 40% Deluxe

** 100% - 40% = 60% Standard

Step 2: Calculate the sales quantities in proportion to the standard mix

Total sales during the period: 1,300 Deluxe + 3,700 Standard = 5,000 units

Unit Sales at Standard Mix:

Sales of Deluxe in standard mix @ 40% of 5,000 = 2,000 units

Sales of Standard in standard mix @ 60% of 5,000 = 3,000 units

Step 3: Calculate the difference between actual sales quantities and the sales quantities in standard mix

	Deluxe **Units**	Standard **Units**
Actual sales quantities (as per question)	1,300	3,700
Unit sales at standard mix (Step 2)	(2000)	(3000)
Difference	**700A**	**700F**

Step 4: Calculate the standard contribution per unit

	Deluxe **Shs**	Standard **Shs**
Revenue	2,500	1,000
Variable cost	(1,500)	(750)
Standard contribution per unit	**1,000**	**250**

Step 5: Calculate the variance for each product

	Deluxe	Standard
Standard contribution per unit (Step 4)	Shs1,000	Shs250
Actual quantity - Standard mix (Step 3)	x (700 units)	x 700 units
Variance	**Shs700,000A**	**Shs175,000F**

Step 6: Add the individual variances

Sales Mix Variance = (Shs 700,000A + Shs 175,000F) = Shs 525,000A

Sales mix variance is adverse in this example because a lower proportion (i.e. 26%) of Deluxe (which is more profitable than Standard) were sold during the year as compared to the standard mix (i.e. 40%).

1.3.2 Analysis Sales Mix Variance

Sales mix variance is only a relative measure of the variation in performance of an organization and should be interpreted with care. For instance, an adverse sales mix variance may be perfectly fine where a company is able to earn extra revenue through sale of lower margin products if such sales are in addition to high sales of the products with higher margins.

Favorable sales mix variance suggests that a higher proportion of more profitable products were sold during the period than was anticipated in the budget.

Reasons for favorable sales mix variance may include:

- Concentration of sales and marketing efforts towards selling the more profitable products
- Increase in the demand for the higher margin products (where demand is a limiting factor)
- Increase in the supply of the more profitable products due to for example addition to the production capacity (where supply is a limiting factor)
- Decrease in the demand or supply of the less profitable products

Adverse sale mix variance suggests that a higher proportion of the low margin products were sold during the period than expected in the budget.

Reasons for adverse sales mix variance may include:

- Demand for the more profitable products being lower than anticipated
- Decrease in the production of the high margin products due to supply side limiting factors (e.g. shortage of raw materials or labor)
- Sales team not focusing on selling products with higher margins due to for example lack of awareness or misaligned performance incentives (e.g. uniform sales commission on the entire product range may not motivate sales staff to compete for high margin sales)
- Increase in demand or supply of the less profitable products

1.3.3 Sales Quantity Variance

Sales Quantity Variance measures the change in standard profit or contribution arising from the difference between actual and anticipated number of units sold during a period.

Hence: This variance measures the effect on profit of selling a different total quantity from the budgeted total quantity

Formula

Sales Quantity Variance may be calculated as follows:

Sales Quantity Variance:

= (Budgeted sales - Unit Sales at Standard Mix) x Standard Contribution*

*Where marginal costing is used

Sales Quantity Variance:

= (Budgeted sales - Unit Sales at Standard Mix) x Standard Profit*

*Where absorption costing is used

1.3.3.1 Explanation Sales Quantity Variance

- Sales quantity variance is an extension of the sales volume variance which demonstrates the impact of a higher or lower sales quantity as compared to budget.
- The difference between sales volume variance and sales quantity variance is that the former is calculated using the actual sales volume whereas the latter is calculated using the sales volume of products in the proportion of standard mix (see example below).
- Since sales quantity variance is calculated using the standard mix, any difference between the standard and actual mix of products is to be ignored (since the difference is accounted for separately under the sales mix variance).

Illustration 7

ABC Inc. is a small company that specializes in the manufacture and sale of gaming computers. Currently, the company offers two models of gaming PCs:

- Deluxe - A professional gaming PC with a water-cooling system priced at Shs 2,500
- Standard - An entry level gaming PC with standard fan cooling priced at Shs 1,000

ABC budgeted sales of 1,600 units of Deluxe and 2,400 units of Standard in the last year. The standard variable costs of a single unit of Deluxe and Standard were set at Shs 1,500 and Shs 750 respectively.

The sales team at ABC managed to sell 1,300 units of Deluxe and 3,700 units of Standard during the last year.

Sales Quantity Variance shall be calculated as follows:

Step 1: Calculate the standard mix ratio

40% Deluxe* and 60% Standard** Standard mix ratio:

* 1,600 / (1,600 + 2,400) % = 40% Deluxe

** 100% - 40% = 60% Standard

Step 2: Calculate the sales quantities in proportion to the standard mix

The objective is to find the respective sales quantities of products as if the total sales during the period where distributed among the two products in proportion to their standard mix.

Total sales during the period: 1,300 Deluxe + 3,700 Standard = 5,000 units

Unit Sales at Standard Mix:

Sales of Deluxe in standard mix @ 40% of 5,000 = 2,000 units

Sales of Standard in standard mix @ 60% of 5,000 = 3,000 units

Step 3: Calculate the difference between actual sales quantities and the sales quantities in standard mix

	Deluxe Units	**Standard Units**
Budgeted sales quantities (as per question)	1,600	2,400
Unit sales at standard mix (Step 2)	(2000)	(3000)
Difference	**400 F**	**600F**

Step 4: Calculate the standard contribution per unit

	Deluxe Shs	**Standard Shs**
Revenue	2,500	1,000
Variable cost	(1,500)	(750)

Standard contribution per unit	**1,000**	**250**

Step 5: Calculate the variance for each product

	Deluxe	**Standard**
Standard contribution per unit (Step 4)	Shs1,000	Shs 250
Budgeted Sales - Sales in Standard mix (Step 3)	x 400 units	x 600 units
Variance	**Shs400,000F**	**Shs150,000F**

Step 6: Add the individual variances

Sales Mix Variance = Shs 400,000F + Shs 150,000F= Shs 550,000F

Step 7: Proof check

The sum of sales mix variance and sales quantity variance should equal sales volume variance. Therefore:

	Shs
Sales Quantity Variance (Step 6)	550,000F
Sales Mix Variance (see solution here)	525,000A
Total	**25,000F**

Equals= Sales Volume Variance:

	Deluxe	Standard	**Total**
Actual Sales	1,300	3,700	
Budgeted Sales	(1,600)	(2,400)	
Difference (Units)	(300)	1,300	
Standard Contribution (Shs)	x 1,000	x 250	
Sales Volume Variance	Shs300,000A	+ Shs 325,000F=	**Shs25,000F**

1.3.3.2 Analysis Sales Quantity

Favorable sales quantity variance suggests that the company was able to sell a higher number of products **in aggregate** as compared to the total number of units budgeted to be sold during a period. Favorable sales quantity variance may be achieved through:

- Improvement in demand side factors where demand is the limiting factor such as by:
    - Improved marketing of company products
    - Higher overall demand in industry (e.g. due to increase in population, reduction in supply of substitutes, etc)
- Improvement in supply side factors where excess demand exists in the market for example through:
    - Installation of a new production plant

- More efficient production (this may be evident in a favorable labor efficiency variance)

Adverse sales quantity variance indicates that the company sold lesser number of goods **on aggregate basis** as compared to the total number of units budgeted to be sold during a period.
Adverse sales quantity variance may be caused by the following:

- Decline in demand side factors where demand is the limiting factor such as by:
  - A reduction in the overall demand in the industry (e.g. due to the introduction of a better or cheaper substitute in the market, etc)
- Decrease in the quantity and quality of supply-side factors where excess demand exists in the market for example due to:
  - Unavailability of a critical manufacturing component or raw material
  - Decline in the productivity of the workforce (this should be evident in an adverse labor efficiency variance)

1.4 Planning and Operational Variances

Due to changing of market and technical circumstances standard may become outdated, in such cases it may be necessary to alter a standard even during a budget period already in progress. Therefore, the approach to variance analysis so far discussed is the traditional one where the original (predetermined) standard is compared with the actual performance, and variance is calculated. If the predetermined standard, set before the budget period, is still realistic under current conditions then the variance report will still be of added value to the user. However, if there have been uncontrollable changes in both internal and external factors then the standards may no longer be realistic and the variances reported will be of little use and no longer relevant for control purposes. To overcome this problem, (Lucey, 2006) suggests that the total variances should be subdivided into *planning and operating variances*.
It should be noted that the original budget and standard are known as ex-ante standards, the ones that are set and deemed to be currently attainable are known as ex-post standards. Hence when the actual results are compared with the ex-ante standard is known as the total (conventional) variances which are split into *planning and operating variances*.

1.4.1 Planning variances

Planning variances seeks to explain the extent to which the original standard needs to be adjusted to reflect changes in operating conditions between the current situation and that envisaged when the standard was originally calculated, in effect it means that the original standard is brought up to date so that it is a realistic attainable target in current conditions. Therefore, planning variance is not controllable but it does provide useful feedback information to management on how successful they are in forecasting. The planning variance compares results based on the revised standard and initial standard. The result is usually considered to be outside the area of control of management. Planning variance i.e. portion uncontrollable by operational management, which compared ex-post (adjusted) standard with ex-ante (original) standard.

1.4.2 Operational variances

Operational variances indicate the extent to which attainable targets (ie the adjusted standards) have been achieved. Operating variances would be calculated after the planning variances have been established and are thus a realistic way of assessing performance. Hence operational variance is a controllable variance that seeks to measure the efficiency of management for the conditions that prevailed

The use of this approach challenges the assumption that in the traditional model, the variances are due in whole to operating deficiencies and that planning that underpins the predetermined standards was accurate.

Operational variance i.e. portions controllable by operational management, which compared actual results with ex-post (adjusted) standard (valued of opportunity cost items). The opportunity cost approach seeks to calculate variances that provide a realistic measurement of the gains or losses arising from controllable operating results.

1.4.3 Computation of traditional (conventional), planning and operational variances

Traditional (conventional) variance is the difference between the original standard or budget before any adjustment (i.e. ex-ante) and actual performance. This variance can be calculated by the following formula

Traditional variance = ex-ante standard – Actual performance

Planning variance is the difference between the original standard or budget (i.e. ex-ante) and ex-post standard or budget i.e. adjusted standard based on the conditions that managers operated during the period. Planning variance can be calculated by the following formula

Planning variance = ex-ante standard – ex-post standard

Operational variance is the difference between ex-post standard or budget i.e. adjusted standard based on the conditions that managers operated during the period and the actual performance. Operational variance can be calculated by the following formula

Operational variance = ex-post standard – Actual performance

Illustration 8 (Case Study)

Kongwa Feeds Ltd manufactures a standard animal feed. The predetermined standards for the budget period Jan-March 2019 were set by management in October 2018.

Standard hours per tonne of product 1.1

Standard direct labour rate per hour Shs 8.50

Standard usage of material per tonne of product 1.2 tonnes
Standard price of material Shs70 per tonne

Research shows that in the quarter ended 31 March 2019 the prevailing market price of material had been Shs 71 per tonne. Since the budget was set the wage rate had increased to Shs 8.75 per hour, national pay award.

During the quarter modifications to plant and machinery shows that direct labour hours per unit should be 1.05 per tonne of product and that standard usage would reduce to 1.175 tonnes per tonne of product.

During the quarter ended 31 March 2019 activity and costs showed:

Actual production 15,400 tonnes
Raw material usage 16,555 tonnes
Actual cost of raw materials used Shs 1,191,960
Actual direct labour cost 16,632 hours Shs 143,035

REQUIRED

Prepare variances analysis report

Solution

Variance Analysis Report

(a) Traditional Approach

Direct Labour cost variance

Standard Cost of Actual Production	Actual Cost	F/(A) Variance	F/(A) Varia
15,400 tonnes * 1.1 = 16,940 std. hrs * Shs8.50 = Shs143,990	Shs143,035	**Shs 955F**	

Direct Labour Rate Variance

(Standard rate – actual rate) actual hours
(Shs8.50 - Shs8.59998) 16,632 **Shs1,663A**

Direct Labour Efficiency Variance

(Standard hours produced – actual hours worked) standard rate **Shs 2,618F**
(16,940 – 16,632) Shs8.50

Direct Material cost variance

Standard Cost of Actual Production	Actual Cost	F/(A) Variance
15,400 tonnes * 1.2 tonnes	16,555	
= 18,480 * Shs70	* Shs72	
= Shs1,293,600	Shs1,191,960	**Shs101,640 F**

Direct Material Price Variance

(Standard price – actual price) actual usage
(Shs70 - Shs72) 16,555 tonnes Shs 33,110A

Direct Material Usage Variance

(Standard usage – actual usage) standard price
(18,480 – 16,555) Shs70 Shs134,750 F

(b) Direct Material Operating Variance (Controllable)

Direct Material Operating Price Variance
Actual cost – (actual usage x prevailing price)
Shs1,191,960 – (16,555 x Shs71) Shs16,555 A

Direct Material Price Planning Variance

(Revised price – standard price) * Standard usage
based on revised standard
= (Shs71 - Shs70) * (15,400 * 1.175) Shs(18,095)A

Direct Material Operating Usage Variance

(Actual quantity – Standard usage based on revised standard)
* Revised standard price
=(16,555 – 18,095) * Shs71 Shs109,340F

Direct Material Usage Planning Variance

(Revised standard usage – standard usage) standard price
=(18,095 – 18,480) * Shs70 Shs 26,950 F

Summary
Planning Variances

	Shs	Shs

Price	18,095A	
Usage	26,950F	8,855F

Operating Variances

Price	16,555A	
Usage	109,340F	92,785F
Traditional Variance		**101,640 F**

Direct labour

Operating Variance

Direct Labour Rate Operating Variance

(Revised rate – actual rate) actual hours

(Shs8.75 - Shs8.59998) 16,632 Shs 2,495F

Direct Labour Rate Planning Variance

(Revised rate – Standard rate) * Standard hours based on revised standard

= (Shs8.75 - Shs8.50) * (15,400 * 1.05) Shs 4,042.50A

Direct Labour Efficiency Operating Variance

(Actual hours – Standard hours based on revised standard) * Revised standard wage rate

= (16,632 – 16,170) * (Shs8.75) Shs (4,042.50)A.

Direct Labour Efficiency Planning Variance

(Revised standard hours – standard hours produced) standard rate

(16,170 – 16,940) Shs 8.50 Shs 6,545F

Summary

Planning Variances	Shs	Shs
Rate	4,042.50A	
Efficiency	6,545 F	2,502.50F

Operating Variances		
Rate	2,495 F	
Efficiency	4,042.50A	1,547.5A
Traditional Variance		**955 F**