## Chapter 10

### Advanced variances

### Chapter learning objectives:

<table>
<thead>
<tr>
<th>Lead</th>
<th>Component</th>
<th>Indicative syllabus content</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1</td>
<td>Discuss costing methods and their results.</td>
<td>(c) Apply standard costing methods including the reconciliation of budgeted and actual profit margins, distinguishing between planning and operational variances.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Manufacturing standards for material, labour, variable overhead and fixed overhead.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Standards and variances in service industries, public services (e.g. health and law enforcement) and the professions (e.g. labour mix variances in consultancies).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Price/rate and usage/efficiency variances for materials, labour and variable overhead.</td>
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<tr>
<td></td>
<td></td>
<td>• Subdivision of total usage/efficiency variances into mix and yield variances.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• <strong>Note:</strong> The calculation of mix variances on both individual and average valuation bases is required.</td>
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<tr>
<td></td>
<td></td>
<td>• Fixed overhead expenditure and volume variances.</td>
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<td></td>
<td></td>
<td>• Subdivision of the fixed overhead volume variance into capacity and efficiency variances.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Sales price and sales volume variances (calculation of the latter on a unit basis related to revenue, gross profit and contribution).</td>
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<tr>
<td></td>
<td></td>
<td>• Sales mix and sales quantity variances. Application of these variances to all sectors including professional services and retail.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Planning and operational variances.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Variance analysis in an activity-based costing system.</td>
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</tbody>
</table>

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## Lead

### Component

(c) Apply standard costing methods including the reconciliation of budgeted and actual profit margins, distinguishing between planning and operational variances.
1. Reasons for variances

- Many industries and processes require a variety of input materials.
- Furthermore, it is possible to vary this mix of materials.

2. Advanced material variances

- **The mix variance** represents the financial impact of using a **different proportion** of raw materials to the standard.
- **The yield variance** represents the financial impact of the input **yielding a different level of output** to the standard.

**Material mix variance**

- Material mix variance occurs when the actual mix of materials varies from the standard mix.
- If the mix changes so that a greater quantity of an expensive material is used, there will be an adverse variance.
- If the mix includes more of a cheaper material, there will be a favourable variance.
- Material mix variance can be calculated by two methods:
  - Individual units method
  - Weighted average method

**Individual units method:**

1) Identify the actual mix (actual proportion; actual total quantity).
2) Divide the actual total quantity into the standard proportions.
3) Calculate the difference for every type of material (the total of these differences should be 0).
4) Multiply by the standard cost per kg of **input** material (this is the variance in money terms).
• **Weighted average method:**
  1) Identify the actual mix (actual proportion; actual total quantity).
  2) Divide the actual total quantity into the standard proportions.
  3) Calculate the difference for every type of material. (the first 3 steps are the same.)
  4) Calculate the standard weighted average cost of *input* material.
  5) Calculate the difference between the individual cost of each *input* material and the weighted average cost of *input* materials.
  6) Multiply the quantity by the value calculated above (step 3 x step 5).

**Mix yield variances**

• Material yield variance occurs when the actual output from a fixed level of input varies from the standard output.
• Yield variance is similar to usage variance but calculated for all the input materials together.
• Yield variance is calculated in units and then multiplied by the weighted average standard cost per unit of material.
• Yield variance is calculated as follows:
  1) Calculate the standard output expected from the actual input (this is the standard yield).
  2) Calculate the difference of the standard yield from the actual yield (i.e. the actual output from actual input).
  3) This gives the yield in terms of units.
  4) Multiply these units by the standard cost of output to get the yield variance in money terms.

**Test Your Understanding 1 – Material mix**

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

- Material A 10 kg at $5 per kg = $50
- Material B 20 kg at $8 per kg = $160

In a particular period, 150 units of the chemical were produced, using 1,000 kg of material A and 1,500 kg of material B.

Calculate the material mix and yield variance and write them in the blanks:

<table>
<thead>
<tr>
<th>Material mix variance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material yield variance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
3. Advanced labour variances

- When a variety of labour is employed, the following advanced variances are calculated:

  ![Labour variance diagram]
  
  - Labour MIX variance
  - Labour YIELD variance

- Advanced labour variances are most relevant in the service sector.
- Most service industries employ different grades of labour.
- For example, an audit firm would have grades ranging from trainee to senior partner.

**Labour mix variance**

- Labour mix indicates the different types/grades of labour employed.
- Similar to the material mix, different grades of labour have different costs.
- When the standard mix of labour is different from the actual mix of labour, a variance arises.
- If more higher-grade labour is used, it will be costly, and hence, there will be an adverse variance.
- When more lower-grade labour is used, it will show up as a favourable variance.
- This is calculated by two methods, as with the material mix variance.

**Individual units method:**

1) Determine the actual hours in actual proportion of the grades of labour (the actual mix).
2) Divide the actual total hours into the standard proportions.
3) Calculate the difference between the actual (step 1) and standard mix (step 2).
4) Multiply by the standard hourly rate.
5) Get the mix variance in money terms.

**Weighted average method:**

1) Determine the actual hours in actual proportion to the grades of labour (the actual mix).
2) Divide the actual total hours into the standard proportions.
3) Calculate the difference between the actual (step 1) and standard mix (step 2).
4) Calculate the standard weighted average cost of labour.
5) Calculate the difference between the individual cost of each grade of labour and the weighted average cost of labour.

6) Multiply the hours by the individual differences from the weighted average rate (step 3 x step 5).

**Labour yield variance**

- This variance measures the output from labour (working hours input).
- It measures the efficiency of the whole team of workers employed.
- When the actual output differs from the standard output from a specific number of hours input, a yield variance arises.
- Again, it is calculated as the material yield variance.
  1) Calculate the standard output expected from the actual hours input (the standard yield).
  2) Calculate the difference of the standard yield from the actual yield (i.e. the actual output from actual hours input).
  3) This gives the yield in terms of hours.
  4) Multiply these hours by the standard rate of labour to get the yield variance in money terms.

**Mix and yield variances**

- Mix and yield variances should only be calculated when the mix (material and labour) is deemed to be controllable by the management.
- When the mix is not controllable, only usage and efficiency variances are appropriate.
- The weighted average method provides a clearer picture, e.g. by showing which material is more expensive than the average.
- Limitations include:
  - Cannot be analysed separately from one another.
  - If the same yield can be attained from a cheaper mix, the standard would need revision.
  - Trying to get a cheaper mix (favourable mix variance) would likely result in adverse yield variance.

**Test Your Understanding 2 – Labour mix**

Red Inc makes a single product for which the standard labour input per unit is:

- Skilled labour: 6 hours @ $12 per hour
- Unskilled labour: 4 hours @ $7 per hour
During a given month:

- Units produced 1,000 units
- 5,250 hours of skilled labour were used
- 5,250 hours of unskilled labour were used

Calculate the labour mix variances for each grade of labour and the labour yield variance in total using the weighted average method.

<table>
<thead>
<tr>
<th>Weighted average mix variance</th>
<th>Yield variance</th>
</tr>
</thead>
</table>

4. Advanced sales variances

Sales mix and quantity variance

- Sales mix and quantity variance further explain the volume variance.
- Sales mix variance measures the change in volume due to a change in the product mix sold.
- Sales quantity variance measures the change in volume due to the actual quantity sold.
- Sales mix variance is only meaningful when selling in the same markets.
- If the product that earns a lower-contribution sells more units at the expense of a higher contribution product, the result will be adverse.
- If the sales mix sells more of a high-contribution product, the results will be favourable.
Advantages and disadvantages of advanced sales variances

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The mix variance highlights individual product trends</td>
<td>• Cannot be useful in isolation (interdependence on other aspects, e.g. quality of material)</td>
</tr>
<tr>
<td>• The mix variance helps strategies to be shaped by exploiting favourable variances</td>
<td>• Sales mix variance is not useful for unrelated products in different markets</td>
</tr>
<tr>
<td>• Success of limited-edition products or new market launches can be evaluated through mix variance</td>
<td>• Difficult for companies to derive value when they have a wide range of products</td>
</tr>
<tr>
<td>• The quantity variance can identify changes in the market size or share</td>
<td>• Need to consider which factors are controllable for the variance to be beneficial</td>
</tr>
<tr>
<td>• Better accountability of managers handling different product lines</td>
<td></td>
</tr>
</tbody>
</table>

Test Your Understanding 3 – Sales mix

A business sells two products, X & Y. The following details are available for them:

<table>
<thead>
<tr>
<th></th>
<th>Standard mix (units)</th>
<th>Standard profit ($ per unit)</th>
<th>Average profit ($ per unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>(2×5)+(3×6)/5</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Budgeted sales: 200 units X and 300 units Y
Actual sales: 180 units X and 310 units Y

A. Calculate the sales quantity profit variance and enter it in the blank __________

B. Calculate the sales mix profit variance using the individual units method and enter it in the blank __________
5. Planning and operational variance

- Variances may also arise due to planning miscalculations.
- When this occurs, the variance is sub-divided into:
  - The planning variance: caused by an inaccurate original plan.
  - The operational variance: due to business decisions that caused a change in the actual results.
Stock plc uses one raw material for one of their products. The standard cost per unit at the start of the year was as follows:

Standard material cost per unit = 7 kg per unit × $4 per kg = $28 per unit

During the year, the supplier changed the material quality due to problems occurring in their country, and the standard had to be revised:

Standard material cost per unit = 8 kg per unit × $3.8 kg per unit = $30.40

The actual output for a given month was 1,400 units. During that time, 11,000 kg of material was purchased and used at a cost of $41,500.

A. Calculate the planning material variances in terms of price and usage and enter them in the given boxes:

<table>
<thead>
<tr>
<th>Planning material price variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning material usage variance</td>
</tr>
</tbody>
</table>

Test Your Understanding 4 – Planning and operational variances
B. Calculate the operational variances in terms of price and usage and enter them in the given boxes:

<table>
<thead>
<tr>
<th>Operational material price variance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational material usage variance</td>
<td></td>
</tr>
</tbody>
</table>

Causes of planning variances

- Planning variance means that the standard cost should have been different.
- It effectively implies improper estimation.
- It means shifting the responsibility for variance from operations to estimation.
- Therefore, there should be a strong case for revision of the standard cost.
- Some valid reasons may be:
  - Change in the main component/input material
  - Unforeseen events leading to substantial changes in material/labour rates
  - A radical new change/technology that changes working times
- Where planning variances are caused by multiple factors, there would consequently be multiple revisions.
- The operational variances are calculated with the most recent revision.
- And the total planning revision is split between multiple factors, showing the variance for each factor separately.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>More relevant in the fast-changing economies of today</td>
<td>Time-consuming to keep calculating up-to-date standards</td>
</tr>
<tr>
<td>Operational variances are more up-to-date with updated efficiency levels</td>
<td>More data is required; where does it come from?</td>
</tr>
<tr>
<td>Incorporating planning variance is more motivating for operational employees</td>
<td>There is an element of subjectivity in deciding which factors should be accommodated in the ex-post standard</td>
</tr>
<tr>
<td>Focuses and helps to improve the initial planning</td>
<td>Can be manipulated to blame uncontrollable factors</td>
</tr>
<tr>
<td></td>
<td>Planning and operational departments would conflict as to how much of the variance is their responsibility</td>
</tr>
</tbody>
</table>
6. Solutions to Test Your Understanding

Test Your Understanding 1 – Material mix

<table>
<thead>
<tr>
<th>Material mix variance</th>
<th>501 F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material yield variance</td>
<td>13,999 F</td>
</tr>
</tbody>
</table>

Material mix variance

<table>
<thead>
<tr>
<th>Material</th>
<th>Std Mix</th>
<th>Actual Material Usage (kg)</th>
<th>Actual usage @ std mix (kg)</th>
<th>Mix variance (kg)</th>
<th>Std cost per kg ($)</th>
<th>Mix Variance ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>10/30</td>
<td>1,000</td>
<td>833</td>
<td>167 (A)</td>
<td>5</td>
<td>835 (A)</td>
</tr>
<tr>
<td>B</td>
<td>20/30</td>
<td>1,500</td>
<td>1,667</td>
<td>167 (F)</td>
<td>8</td>
<td>1,336 (F)</td>
</tr>
</tbody>
</table>

Material yield variance

<table>
<thead>
<tr>
<th>Material</th>
<th>Standard usage for actual output (kg)</th>
<th>Actual usage at standard mix (kg)</th>
<th>Yield variance (kg)</th>
<th>Std cost per kg ($)</th>
<th>Yield variance ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>150 \times 10 = 1,500</td>
<td>833</td>
<td>667 (F)</td>
<td>5</td>
<td>3,335 (F)</td>
</tr>
<tr>
<td>B</td>
<td>150 \times 20 = 3,000</td>
<td>1,667</td>
<td>1,333 (F)</td>
<td>8</td>
<td>10,664 (F)</td>
</tr>
</tbody>
</table>

Test Your Understanding 2 – Labour mix

<table>
<thead>
<tr>
<th>Weighted average mix variance</th>
<th>$5,250 F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield variance</td>
<td>$5,000 A</td>
</tr>
</tbody>
</table>

Weighted average method

Weighted average standard rate = \frac{6 \times $12 + 4 \times $7}{6 \text{ hours} + 4 \text{ hours}}

Weighted average standard rate = $10 per hour
Weighted average mix variance

<table>
<thead>
<tr>
<th></th>
<th>Skilled labour hours</th>
<th>Unskilled labour hours</th>
<th>Total hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual input</td>
<td>5,250</td>
<td>5,250</td>
<td>10,500</td>
</tr>
<tr>
<td>Actual input in standard proportion 6:4</td>
<td>6,300</td>
<td>4,200</td>
<td>10,500</td>
</tr>
<tr>
<td>Difference in hours</td>
<td>-1,050</td>
<td>1,050</td>
<td></td>
</tr>
<tr>
<td>Difference in rate (weighted average std rate – individual standard labour rate) × (10-12) (10-7)</td>
<td>-2</td>
<td>-3</td>
<td></td>
</tr>
<tr>
<td>Mix variance</td>
<td>$2,100 F</td>
<td>$1,350 F</td>
<td>5,250 F</td>
</tr>
</tbody>
</table>

Yield variance

Standard cost per unit of output = (6×$12 + 4×$7)/1 unit = $100 per unit

Standard yield = 10,500 units × (1 unit/10 hours) = 1,050 hours (A)

Actual yield = 1,000 hours (B)

Variance = 50 hours (A)

× Standard price per kg of output = 100

Yield variance = $5,000 A

**Test Your Understanding 3 – Sales mix**

**Solution to A - Sales quantity profit variance = $56 A**

(Actual units – budgeted units) × weighted average profit per unit

(500 units – 490 units) × $5.6 per unit

(10 units) × $5.6 per unit

$56 A

**Solution to B - Sales mix profit variance = $16 F**

<table>
<thead>
<tr>
<th></th>
<th>Standard mix</th>
<th>Actual mix</th>
<th>Variance (units)</th>
<th>Profit per unit ($)</th>
<th>Variance ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>196</td>
<td>180</td>
<td>16 (A)</td>
<td>5</td>
<td>80 (A)</td>
</tr>
<tr>
<td>Y</td>
<td>294</td>
<td>310</td>
<td>16 (F)</td>
<td>6</td>
<td>96 (F)</td>
</tr>
<tr>
<td></td>
<td>490</td>
<td>490</td>
<td></td>
<td></td>
<td>16 (F)</td>
</tr>
</tbody>
</table>
Please note that the standard mix is the total unit sales (490) multiplied by 2/5 to give X and 3/5 to give Y.

**Test Your Understanding 4 – Planning and operational variances**

**Solution to A**

| Planning material price variance | $2,240 F |
| Planning material usage variance | $5,600 A |

RSQ × RSP = 1,400 × 8 × $3.80 = $42,560
RSQ × SP = 1,400 × 8 × $4 = $44,800

Price variance = $2,240 F

RSQ × SP = 1,400 × 8 × $4 = $44,800
SQ × SQ = 1,400 × 7 × $4 = $39,200

Usage variance = $5,600 A

**Solution to B**

| Operational material price variance | $300 F |
| Operational material usage variance | $760 F |

AQ × AP = $41,500
AQ × RSP = 11,000 × $3.80 = $41,800

Operational price variance = $300 F

AQ × RSP = 11,000 × $3.80 = $41,800
RSQ × RSP = 1,400 × 8 × $3.80 = $42,560

Operational usage variance = $760 F
8. Chapter summary

Advanced variances
Chapter 10

Material

Material Mix Variance
- if we use more expensive/cheaper product
- 2 methods to calculate:
  * individual unit method
  * Weighted average method

Material Yield Variance
- happens if we use more/less material overall

Labour

Labour Mix Variance
- happens if we use more/less labour overall
- 2 methods to calculate:
  * individual unit method
  * Weighted average method

Labour Yield Variance
- happens if we use more/less labour overall

Sales mix and quantity
- analyses the sales volume variance
- mix is adverse if we sell less of the more profitable product

Planning variances
- original - revised standard
- uncontrollable

Operational variances
- revised - actual standards results
- controllable