CHAPTER 10:
HYPOTHESIS TESTING AND
OVERALL PERFORMANCE OF
THE SMALL SCALE AGRO-PROCESSING
INDUSTRY IN THE AHMEDNAGAR DISTRICT
10. HYPOTHESIS TESTING AND OVERALL PERFORMANCE OF THE SMALL SCALE AGRO-PROCESSING INDUSTRY IN THE AHMEDNAGAR DISTRICT

10.1. Hypothesis Testing

10.1.1. The marketing performance of the Small Scale Agro-Processing Industry in the Ahmednagar district is satisfactory.

10.1.2. The food sector dominates in the sales of the Small Scale Agro-Processing Industry in the Ahmednagar district.

10.1.3. There are significant differences in the mean annual sales of the product categories of the Small Scale Agro-Processing Industry in the Ahmednagar district.

10.1.4. The proportion of closure in the Small Scale Agro-Processing Industry is less than that in the Small Scale Sector in the Ahmednagar district.

10.1.5. The proportion of closure in the women enterprises is more than that in the enterprises owned by men in the Small Scale Agro-Processing Industry in the Ahmednagar district.

10.1.6. The proportion of closure in the food sector is less than that in the non food sector of the Small Scale Agro-Processing Industry in the Ahmednagar district.

10.1.7. The assistance provided by government organizations has been effective in checking the extent of closure in the Small Scale Agro-Processing Industry in the Ahmednagar district.

10.2. Overall Performance of the Small Scale Agro-Processing Industry

10.2.1. Tehsil wise Overall Performance of the Industry

10.2.2. Business Sector wise Overall Performance of the Industry

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10. HYPOTHESIS TESTING AND OVERALL PERFORMANCE OF THE SMALL SCALE AGRO-PROCESSING INDUSTRY

The inferential analysis is carried out to test seven hypotheses formulated related to the study. In order to test the hypotheses, two parametric tests namely - z-test, F-test and one non parametric test \( \chi^2 \) (Chi-Square) is used. The overall performance of the small scale agro-processing industry is assessed tehsil wise, business sector wise and product category wise. The overall performance is assessed on four parameters namely – share in number of enterprises, extent of closure, share in industry sales and average sales growth rate. Based on these four parameters score sheet is prepared and ranks are given to tehsils, sectors and product categories. Further, the tehsils, sectors and product categories are classified into three classes viz. A (high performers), B (medium performers) and C (low performers). The analysis is presented on following lines.

10.1. Hypothesis Testing

10.2. Overall Performance of the Small Scale Agro-Processing Industry

10.1. HYPOTHESIS TESTING:

The seven hypotheses tested are given below.

10.1.1. The marketing performance of the Small Scale Agro-Processing Industry in the Ahmednagar district is satisfactory.

10.1.2. The food sector dominates in the sales of the Small Scale Agro-Processing Industry in the Ahmednagar district.

10.1.3. There are significant differences in the mean annual sales of the product categories of the Small Scale Agro-Processing Industry in the Ahmednagar district.

10.1.4. The proportion of closure in the Small Scale Agro-Processing Industry is less than that in the Small Scale Sector in the Ahmednagar district.

10.1.5. The proportion of closure in the women enterprises is more than that in the enterprises owned by men in the Small Scale Agro-Processing Industry in the Ahmednagar district.

10.1.6. The proportion of closure in the food sector is less than that in the non food sector of the Small Scale Agro-Processing Industry in the Ahmednagar district.

10.1.7. The assistance provided by government organizations has been effective in checking the extent of closure in the Small Scale Agro-Processing Industry in the Ahmednagar district.
10.1.1. The marketing performance of the Small Scale Agro-Processing Industry in the Ahmednagar district is satisfactory.

The marketing performance of the small scale agro-processing industry in the Ahmednagar district is analysed on the basis of the ‘Sales’. The mean annual sales growth rate of the small scale agro-processing industry in the Ahmednagar district is considered as the indicator of the marketing performance of the industry. The mean annual sales growth rate of the small scale agro-processing industry is compared with that of the overall small scale sector in the Ahmednagar district in order to test the hypothesis. The rationale for comparison is that if the mean annual sales growth rate of the small scale agro-processing industry is same as that of the overall small scale sector in the Ahmednagar district, then the industry is growing at the same annual growth rate as that of the small scale sector and hence its marketing performance is satisfactory. The time period for the analysis of the mean annual sales growth rate is from financial year 2003-04 to 2007-08. It is found that the mean annual sales growth rate of the overall small scale sector in the Ahmednagar district is 12.08% during the period from the financial year 2003-04 to 2007-08.

10.1.1.1. Null and Alternate Hypotheses:

The null and alternate hypotheses are formulated as follows.

- **Null Hypothesis (H₀):** The marketing performance of the small scale agro-processing industry in the Ahmednagar district is satisfactory.

  \[ H₀: \mu_H₀ = 12.08 \]

- **Alternate Hypothesis (Hₐ):** The marketing performance of the small scale agro-processing industry in the Ahmednagar district is dissatisfactory.

  \[ Hₐ: \mu_Hₐ < 12.08 \]

Where, \( \mu = \) Mean Annual sales of the Population (Small Scale Agro-Processing Industry)
10.1.1.2. Selection of the Type of Test and Sampling Distribution:

In order to test the hypothesis *z-test for mean* is used because of the following reasons.

- The sample mean (mean annual sales growth rate) is to be compared with that of hypothesized population mean.
- There is only one sample (group), so one sample test is used.
- Since the means are compared, test for mean is used.
- The sample size is more than 30; therefore test for large sample is used.

The sample mean is to be compared with the hypothesized population mean. Therefore, *sampling distribution chosen is of mean*. Since the size of the sample is 225 (large sample) the distribution of mean is *normal probability distribution*.

10.1.1.3. Selection of Critical Value:

The critical value is the table value of the Standard Variate for a particular significance level. It depends on the following factors.

- *Significance Level* (\(\alpha\)): The significance level chosen is 5%. It indicates the Type I (\(\alpha\)) error. That means there is a risk of 5% that null hypothesis is rejected when it is true.
- *One tailed or Two tailed Test*: Since the alternate hypothesis has only one possibility i.e. one sided, *one tailed test* is used here. Further, the alternate hypothesis is *less than* type therefore; *left tailed test* is used here.
- Degree of Freedom (df): Since the sample size is large (more than 30) the degree of freedom is not to be considered.

Based on the 5% significance level and the one sided test (left tail) the critical value for the *z* is found out from the *z*-table and it is -1.645.

\[
z = -1.645 \text{ (Critical Value/Table Value)} \quad \text{----------------- (1)}
\]
10.1.1.4. Computation of Test Statistic:

The test statistic \( z \) is computed on the basis of sample information using following formula.

\[
z = \frac{\bar{X} - \mu_{H0}}{(\sigma_p / \sqrt{n}) \times \left[ \sqrt{\left( N-n \right) / (N-1)} \right]} \tag{2}
\]

Where,

- \( z \) = Test Statistic
- \( \bar{X} \) = Sample Mean = 11.36 (Table No. 7.1)
- \( \mu_{H0} \) = Hypothesized Population Mean = 12.08
- \( \sigma_p \) = Standard Deviation in Population. Since the standard deviation of the population is not known, Standard Deviation in Sample (\( \sigma_s \)) is used as the best estimate of \( \sigma_p \) because the sample size is large (more than 30)
- \( \sigma_p \) = \( \sigma_s \) = 12.15 (calculated)
- \( n \) = Size of Sample. Even though the size of sample is 225 the mean sales growth rate of the sample enterprises is based on the sales of the 152 working enterprises. Therefore, size of sample is considered as the size of working enterprises in sample i.e. 152.
- \( N \) = Size of Population. Even though the size of the population is 702, the mean annual sales growth rate is calculated for only working enterprises. Therefore, size of the population is considered as the size of working enterprises in the population. It is estimated using point estimate from the working enterprises in the sample. The sample proportion of the working enterprises is 67.56%. As per point estimate sample proportion is considered as the best estimate of the population proportion. Therefore, the population proportion of the working enterprises become 67.56%. Thus, the working enterprises in the population are 474 (67.56% of 702).

After putting all these values in the equation (2),

\[
z = \frac{11.36 - 12.08}{(12.15 / \sqrt{152}) \times \left[ \sqrt{(474-152) / (474-1)} \right]}
\]
\[ z = \frac{-0.72}{(12.15 / 12.33) \times \sqrt{0.68}} \]

\[ z = \frac{-0.72}{0.99 \times 0.83} \]

\[ z = \frac{-0.72}{0.81} \]

\[ z = -0.89 \text{ (Test Statistic)} \]  

10.1.1.5. Comparison of Test Statistic with Critical Value and Interpretation:

The critical value/table value for \( z \) is -1.645 (equation 1). The calculated value of test statistic is \( z = -0.89 \) (equation 3).

As the alternate hypothesis is one sided (left tailed test) the rejection region for null hypothesis at 5% significance level is given below.

\[ R : z < -1.645 \]

The calculated value of the test statistic (\( z = -0.89 \)) is more than the critical value/table value (\( z = -1.645 \)). This means the calculated value of the test statistic lie in the acceptance region. Therefore, there is no statistical evidence to reject the null hypothesis (\( H_0 \)). Hence the null hypothesis (\( H_0 \)) is accepted. That means ‘The marketing performance of the small scale agro-processing industry in the Ahmednagar district is satisfactory.’ It indicates that the mean annual sales growth rate of the small scale agro-processing industry is same as that of the overall small scale sector in Ahmednagar district during the period from financial year 2003-04 to 2007-08.

10.1.1.6. Result of Hypothesis Test:

The null hypothesis (\( H_0 \)) is accepted. That means the formulated hypothesis is accepted. 'The marketing performance of the small scale agro-processing industry in the Ahmednagar district is satisfactory.'
10.1.2. The food sector dominates in the sales of the Small Scale Agro-Processing Industry in the Ahmednagar district.

The marketing performance of the small scale agro-processing industry in the Ahmednagar district is analysed on the basis of the ‘Sales’. The contribution of business sectors in the sales of the small scale agro-processing industry in the Ahmednagar district is calculated for the financial year 2007-08. Since there are two business sectors (food and non food) only, the sectoral share of more than 75% (3/4th) in the sales of the small scale agro-processing industry in Ahmednagar district is considered as the indicator of the dominance in the industry sales. Therefore, the proportion (%) of the food sector in the sales of small scale agro-processing industry is compared with 75% in order to test the hypothesis.

10.1.2.1. Null and Alternate Hypotheses:

The null and alternate hypotheses are formulated as follows.

- **Null Hypothesis (H₀):** The share of the food sector is equal to 75% in the Sales of the Small Scale Agro-Processing Industry in the Ahmednagar district.

  \[ H₀: \ p = 0.75 \]

- **Alternate Hypothesis (Hₐ):** The food sector dominates in the sales of the Small Scale Agro-Processing Industry in the Ahmednagar district.

  \[ Hₐ: \ p > 0.75 \]

Where,

\[ P = \text{Proportion (Share) of the food sector in the sales of the small scale agro-processing Industry} \]
10.1.2.2. Selection of the Type of Test and Sampling Distribution:

In order to test the hypothesis $z$-test for proportion is used because of the following reasons.

- The sample proportion is to be compared with hypothesized population proportion.
- There is one sample, so one sample test is used.
- The sample size is more than 30; therefore test for large sample is used.

The sample proportion is to be compared with hypothesized proportion. Therefore, sampling distribution chosen is of proportion. Since the sample size is more than 30 (large sample) the distribution of proportion is normal probability distribution.

10.1.2.3. Selection of Critical Value:

The critical value is the table value of the Standard Variate for a particular significance level. It depends on the following factors.

- **Significance Level ($\alpha$):** The significance level chosen is 5%. It indicates the Type I ($\alpha$) error. That means there is a risk of 5% that null hypothesis is rejected when it is true.

- **One tailed or Two tailed Test:** Since the alternate hypothesis has only one possibility i.e. one sided, one tailed test is used here. Further, the alternate hypothesis is greater than type therefore; right tailed test is used here.

- **Degree of Freedom (df):** Since the sample size is large (more than 30) the degree of freedom is not to be considered.

Based on the 5% significance level and the one sided test (right tail) the critical value for the $z$ is found out from the $z$-table and it is 1.645.

$$z = 1.645 \text{ (Critical Value/Table Value)} \quad \text{---------------- (4)}$$
10.1.2.4. Computation of Test Statistic:

The test statistic \( z \) is computed on the basis of sample information using following formula.

\[
z = \frac{\hat{p} - p}{\sqrt{(p\times q) \times \left(\frac{(N-n)}{(nN)}\right)}} \tag{5}
\]

Where,

\( z \) = Test Statistic

\( \hat{p} \) = Sample Proportion = 87.39\% (Table No. 7.7.) = 0.8739

\( p \) = Hypothesized Population Proportion = 75\% = 0.75

\( q \) = 1 - \( p \) = 1 – 0.75 = 0.25

\( n \) = Size of Sample. Even though the size of sample is 225 the proportion of sales of the business sectors in the industry is based on the sales of the 152 working enterprises. Therefore, size of sample is considered as the size of working enterprises in sample i.e. 152.

\( N \) = Size of Population. The size of the population is 702. The share of sales of the business sectors in the industry is based on the sales of the working enterprises. Therefore, size of the population is considered as the size of working enterprises in the population. It is estimated using point estimate from the working enterprises in the sample. The sample proportion of the working enterprises is 67.56\%. As per point estimate sample proportion is considered as the best estimate of the population proportion. Therefore, the population proportion of the working enterprises become 67.56\%. Thus, the working enterprises in the population are 474 (67.56\% of 702).

After putting all these values in the equation (5),

\[
z = \frac{0.8739 - 0.75}{\sqrt{(0.75 \times 0.25) \times \left(\frac{(474-152)}{(152\times 474)}\right)}}
\]
\[ z = \frac{0.1239}{\sqrt{(0.1875) \times \left[ \frac{322}{72048} \right]}} \]

\[ z = \frac{0.1239}{\sqrt{0.0008}} \]

\[ z = \frac{0.1239}{0.0289} \]

\[ z = 4.28 \text{ (Test Statistic)} \] \hspace{1cm} \text{(6)}

10.1.2.5. Comparison of Test Statistic with Critical Value and Interpretation:
The critical value/table value for \( z \) is 1.645 (equation 4). The calculated value of test statistic is \( z = 4.28 \) (equation 6).

As the alternate hypothesis is one sided (right tailed test) the rejection region for null hypothesis at 5% significance level is given below.

\[ R : z > 1.645 \]

The calculated value of the test statistic \( (z=4.28) \) is more than the critical value/table value \( (z=1.645) \). This means the calculated value of the test statistic lie in the rejection region. Therefore, there is a statistical evidence to reject the null hypothesis \( (H_0) \). Hence the null hypothesis \( (H_0) \) is rejected and alternate hypothesis is accepted \( (H_a) \).

That means ‘The food sector dominates in the sales of the Small Scale Agro-Processing Industry in the Ahmednagar district’. It indicates that the share of the food sector in the sales of the small scale agro-processing industry in Ahmednagar district is more than 75% in the financial year 2007-08.

10.1.2.6. Result of Hypothesis Test:
The alternate hypothesis \( (H_a) \) is accepted. That means the formulated hypothesis is accepted.

‘The Food Sector dominates in the sales of the Small Scale Agro-Processing Industry in the Ahmednagar district.'
10.1.3. There are significant differences in the mean annual sales of the product categories of the Small Scale Agro-Processing Industry in the Ahmednagar district.

The marketing performance of the small scale agro-processing industry in the Ahmednagar district is analysed on the basis of the ‘Sales’. The mean annual sales of the product categories of the small scale agro-processing enterprises in the Ahmednagar district is calculated for financial year 2007-08. The difference in the mean annual sales of the product categories is checked in order to find out whether there are any significant differences in them.

10.1.3.1. Null and Alternate Hypotheses:

The null and alternate hypotheses are formulated as follows.

- **Null Hypothesis (H₀):** There are no differences in the mean annual sales of the product categories of the Small Scale Agro-Processing Industry in the Ahmednagar district.

  $$H₀: µ₁ = µ₂ = …. = µₖ$$

- **Alternate Hypothesis (Hₐ):** There are significant differences in the mean annual sales of the product categories of the Small Scale Agro-Processing Industry in the Ahmednagar district.

  $$Hₐ: µ₁ ≠ µ₂ ≠ …. ≠ µₖ$$

Where, $µ₁, µ₂, … µₖ$ = Mean Annual Sales of the product categories of the Small Scale Agro-Processing Industry.
10.1.3.2. Selection of the Type of Test and Sampling Distribution:

In order to test the hypothesis F-test is used because of the following reasons.

- The difference between the mean annual sales of the product categories is to be checked in order to find out whether there exists any significant difference.
- Since the variability in the mean annual sales is to be checked ‘Analysis of Variance (ANOVA) technique is used.
- There is only one factor (sales), so one way ANOVA is used.

The difference between the mean annual sales of the product categories is to be checked in order to find out whether there exists any significant difference. Since variability in the sales is to be checked, *sampling distribution chosen is F-distribution.*

10.1.3.3. Selection of Critical Value:

The critical value is the table value of the Standard Variate for a particular significance level. It depends on the following factors.

- *Significance Level (α):* The significance level chosen is 5%. It indicates the Type I (α) error. That means there is a risk of 5% that null hypothesis is rejected when it is true.
- Degree of Freedom (df): Even though the sample size 225, the mean of annual sales of the product categories/industry is based on the sales of the working enterprises. Therefore, the sample size (n) is considered as the sample size of working enterprises i.e. 152. Therefore, n=152. Further there are 15 product categories (samples) in the industry, therefore k= 15 samples. Based on n and k the values for v1 and v2 are calculated. v1 = k-1 = 15 – 1 = 14, v2 = n-k = 152 – 15 = 137. Therefore, v1= 14, v2 = 137.

Based on the 5% significance level and the degree of freedom (df) the critical value for the F is found out from the F-table and it is 1.712.

\[
F = 1.712 \text{ (Critical Value/Table Value)} \quad \text{--------------- (7)}
\]
10.1.3.4. Computation of Test Statistic:

The test statistic \( F \) is computed on the basis of sample information using following formula.

\[
F = \frac{MS \text{ Between Samples}}{MS \text{ Within Samples}} \quad \text{(8)}
\]

Where,

- \( F \) = Test Statistic
- \( MS \) = Mean Square. It is calculated by dividing Sum of Squares (SS) by Degree of Freedom (df)

The Sum of Squares (SS) is calculated for both ‘Between Product Categories (Samples)’ and ‘Within Product Categories (Samples)’ as follows.

**Sum of Squares (SS) for Between Product Categories (Samples)**

\[
SS = n_1(X_1 - \bar{X})^2 + n_2(X_2 - \bar{X})^2 + \ldots + n_k(X_k - \bar{X})^2
\]

Where,

- \( n_1, n_2, \ldots, n_k \) = Number of Working Enterprises in the Product Categories (Samples) from 1 to k
- \( \bar{X}_1, \bar{X}_2, \ldots, \bar{X}_k \) = Mean Annual Sales of the Product Categories (Samples) from 1 to k
- \( \bar{X} \) = Mean Annual Sales of the Industry = Rs. 242.60 Lakhs

**Sum of Squares (SS) for Within Product Categories (Samples)**

\[
SS = (X_{1i} - \bar{X}_1)^2 + (X_{2i} - \bar{X}_2)^2 + \ldots + (X_{ki} - \bar{X}_k)^2
\]

Where,

- \( X_{1i}, X_{2i}, \ldots, X_{ki} \) = Annual Sales of Working Enterprises of the respective Product Categories (Samples) from 1 to k
- \( \bar{X}_1, \bar{X}_2, \ldots, \bar{X}_k \) = Mean Annual Sales of the Product Categories (Samples) from 1 to k
The Sum of Squares (SS) is calculated for both ‘Between Product Categories (Samples)’ and ‘Within Product Categories (Samples)’ using above formulae and calculation is shown below.

Table 10.1: Sum of Squares (SS) for Between Product Categories (Samples) for ANOVA

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Product Category</th>
<th>Mean of Annual Sales of Category $\overline{X_1, \ldots, \overline{X_k}}$</th>
<th>Number of Working Enterprises $n_1, n_2, \ldots, n_k$</th>
<th>$n_1(\overline{X_1} - \overline{X})^2$</th>
<th>$\ldots$</th>
<th>$n_k(\overline{X_k} - \overline{X})^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Processing of Fruits &amp; Veg.</td>
<td>24.88</td>
<td>10</td>
<td>474019.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Vegetable Oil</td>
<td>146.4</td>
<td>9</td>
<td>83289.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Milk &amp; Milk Products</td>
<td>953.7</td>
<td>30</td>
<td>15169896.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Grain Mill Products</td>
<td>53.93</td>
<td>4</td>
<td>142385.48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Animal Feed</td>
<td>51.05</td>
<td>7</td>
<td>256839.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Bakery Products</td>
<td>24.8</td>
<td>13</td>
<td>616678.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Confectionary</td>
<td>13.72</td>
<td>3</td>
<td>157158.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Spices</td>
<td>63.73</td>
<td>7</td>
<td>223961.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Supari/Tobacco Products</td>
<td>192.4</td>
<td>3</td>
<td>7560.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Other Food Products</td>
<td>17.41</td>
<td>5</td>
<td>253552.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Textiles</td>
<td>322.51</td>
<td>8</td>
<td>51084.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Wood &amp; Wood Products</td>
<td>27.33</td>
<td>34</td>
<td>1575599.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Paper &amp; Paper Products</td>
<td>95.92</td>
<td>11</td>
<td>236665.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Ayurvedic Products</td>
<td>12.8</td>
<td>6</td>
<td>316848.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Essency Stick</td>
<td>4.75</td>
<td>2</td>
<td>113145.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$$SS = n_1(\overline{X_1} - \overline{X})^2 + n_2(\overline{X_2} - \overline{X})^2 + \ldots + n_k(\overline{X_k} - \overline{X})^2$$

19678686
Table 10.2: Sum of Squares (SS) for Within Product Categories (Samples) for ANOVA

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Product Category</th>
<th>Mean of Annual Sales of Category $X_{i1}, ..., X_{ik}$</th>
<th>$(X_{i1} - \bar{X}_1)^2$</th>
<th>$(X_{i2} - \bar{X}_2)^2$</th>
<th>...</th>
<th>$(X_{ik} - \bar{X}_k)^2$</th>
<th>$SS$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Processing of Fruits &amp; Veg.</td>
<td>24.88</td>
<td>3480.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Vegetable Oil</td>
<td>146.4</td>
<td>422823.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Milk &amp; Milk Products</td>
<td>953.7</td>
<td>38017718.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Grain Mill Products</td>
<td>53.93</td>
<td>2353.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Animal Feed</td>
<td>51.05</td>
<td>22720.24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Bakery Products</td>
<td>24.8</td>
<td>7863.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Confectionary</td>
<td>13.72</td>
<td>251.49</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Spices</td>
<td>63.73</td>
<td>80308.61</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Supari/Tobacco Products</td>
<td>192.4</td>
<td>164398.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Other Food Products</td>
<td>17.41</td>
<td>1319.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Textiles</td>
<td>322.51</td>
<td>500445.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Wood &amp; Wood Products</td>
<td>27.33</td>
<td>63031.09</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Paper &amp; Paper Products</td>
<td>95.92</td>
<td>97384.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Ayurvedic Products</td>
<td>12.8</td>
<td>1303.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Essency Stick</td>
<td>4.75</td>
<td>5.99</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ‘Degree of Freedom (df)’ is calculated for both between ($v_1$) and within ($v_2$) product categories (samples) as follows.

Even though the sample size 225, the mean of annual sales of the product categories/industry is based on the sales of the working enterprises. Therefore, the sample size (n) is considered as the sample size of working enterprises i.e. 152. Therefore, $n=152$. Further there are 15 product categories (samples) in the industry, therefore $k= 15$ samples. Based on n and k the values for $v_1$ and $v_2$ are calculated.
Degree of Freedom (df) for Between Product Categories (Samples) ($v_1$)

\[ v_1 = k - 1 \]
\[ v_1 = 15 - 1 \]
\[ v_1 = 14 \] \ldots \ldots (9)

Degree of Freedom (df) for Between Product Categories (Samples) ($v_2$)

\[ v_2 = n - k \]
\[ v_2 = 152 - 15 \]
\[ v_2 = 137 \] \ldots \ldots (10)

Degree of Freedom (df) Total

\[ n - 1 = 152 - 1 \]
\[ = 151 \] \ldots \ldots (11)

Based on ‘Sum of Squares (SS)’ and ‘Degree of Freedom (df)’ the ‘Mean Squares (MS)’ are calculated as follows.

**Mean Square (MS) Between Samples**

\[
MS \text{ Between Product Categories (Samples)} = \frac{SS \text{ Between Product Categories (Samples)}}{df \text{ Between Product Categories (Samples)}}
\]

After putting values of SS between product categories (samples) from Table No. 10.1, and df between product categories (samples) from equation 9),

\[
MS \text{ Between Product Categories (Samples)} = \frac{19678686}{14}
\]

\[ MS \text{ Between Product Categories (Samples)} = 1405620.00 \] \ldots \ldots (12)
Mean Square (MS) Within Samples

\[ MS \text{ Within Product Categories (Samples)} = \frac{SS \text{ Within Product Categories (Samples)}}{df \text{ Within Product Categories (Samples)}} \]

After putting values of SS within product categories (samples) from Table No. 10.2, and df between product categories (samples) from equation 10),

\[ MS \text{ Within Product Categories (Samples)} = \frac{39385408}{137} \]

\[ MS \text{ Within Product Categories (Samples)} = 287484.70 \quad \text{......... (13)} \]

As shown in equation 8) the F-ratio is calculated as follows.

\[ F = \frac{MS \text{ Between Samples}}{MS \text{ Within Samples}} \]

Where,

\[ F = \text{Test Statistic} \]

\[ MS = \text{Mean Square} \]

After putting values of Mean Square (MS) from equation 12) and 13),

\[ F = \frac{1405620.00}{287484.70} \]

\[ F = 4.889374 \]

\[ F = 4.889 \quad \text{......... (14)} \]

The analysis of variance table for one-way ANOVA is shown below.
Table 10.3: Analysis of Variance for One-way ANOVA

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares (SS)</th>
<th>Degree of Freedom (d.f.)</th>
<th>Mean Square (MS)</th>
<th>F-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Product Categories (Samples)</td>
<td>19678686</td>
<td>14</td>
<td>1405620.00</td>
<td>4.889</td>
</tr>
<tr>
<td>Within Product Categories (Samples)</td>
<td>39385408</td>
<td>137</td>
<td>287484.70</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>59064094</td>
<td>151</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10.1.3.5. Comparison of Test Statistic with Critical Value and Interpretation:

The critical value/table value for F is 1.712 (equation 7). The calculated value of test statistic is \( F = 4.889 \) (equation 14). The rejection region for null hypothesis at 5% significance level is given below.

\[ R : F > 1.712 \]

The calculated value of the test statistic (\( F = 4.889 \)) is more than the critical value/table value (\( F = 1.712 \)). This means the calculated value of the test statistic lie in the rejection region. Therefore, there is a statistical evidence to reject the null hypothesis (\( H_0 \)). Hence the null hypothesis (\( H_0 \)) is rejected and alternate hypothesis (\( H_a \)) is accepted. That means ‘There are significant differences in the mean annual sales of the product categories of the Small Scale Agro-Processing Industry in the Ahmednagar district.’ It indicates that there is variability in the mean annual sales of the product categories of the small scale agro-processing industry in Ahmednagar district in the financial year 2007-08.

10.1.3.6. Result of Hypothesis Test:

The alternate hypothesis (\( H_a \)) is accepted. That means the formulated hypothesis is accepted.

‘There are significant differences in the mean annual sales of the product categories of the Small Scale Agro-Processing Industry in the Ahmednagar district’.
10.1.4. The proportion of closure in the Small Scale Agro-Processing Industry is less than that in the Small Scale Sector in the Ahmednagar district.

The proportion of closure in the small scale agro-processing industry in Ahmednagar district is compared with that in the overall small scale sector in the district in order to test the hypothesis. As per the database of District Industries Centre (DIC), Ahmednagar, the proportion of closure in the overall small scale sector is 38.50%.

10.1.4.1. Null and Alternate Hypotheses:

The null and alternate hypotheses are formulated as follows.

• **Null Hypothesis (H₀):** The proportion of closure in the Small Scale Agro-Processing Industry is same as that in the Small Scale Sector in the Ahmednagar district.
  
  \[ H₀: p = 0.3850 \]

• **Alternate Hypothesis (Hₐ):** The proportion of closure in the Small Scale Agro-Processing Industry is less than that in the Small Scale Sector in the Ahmednagar district.
  
  \[ Hₐ: p < 0.3850 \]

Where, \( P \) = Proportion of the closure in the small scale agro-processing industry.

10.1.4.2. Selection of the Type of Test and Sampling Distribution:

In order to test the hypothesis *z-test for proportion* is used because of the following reasons.

- The sample proportion is to be compared with hypothesized population proportion.
- There is one sample, so one sample test is used.
- The sample size is more than 30; therefore test for large sample is used.

The sample proportion is to be compared with hypothesized proportion. Therefore, *sampling distribution chosen is of proportion*. Since the sample size is more than 30 (large sample) the distribution of proportion is *normal probability distribution*. 
10.1.4.3. Selection of Critical Value:
The critical value is the table value of the Standard Variate for a particular significance level. It depends on the following factors.

- **Significance Level (\(\alpha\)):** The significance level chosen is 5%. It indicates the Type I (\(\alpha\)) error. That means there is a risk of 5% that null hypothesis is rejected when it is true.

- **One tailed or Two tailed Test:** Since the alternate hypothesis has only one possibility i.e. one sided, one tailed test is used here. Further, the alternate hypothesis is less than type therefore; left tailed test is used here.

- **Degree of Freedom (df):** Since the sample size is large (more than 30) the degree of freedom is not to be considered.

Based on the 5% significance level and the one sided test (left tail) the critical value for the \(z\) is found out from the z-table and it is -1.645.

\[
 z = -1.645 \text{ (Critical Value/Table Value) \hspace{1cm} (15)}
\]

10.1.4.4. Computation of Test Statistic:
The test statistic (\(z\)) is computed on the basis of sample information using following formula.

\[
 z = \frac{\hat{p} - p}{\sqrt{(p*q) * [(N-n) / (nN)]}} \hspace{1cm} \text{(16)}
\]

Where,

- \(z\) = Test Statistic
- \(\hat{p}\) = Sample Proportion = 32.44% (Table No. 9.15) = 0.3244
- \(p\) = Hypothesized Population Proportion = 38.50% = 0.3850
- \(q\) = 1 - \(p\) = 1 - 0.3850 = 0.6150
- \(n\) = Size of Sample = 225
- \(N\) = Size of Population = 702

After putting all these values in the equation (16),

\[
 z = \frac{0.3244 - 0.3850}{\sqrt{(0.3850 * 0.6150) * [(702 - 225) / (225*702)]}}
\]

\[
 z = -2.27 \text{ (Test Statistic)} \hspace{1cm} \text{(17)}
\]
10.1.4.5. Comparison of Test Statistic with Critical Value and Interpretation:
The critical value/table value for $z$ is -1.645 (equation 15). The calculated value of test statistic is $z = -2.27$ (equation 17). As the alternate hypothesis is one sided (left tailed test) the rejection region for null hypothesis at 5% significance level is given below.

\[ R : z < -1.645 \]

The calculated value of the test statistic ($z=-2.27$) is less than the critical value/table value ($z=-1.645$). This means the calculated value of the test statistic lie in the rejection region. Therefore, there is a statistical evidence to reject the null hypothesis ($H_0$). Hence the null hypothesis ($H_0$) is rejected and alternate hypothesis is accepted ($H_a$).

10.1.4.6. Result of Hypothesis Test:
The alternate hypothesis ($H_a$) is accepted. That means the formulated hypothesis is accepted.

‘The proportion of closure in the Small Scale Agro-Processing Industry is less than that in the Small Scale Sector in the Ahmednagar district’.

10.1.5. The proportion of closure in the women enterprises is more than that in the enterprises owned by men, in the Small Scale Agro-Processing Industry in the Ahmednagar district.
The proportion of closure in the women enterprises of the small scale agro-processing industry in Ahmednagar district is compared with that in the enterprises owned by men, of the industry in order to test the hypothesis.

10.1.5.1. Null and Alternate Hypotheses:
The null and alternate hypotheses are formulated as follows.

- **Null Hypothesis ($H_0$):** The proportion of closure in the women enterprises is same as that in the enterprises owned by men, in the Small Scale Agro-Processing Industry in the Ahmednagar district.

  \[ H_0 : p_1 = p_2 \]

- **Alternate Hypothesis ($H_a$):** The proportion of closure in the women enterprises is more than that in the enterprises owned by men, in the Small Scale Agro-Processing Industry in the Ahmednagar district.

  \[ H_a : p_1 > p_2 \]

Where, $P_1 =$ Proportion of the closure in the women enterprises of the industry.

$P_2 =$ Proportion of the closure in the enterprises owned by men, of the industry.
10.1.5.2. Selection of the Type of Test and Sampling Distribution:

In order to test the hypothesis $z$-test for difference between proportions is used because of the following reasons.

- The proportion of closure in one sample (women enterprises) is to be compared with that of other sample (enterprises owned by men) in order to find difference between proportions.
- There are two samples, so two sample test is used.
- The sample size is more than 30; therefore test for large sample is used.

The proportion in one sample is to be compared with that in the other sample. Therefore, sampling distribution chosen is of proportion. Since the sample size is more than 30 (large sample) the distribution of proportion is normal probability distribution.

10.1.5.3. Selection of Critical Value:

The critical value is the table value of the Standard Variate for a particular significance level. It depends on the following factors.

- Significance Level ($\alpha$): The significance level chosen is $5\%$. It indicates the Type I ($\alpha$) error. That means there is a risk of $5\%$ that null hypothesis is rejected when it is true.
- One tailed or Two tailed Test: Since the alternate hypothesis has only one possibility i.e. one sided, one tailed test is used here. Further, the alternate hypothesis is greater than type therefore; right tailed test is used here.
- Degree of Freedom (df): Since the sample size is large (more than 30) the degree of freedom is not to be considered.

Based on the $5\%$ significance level and the one sided test (right tail) the critical value for the $z$ is found out from the $z$-table and it is 1.645.

\[
z = 1.645 \text{ (Critical Value/Table Value)} \quad \text{(18)}
\]

10.1.5.4. Computation of Test Statistic:

The test statistic ($z$) is computed on the basis of sample information using following formula. Since the two samples are drawn from the populations which are similar (homogeneous) with regard to the given attribute, the formula regarding homogenized populations is used.
\[ z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\left(\frac{p_0 * q_0}{n_1}\right) + \left(\frac{p_0 * q_0}{n_2}\right)}} \]  
---------------------- (19)

Where,

\( z \) = Test Statistic

\( \hat{p}_1 \) = Proportion of Closure in Sample One (Women Ent.) = 38.71% (Table 9.22) = 0.3871

\( \hat{p}_2 \) = Proportion of Closure in Sample Two (Ent. owned by men) = 31.44% (Table 9.22) = 0.3144

\( p_0 \) = Best Estimate (Point Estimate) of proportion of closure in population

\( q_0 = 1 - p_0 = 1 - 0.3244 = 0.6156 \)

\( n_1 \) = Size of Sample One (Women Enterprises) = 31

\( n_2 \) = Size of Sample Two (Enterprises Owned by Men) = 194

After putting all these values in the equation (19),

\[ z = \frac{0.3871 - 0.3144}{\sqrt{\left(\frac{0.3244*0.6156}{31}\right) + \left(\frac{0.3244*0.6156}{194}\right)}} \]

\[ z = 0.80 \text{ (Test Statistic)} \]  
---------------------- (20)

10.1.5.5. **Comparison of Test Statistic with Critical Value and Interpretation:**

The critical value/table value for \( z \) is 1.645 (equation 18). The calculated value of test statistic is \( z = 0.80 \) (equation 20).

As the alternate hypothesis is one sided (right tailed test) the rejection region for null hypothesis at 5% significance level is given below.

\[ R : z > 1.645 \]

The calculated value of the test statistic (\( z = 0.80 \)) is less than the critical value/table value (\( z = 1.645 \)). This means the calculated value of the test statistic lie in the acceptance region. Therefore, there is no statistical evidence to reject the null hypothesis \( (H_0) \). Hence the null hypothesis \( (H_0) \) is accepted. That means ‘The proportion of closure in the women enterprises is same as that in the enterprises owned by men, in the Small Scale Agro-Processing Industry in the Ahmednagar district’. Thus the formulated hypothesis is rejected.
10.1.5.6. Result of Hypothesis Test:
The formulated hypothesis (Ha) is rejected.
‘The proportion of closure in the women enterprises is more than that in the enterprises owned by men, in the Small Scale Agro-Processing Industry in the Ahmednagar district’.

The null hypothesis (H₀) is accepted.
‘The proportion of closure in the women enterprises is same as that in the enterprises owned by men, in the Small Scale Agro-Processing Industry in the Ahmednagar district’.

10.1.6. The proportion of closure in the food sector is less than that in the non food sector of the Small Scale Agro-Processing Industry in the Ahmednagar district.
The proportion of closure in the food sector of the small scale agro-processing industry in Ahmednagar district is compared with that in the non food sector of the industry in order to test the hypothesis.

10.1.6.1. Null and Alternate Hypotheses:
The null and alternate hypotheses are formulated as follows.

- **Null Hypothesis (H₀):** The proportion of closure in the food sector is same as that in the non food sector of the Small Scale Agro-Processing Industry in the Ahmednagar district.
  \[ H₀: p₁ = p₂ \]

- **Alternate Hypothesis (Hₐ):** The proportion of closure in the food sector is less than that in the non food sector of the Small Scale Agro-Processing Industry in the Ahmednagar district.
  \[ Hₐ: p₁ < p₂ \]

Where, \( P₁ \) = Proportion of the closure in the food sector of the industry.

\( P₂ \) = Proportion of the closure in the non food sector of the industry.
10.1.6.2. Selection of the Type of Test and Sampling Distribution:

In order to test the hypothesis z-test for difference between proportions is used because of the following reasons.

- The proportion of closure in one sample (food sector) is to be compared with that of other sample (non food sector) in order to find difference between proportions.
- There are two samples, so two sample test is used.
- The sample size is more than 30; therefore test for large sample is used.

The proportion in one sample is to be compared with that in the other sample. Therefore, sampling distribution chosen is of proportion. Since the sample size is more than 30 (large sample) the distribution of proportion is normal probability distribution.

10.1.6.3. Selection of Critical Value:

The critical value is the table value of the Standard Variate for a particular significance level. It depends on the following factors.

- Significance Level (α): The significance level chosen is 5%. It indicates the Type I (α) error. That means there is a risk of 5% that null hypothesis is rejected when it is true.
- One tailed or Two tailed Test: Since the alternate hypothesis has only one possibility i.e. one sided, one tailed test is used here. Further, the alternate hypothesis is less than type therefore; left tailed test is used here.
- Degree of Freedom (df): Since the sample size is large (more than 30) the degree of freedom is not to be considered.

Based on the 5% significance level and the one sided test (left tail) the critical value for the z is found out from the z-table and it is - 1.645.

\[ z = -1.645 \text{ (Critical Value/Table Value)} \]

10.1.6.4. Computation of Test Statistic:

The test statistic (z) is computed on the basis of sample information using following formula. Since the two samples are drawn from the populations which are similar (homogeneous) with regard to the given attribute, the formula regarding homogenized populations is used.
\[ z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\left( p_0 q_0/n_1 + p_0 q_0/n_2 \right)}} \]  
\[ \text{Where,} \]
\[ z = \text{Test Statistic} \]
\[ \hat{p}_1 = \text{Proportion of Closure in Sample One (Food Sector)} = 26.02\% \text{ (Table 9.16)} = 0.2602 \]
\[ \hat{p}_2 = \text{Proportion of Closure in Sample Two (Non Food Sector)} = 40.20\% \text{ (Table 9.16)} = 0.4020 \]
\[ p_0 = \text{Best Estimate (Point Estimate) of proportion of closure in population} \]
\[ = 32.44\% \text{ (Table 9.15)} = 0.3244 \text{ (Generally calculated as } (n_1 \cdot p_1 + n_2 \cdot p_2)/(n_1 + n_2)) \]
\[ q_0 = 1 - p_0 = 1 - 0.3244 = 0.6156 \]
\[ n_1 = \text{Size of Sample One (Food Sector)} = 123 \]
\[ n_2 = \text{Size of Sample Two (Non Food Sector)} = 102 \]

After putting all these values in the equation (21),
\[ z = \frac{0.2602 - 0.4020}{\sqrt{\left( 0.3244 \cdot 0.6156/123 + 0.3244 \cdot 0.6156/102 \right)}} \]
\[ z = -2.26 \text{ (Test Statistic)} \]

10.1.6.5. **Comparison of Test Statistic with Critical Value and Interpretation:**

The critical value/table value for \( z \) is -1.645 (equation 20). The calculated value of test statistic is \( z = -2.26 \) (equation 22). As the alternate hypothesis is one sided (left tailed test) the rejection region for null hypothesis at 5% significance level is given below.

\[ R : z < -1.645 \]

The calculated value of the test statistic (\( z = -2.26 \)) is less than the critical value/table value (\( z = -1.645 \)). This means the calculated value of the test statistic lie in the rejection region. Therefore, there is a statistical evidence to reject the null hypothesis (\( H_0 \)). Hence the null hypothesis (\( H_0 \)) is rejected and alternate hypothesis is accepted (\( H_a \)).

10.1.6.6. **Result of Hypothesis Test:**

The alternate hypothesis (\( H_a \)) is accepted. That means the formulated hypothesis is accepted.

‘The proportion of closure in the food sector is less than that in the non food sector of the Small Scale Agro-Processing Industry in the Ahmednagar district’.
10.1.7. The assistance provided by government organizations has been effective in checking the extent of closure in the Small Scale Agro-Processing Industry in the Ahmednagar district.

The government through its various organizations promotes the small scale agro-processing industry. The assistance provided by government promotional organizations acts as stimulus to the entrepreneurs at the same time checks the extent of closure in the industry. Therefore, the effectiveness of the assistance provided by government proportional organizations is tested on the basis of the check (control) it has kept in extent of closure in the industry.

10.1.7.1. Null and Alternate Hypotheses:

The null and alternate hypotheses are formulated as follows.

- **Null Hypothesis (H₀):** The assistance provided by government organizations and the extent of closure in the Small Scale Agro-Processing Industry in the Ahmednagar District are independent.

- **Alternate Hypothesis (H₁):** The assistance provided by government organizations and the extent of closure in the Small Scale Agro-Processing Industry in the Ahmednagar District are dependent.

That means if the alternate hypothesis (H₁) is accepted then one can conclude that, ‘The assistance provided by government promotional organization has been effective in checking the extent of closure in the Small Scale Agro-Processing Industry in the Ahmednagar district.’

10.1.7.2. Selection of the Type of Test and Sampling Distribution:

In order to test the hypothesis Chi-Square ($\chi^2$) test is used because of the following reasons.

- Here, the effect of one attribute (assistance provided by government promotional organizations) is to be checked on other attribute (extent of closure). That means independence of these two variables is to be checked.

- After considering the nature of two attributes (assistance provided by government promotional organizations and extent of closure) non parametric test is used.

The independence of two variables is to be checked. Since Chi-Square ($\chi^2$) test is used the sampling distribution chosen is of Chi-Square($\chi^2$).
### 10.1.7.3. Selection of Critical Value:

The critical value is the table value of the Standard Variate for a particular significance level. It depends on the following factors.

- **Significance Level (α):** The significance level chosen is 5%. It indicates the Type I (α) error. That means there is a risk of 5% that null hypothesis is rejected when it is true.
- **Degree of Freedom (df):** Since there are only two attributes having two values each the cross table prepared is 2*2. That means there are two rows (r=2) and two columns (c=2). The degree of freedom is calculated as,

\[
d.f. = (c-1) \times (r-1) = (2-1) \times (2-1) = 1 \times 1 = 1
\]

Based on the 5% significance level and the one degree of freedom the critical value for the \(\chi^2\) is found out from the \(\chi^2\) table and it is 0.00393

\[
\chi^2 = 0.00393 \quad \text{(Critical Value/Table Value)} \quad \text{---------------- (23)}
\]

### 10.1.7.4. Computation of Test Statistic:

The test statistic Chi-Square \(\chi^2\) is computed on the basis of sample information using following formula.

\[
\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \quad \text{---------------- (24)}
\]

Where,

\[
\chi^2 = \text{Test Statistic Chi-Square} \\
O_{ij} = \text{Observed frequency of the cell in } i\text{th row and } j\text{th column} \\
E_{ij} = \text{Expected frequency of the cell in } i\text{th row and } j\text{th column}
\]

The cross table of the observed frequencies \((O_{ij})\) is shown below in 2*2 Table 10.4.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Status</th>
<th>Working Enterprises</th>
<th>Close Enterprises</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Government Assistance</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Have Received Government Assistance</td>
<td>83</td>
<td>28</td>
<td>111</td>
</tr>
<tr>
<td>2</td>
<td>Have Not Received Government Assistance</td>
<td>69</td>
<td>45</td>
<td>114</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>152</strong></td>
<td><strong>73</strong></td>
<td><strong>225</strong></td>
</tr>
</tbody>
</table>
Based on the *Observed frequencies* \((O_{ij})\) the *Expected frequencies* \((E_{ij})\) for all the cells are calculated using following formula.

\[
\text{Expected frequency of any cell} = \frac{(\text{Row total for the row of that cell}) \times (\text{Column total for the column of that cell})}{(\text{Grand Total})} \tag{25}
\]

For Example,

\[
E_{11} = \frac{111 \times 152}{225} = 75
\]

The calculated *Expected frequencies* \((E_{ij})\) are shown in Table 10.5 below.

**Table 10.5: Cross Tabulation of Expected Frequencies \((E_{ij})\) for Chi-Square \((\chi^2)\) Test**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Status</th>
<th>Working Enterprises</th>
<th>Close Enterprises</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Government Assistance</td>
<td>1</td>
<td>2</td>
<td>111</td>
</tr>
<tr>
<td>1</td>
<td>Have Received Government Assistance</td>
<td>E_{11} = 75</td>
<td>E_{12} = 36</td>
<td>111</td>
</tr>
<tr>
<td>2</td>
<td>Have Not Received Government Assistance</td>
<td>E_{21} = 77</td>
<td>E_{22} = 37</td>
<td>114</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>152</strong></td>
<td><strong>73</strong></td>
<td><strong>225</strong></td>
</tr>
</tbody>
</table>

The calculation of Chi-Square \((\chi^2)\) is shown in Table 10.6.

**Table 10.6: Calculation of Chi-Square \((\chi^2)\) Value**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Observed Frequencies ((O_{ij}))</th>
<th>Expected Frequencies ((E_{ij}))</th>
<th>((O_{ij} - E_{ij}))</th>
<th>((O_{ij} - E_{ij})^2) / (E_{ij})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have Received Government Assistance and Working Enterprises</td>
<td>83</td>
<td>75</td>
<td>8</td>
<td>64</td>
</tr>
<tr>
<td>Have Received Government Assistance and Close Enterprises</td>
<td>28</td>
<td>36</td>
<td>-8</td>
<td>64</td>
</tr>
<tr>
<td>Have Not Received Government Assistance and Working Enterprises</td>
<td>69</td>
<td>77</td>
<td>-8</td>
<td>64</td>
</tr>
<tr>
<td>Have Not Received Government Assistance and Close Enterprises</td>
<td>45</td>
<td>37</td>
<td>8</td>
<td>64</td>
</tr>
</tbody>
</table>
As per equation 24) the Chi-Square ($\chi^2$) is calculated as follows.

$$\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

Therefore, referring the above Table,

$$\chi^2 = 0.85 + 1.78 + 0.83 + 1.73$$

$$\chi^2 = 5.19$$

\[\text{---------- (25)}\]

10.1.7.5. Comparison of Test Statistic with Critical Value and Interpretation:

The critical value/table value for $\chi^2$ is 0.00393 (equation 23). The calculated value of test statistic is $\chi^2 = 5.19$ (equation 25). The rejection region for null hypothesis at 5% significance level is given below.

$$R : \chi^2 > 0.00393$$

The calculated value of the test statistic ($\chi^2 = 5.19$) is greater than the critical value/table value ($\chi^2 = 0.00393$). This means the calculated value of the test statistic lie in the rejection region. Therefore, there is a statistical evidence to reject the null hypothesis ($H_0$). Hence the null hypothesis ($H_0$) is rejected and alternate hypothesis ($H_a$) is accepted. That means ‘The assistance provided by government organizations and the extent of closure in the Small Scale Agro-Processing Industry in the Ahmednagar District are dependent.’ This means the ‘The assistance provided by government promotional organization has been effective in checking the extent of closure in the Small Scale Agro-Processing Industry in the Ahmednagar District’.

10.1.7.6. Result of Hypothesis Test:

The alternate hypothesis ($H_a$) is accepted. That means the formulated hypothesis is accepted.

‘The assistance provided by government organizations has been effective in checking the extent of closure in the Small Scale Agro-Processing Industry in the Ahmednagar district’. 
10.2. OVERALL PERFORMANCE OF THE SMALL SCALE AGRO-PROCESSING INDUSTRY:

The overall performance of the small scale agro-processing industry is assessed tehsil wise, business sector wise and product category wise. The overall performance is assessed on four parameters namely – share in number of enterprises, extent of closure, share in industry sales and average sales growth rate. Based on these four parameters score sheet is prepared. The rationale behind giving score is as follows.

- If the share in number of enterprises in the industry is more, more is the score.
- If the extent of closure is less, more is the score.
- If the share in industry sales is more, more is the score.
- If the average sales growth rate is more, more is the score.

The ranks are given based on the score to tehsils, sectors and product categories. Further, the tehsils and product categories are classified into three classes viz. A (high performers), B (medium performers) and C (low performers).

10.2.1. Tehsil wise Overall Performance of the Industry:

The Tehsil wise overall performance of the small scale agro-processing industry is assessed and the scores given are based on the following criteria. (Table No. 10.7)

<table>
<thead>
<tr>
<th>Share in No. of Enterprises</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5%</td>
<td>1</td>
</tr>
<tr>
<td>5 – 10%</td>
<td>2</td>
</tr>
<tr>
<td>10 – 15%</td>
<td>3</td>
</tr>
<tr>
<td>15 – 20%</td>
<td>4</td>
</tr>
<tr>
<td>&gt;=20%</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Extent of Closure</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;50%</td>
<td>1</td>
</tr>
<tr>
<td>40% - 50%</td>
<td>2</td>
</tr>
<tr>
<td>30% - 40%</td>
<td>3</td>
</tr>
<tr>
<td>20% - 30%</td>
<td>4</td>
</tr>
<tr>
<td>&lt;=20%</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Share in Industry Sales</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5%</td>
<td>1</td>
</tr>
<tr>
<td>5% - 10%</td>
<td>2</td>
</tr>
<tr>
<td>10% - 15%</td>
<td>3</td>
</tr>
<tr>
<td>15% - 20%</td>
<td>4</td>
</tr>
<tr>
<td>&gt;=20%</td>
<td>5</td>
</tr>
</tbody>
</table>
Table 10.7: TAHASIL WISE OVERALL PERFORMANCE OF THE SMALL SCALE AGRO-PROCESSING INDUSTRY
IN THE AHMEDNAGAR DISTRICT

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Tahasil</th>
<th>Parameter</th>
<th>Share in No. of Enterprises</th>
<th>Extent of Closure</th>
<th>Share in Industry Sales</th>
<th>Average Sales Growth Rate</th>
<th>Overall Score (20)</th>
<th>Rank</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ahmednagar</td>
<td></td>
<td>32.19</td>
<td>5</td>
<td>29.17</td>
<td>11.72</td>
<td>3</td>
<td>15</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td>Rahuri</td>
<td></td>
<td>5.27</td>
<td>2</td>
<td>25.00</td>
<td>12.59</td>
<td>3</td>
<td>11</td>
<td>B</td>
</tr>
<tr>
<td>3</td>
<td>Shrirampur</td>
<td></td>
<td>7.98</td>
<td>2</td>
<td>33.33</td>
<td>8.47</td>
<td>2</td>
<td>9</td>
<td>B</td>
</tr>
<tr>
<td>4</td>
<td>Rahata</td>
<td></td>
<td>3.99</td>
<td>1</td>
<td>22.22</td>
<td>10.46</td>
<td>3</td>
<td>12</td>
<td>A</td>
</tr>
<tr>
<td>5</td>
<td>Akole</td>
<td></td>
<td>2.99</td>
<td>1</td>
<td>57.14</td>
<td>0.16</td>
<td>1</td>
<td>5</td>
<td>C</td>
</tr>
<tr>
<td>6</td>
<td>Sangamner</td>
<td></td>
<td>12.26</td>
<td>3</td>
<td>35.71</td>
<td>5.65</td>
<td>2</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Pathardi</td>
<td></td>
<td>4.13</td>
<td>1</td>
<td>33.33</td>
<td>0.43</td>
<td>1</td>
<td>7</td>
<td>C</td>
</tr>
<tr>
<td>8</td>
<td>Shevgaon</td>
<td></td>
<td>2.99</td>
<td>1</td>
<td>28.57</td>
<td>5.18</td>
<td>2</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Parner</td>
<td></td>
<td>7.69</td>
<td>2</td>
<td>29.41</td>
<td>12.02</td>
<td>3</td>
<td>11</td>
<td>B</td>
</tr>
<tr>
<td>10</td>
<td>Shrigonda</td>
<td></td>
<td>6.27</td>
<td>2</td>
<td>35.71</td>
<td>16.54</td>
<td>4</td>
<td>11</td>
<td>B</td>
</tr>
<tr>
<td>11</td>
<td>Karjat</td>
<td></td>
<td>1.85</td>
<td>1</td>
<td>50.00</td>
<td>8.21</td>
<td>2</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>12</td>
<td>Jamkhed</td>
<td></td>
<td>1.71</td>
<td>1</td>
<td>50.00</td>
<td>0.06</td>
<td>1</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>13</td>
<td>Newasa</td>
<td></td>
<td>5.41</td>
<td>2</td>
<td>25.00</td>
<td>3.93</td>
<td>1</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>14</td>
<td>Kopargaon</td>
<td></td>
<td>5.27</td>
<td>2</td>
<td>41.67</td>
<td>4.58</td>
<td>1</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>100.00</strong></td>
<td><strong>32.44</strong></td>
<td><strong>100.00</strong></td>
<td><strong>11.36</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Marking Scheme: Average Sales Growth Rate

<table>
<thead>
<tr>
<th>Sales Growth Rate</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5 %</td>
<td>1</td>
</tr>
<tr>
<td>5 – 10%</td>
<td>2</td>
</tr>
<tr>
<td>10 – 15%</td>
<td>3</td>
</tr>
<tr>
<td>15 – 20%</td>
<td>4</td>
</tr>
<tr>
<td>&gt;=20%</td>
<td>5</td>
</tr>
</tbody>
</table>

Based on the overall score the ranks are given and the tehsils are classified into three classes as follows.

**Overall Assessment:**

<table>
<thead>
<tr>
<th>Overall Score (20)</th>
<th>Grade/Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;= 12 (&gt;=60%)</td>
<td>A : High Performers</td>
</tr>
<tr>
<td>8 – 12 (40-60%)</td>
<td>B: Medium Performers</td>
</tr>
<tr>
<td>&lt;8 (&lt;40%)</td>
<td>C: Low Performers</td>
</tr>
</tbody>
</table>

**Interpretation:**

- It is found that the overall performance of the small scale agro-processing industry in the four tehsils in the Ahmednagar district namely – Ahmednagar, Sangamner, Rahata and Shevgaon is High i.e. above average.
- The overall performance of the small scale agro-processing industry in the six tehsils in the Ahmednagar district namely – Rahuri, Parner, Shrigonda, Shrirampur, Newasa and Kopargaon is Medium i.e. average.
- The overall performance of the small scale agro-processing industry in the four tehsils in the Ahmednagar district namely – Pathardi, Karjat, Akole and Jamkhed is Low i.e. below average.

**10.2.1. Business Sector wise Overall Performance of the Industry:**

The business sector wise overall performance of the small scale agro-processing industry is assessed and the scores given are based on the following criteria. (Table No.10.8)

Marking Scheme: Share in No. of Enterprises

<table>
<thead>
<tr>
<th>Share in No. of Enterprises</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 40 %</td>
<td>1</td>
</tr>
<tr>
<td>40 – 50%</td>
<td>2</td>
</tr>
<tr>
<td>50 – 60%</td>
<td>3</td>
</tr>
<tr>
<td>60 – 70%</td>
<td>4</td>
</tr>
<tr>
<td>&gt;=70%</td>
<td>5</td>
</tr>
</tbody>
</table>
Table 10.8: BUSINESS SECTOR WISE OVERALL PERFORMANCE OF THE SMALL SCALE AGRO-PROCESSING INDUSTRY IN THE AHMEDNAGAR DISTRICT

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Business Sector</th>
<th>Share in No. of Enterprises</th>
<th>Extent of Closure</th>
<th>Share in Industry Sales</th>
<th>Average Sales Growth Rate</th>
<th>Overall Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parameter</td>
<td>Share (%)</td>
<td>Score (%)</td>
<td>Extent of Closure (%)</td>
<td>Score (%)</td>
<td>Avg. Growth Rate (%)</td>
</tr>
<tr>
<td>1</td>
<td>Food</td>
<td>54.70</td>
<td>3</td>
<td>26.02</td>
<td>4</td>
<td>87.39</td>
</tr>
<tr>
<td>2</td>
<td>Non Food</td>
<td>45.30</td>
<td>2</td>
<td>40.20</td>
<td>2</td>
<td>12.61</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>100.00</strong></td>
<td><strong>32.44</strong></td>
<td><strong>100.00</strong></td>
<td><strong>11.36</strong></td>
<td></td>
</tr>
</tbody>
</table>
Interpretation:
It is found that the overall performance of the food sector of the small scale agro-processing industry in the Ahmednagar district is better than that of the non food sector.

10.2.1. Product Category wise Overall Performance of the Industry:
The product category wise overall performance of the small scale agro-processing industry is assessed and the scores given are based on the following criteria. (Table No.10.9)

Marking Scheme: Share in No. of Enterprises

<table>
<thead>
<tr>
<th>Share in No. of Enterprises</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5 %</td>
<td>1</td>
</tr>
<tr>
<td>5 – 10%</td>
<td>2</td>
</tr>
<tr>
<td>10 – 15%</td>
<td>3</td>
</tr>
<tr>
<td>15 – 20%</td>
<td>4</td>
</tr>
<tr>
<td>&gt;=20%</td>
<td>5</td>
</tr>
</tbody>
</table>
Table 10.9: PRODUCT CATEGORY WISE OVERALL PERFORMANCE OF THE SMALL SCALE AGRO-PROCESSING INDUSTRY IN THE AHMEDNAGAR DISTRICT

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Parameter</th>
<th>Share in No. of Enterprises</th>
<th>Extent of Closure</th>
<th>Share in Industry Sales</th>
<th>Average Sales Growth Rate</th>
<th>Overall Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tahasil Share (%)</td>
<td>Extent of Closure (%)</td>
<td>Share (%)</td>
<td>Extent of Closure (%)</td>
<td>Share (%)</td>
<td>Rank Grade</td>
</tr>
<tr>
<td>1</td>
<td>Processing of Fruits &amp; Veg.</td>
<td>5.41</td>
<td>2</td>
<td>16.67</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>Vegetable Oil</td>
<td>5.84</td>
<td>2</td>
<td>30.77</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Milk &amp; Milk Products</td>
<td>16.52</td>
<td>4</td>
<td>18.92</td>
<td>5</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>Grain Mill Products</td>
<td>2.99</td>
<td>1</td>
<td>42.86</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>Animal Feed</td>
<td>4.84</td>
<td>1</td>
<td>36.36</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>Bakery Products</td>
<td>6.98</td>
<td>2</td>
<td>18.75</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>Confectionary</td>
<td>3.13</td>
<td>1</td>
<td>57.14</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Spices</td>
<td>3.99</td>
<td>1</td>
<td>22.22</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td>Tobacco Related Products</td>
<td>1.85</td>
<td>1</td>
<td>25.00</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>10</td>
<td>Other Food Products</td>
<td>3.13</td>
<td>1</td>
<td>28.57</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>11</td>
<td>Textiles</td>
<td>6.55</td>
<td>2</td>
<td>46.67</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>Wood &amp; Wood Product</td>
<td>24.22</td>
<td>5</td>
<td>37.04</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>13</td>
<td>Paper &amp; Paper Products</td>
<td>9.26</td>
<td>2</td>
<td>47.62</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>14</td>
<td>Ayurvedic Product</td>
<td>3.42</td>
<td>1</td>
<td>25.00</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>15</td>
<td>Essence Sticks</td>
<td>1.85</td>
<td>1</td>
<td>50.00</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>100.0</td>
<td>32.44</td>
<td>100.0</td>
<td>11.36</td>
<td></td>
</tr>
</tbody>
</table>
Based on the overall score the ranks are given and the product categories are classified into three classes as follows.

### Overall Assessment:

<table>
<thead>
<tr>
<th>Overall Score (20)</th>
<th>Grade/Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;= 12 (&gt;=60%)</td>
<td>A: High Performers</td>
</tr>
<tr>
<td>8 – 12 (40-60%)</td>
<td>B: Medium Performers</td>
</tr>
<tr>
<td>&lt;8 (&lt;40%)</td>
<td>C: Low Performers</td>
</tr>
</tbody>
</table>

### Interpretation:

- It is found that the overall performance of the two product categories of the small scale agro-processing industry in the Ahmednagar district namely – ‘Milk and Milk Products’ and ‘Processing of fruits and Vegetables’ is High i.e. above average.
- The overall performance of the four product categories of the small scale agro-processing industry namely – Vegetable Oil’, ‘Confectionary’, ‘Tobacco related Products’ and ‘Essence Sticks’’ is Low i.e. below average.