CHAPTER VI: FINDINGA, HYPOTHESES TESTING AND POLICY IMPERATIVE

Introduction:

There are three sections in this chapter. Section A presents brief findings of the study. Section B deals with hypothesis testing and Section C presents major policy imperatives, based on the study.

Section A

6.1 Findings of the Study:

The following section presents major findings of the study;

- Chapter one was introductory in nature and it has laid-down the foundation for the present study.
- Second chapter was devoted for review of literature and it has been found from the review of literature that most of the previous studies have focused on land utilization, size of farmers, inputs use, crop diversification, productivity, market behaviour of agricultural commodity, export of agricultural commodities and problems in horticultural crops. These studies have also tried to establish linkages between land utilization and productivity, size of farmers and production, inputs use and productivity, market arrivals and price behaviour, technological factors and crops diversification.
- Land use pattern has been analysed in chapter three.
- It has been found from the study that the area of horticulture has been significantly increased when compared to the net area sown both in India as well as in Karnataka.
- The net area sown has been increased in Karnataka significantly higher than India and the horticulture area has been increased in India significantly higher than Karnataka.
- The ratio of horticultural area to net area sown is more in Karnataka compare to India.
- It has been found from the study that vegetable and plantation crops have occupied major share in horticulture land compared to land used for other horticulture crops.
Hence, horticulture has becoming a major alternative to agriculture in India and it is a most promising alternative to agriculture in Karnataka.

Market behaviour of vegetables have been analysed in the fourth chapter.

Market arrivals and prices of selected vegetable crops such as cabbage, cauliflower and tomato in selected markets namely Bangalore, Chennai, Delhi, Kolkata and Mumbai and it has been found that the all the variables have found stationary at levels data for integrated of the order zero.

The study has found that the arrival of cabbage significantly high in Kolkata and Mumbai market compared to Bangalore market.

There were no significant differences among the markets except Kolkata where the price was significantly higher than all markets.

Arrivals of cauliflower was significantly high in Chennai, Delhi and Mumbai market compared to Bangalore.

Whereas price of cauliflower was high in Delhi and Mumbai markets compared to Bangalore market.

Arrival of tomato was found significantly high in Chennai, Delhi and Mumbai market.

Whereas not much difference in price except Mumbai compared to Bangalore market.

It has found from the study that arrival of cabbage cause the price in Bangalore and Chennai market.

Whereas price of cabbage cause arrival in Kolkata.

Interestingly, no market relation were found for cabbage in Delhi and Mumbai market.

The arrival of cauliflower cause price in Bangalore and Chennai market, there were no market relations found in Delhi, Kolkata and Mumbai.

The arrival of tomato cause price in Bangalore Chennai and Kolkata, whereas price cause in arrival in Delhi market.

There were no market relations for tomato were found in Mumbai market. The study attempted to test the Marshalien principles of market.

It has been found that supply determines the price of cabbage only in Bangalore market, which is against to the Marshal principles.

In Kolkata, the price of cabbage negatively influence the supply of cabbage which against to the Marshalien law.
No market relation and principles found for cauliflower. Only in Bangalore market, the supply of tomato determines the price of tomato.

Therefore, Indian vegetable markets not really functioning in order to derives the benefits neither consumer nor farmers.

The present chapter examined the cost, benefits and problems of vegetables growing. It was also analysed the perception of farmers about growing and marketing of vegetables.

It has been found from the study that no significant difference found in cost of growing vegetables based on districts and age of farmers.

In most of the cases the cost of growing vegetables was found more for farmers completed school education.

Drip irrigation, small and medium farmers had have cost advantages in growing vegetables. The cost advantages for also found for large scale vegetable growing farmers. Meantime, cost various based on type of crops.

Therefore, large farmers with drip irrigation facilities have better cost advantages in growing vegetables.

However, income and profit found relatively high for small farmers. Therefore, small farmers can grow cauliflower and ridge gourd to make maximum profit.

The majority of the farmers have problems in irrigation, fertilizer, electricity, availing loan, use of new technologies and their implements, transportation of vegetables, availing market information and price.

Commission agents were found as controller of vegetable arrivals, price and others. Farmers were always in the mercy of these commission agents.

It has been found from the study that all vegetable growing farmers not facing the problem in purchasing plant or seed.

All vegetable growing farmers facing the problem of labour for cultivation.

Accordingly, growing vegetable has been found profitable as well as risk with uncertainty.
Section B

6.2 Hypotheses Testing:

In the following section an attempt has made to test the hypotheses constructed in the formation of research work;

Hypothesis No. 1:

Hₐ: Area of horticulture has not been significantly increased in India.

H₁: Area of horticulture has been significantly increased in India.

Comparison of Growth Rates in India between NAS and HGA

<table>
<thead>
<tr>
<th>Description</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Area Sown</td>
<td>19</td>
<td>.0316</td>
<td>2.23558</td>
<td>.51288</td>
</tr>
<tr>
<td>Horticulture Grown Area</td>
<td>19</td>
<td>2.9789</td>
<td>5.46479</td>
<td>1.25371</td>
</tr>
</tbody>
</table>

Independent Samples Test

<table>
<thead>
<tr>
<th>Description</th>
<th>Levene's Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig.</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>3.716</td>
<td>.062</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-2.176</td>
<td>.040</td>
</tr>
</tbody>
</table>
The above table shows that the average annual growth rate of net area sown in India was 0.0316 and the average annual growth rate of horticulture grown area was 2.9789. The difference between the two is -2.94737. It is found from F-test that the variance between the two groups is not significant. Therefore, equal variance was assumed. It is found from the t-test that the mean difference between groups is significant at 5 percent level. Therefore, the area of horticulture grown has been increased significantly higher than the growth of the net area sown in India. Accordingly, the null hypothesis is rejected and alternative hypothesis is accepted. Hence, Area of horticulture has been significantly increased in India.

**Hypothesis No. 2:**

**H₀:** The use of land for vegetable crops is not significantly high compared to other horticulture crops.

**H₁:** The use of land for vegetable crops is significantly high compared to other horticulture crops.

**Land Use for Horticultural Crops in India**

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Duncan</th>
<th>Subset for alpha = 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Nuts</td>
<td>20</td>
<td>.0674</td>
<td></td>
</tr>
<tr>
<td>Flowers</td>
<td>20</td>
<td>.0986</td>
<td></td>
</tr>
<tr>
<td>Aromatic and Medicinal Plants</td>
<td>20</td>
<td>.1284</td>
<td></td>
</tr>
<tr>
<td>Spices</td>
<td>20</td>
<td>2.7221</td>
<td></td>
</tr>
<tr>
<td>Plantation Crops</td>
<td>20</td>
<td>2.9330</td>
<td></td>
</tr>
<tr>
<td>Fruits</td>
<td>20</td>
<td>4.3806</td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>20</td>
<td>6.3748</td>
<td></td>
</tr>
<tr>
<td>Sig.</td>
<td></td>
<td>.791</td>
<td>.327</td>
</tr>
</tbody>
</table>

Means for groups in homogeneous subsets are displayed.
It has been found from the Duncan test that in India, the use of land for vegetable crops was significantly higher than all other horticultural crops. The use of land for fruits was significantly lower than vegetables, however, significantly higher than all other horticultural crops. There is no significant difference in use of land between spices and plantation crops, however, the average use of land for spices and plantation crops was significantly lower than fruits and vegetables, meantime, significantly higher than nuts, flowers and aromatic and medicinal plants. It is also found from the test that there is no significant difference in use of land among Nuts, flowers and aromatic and medicinal plants. Accordingly, the null hypothesis is rejected and alternative hypothesis is accepted. Hence, the use of land for vegetable crops was significantly high compared to other horticultural crops.

**Hypothesis No. 3:**

$H_0$: Arrivals of Cauliflower is not significantly low in Bangalore compared to all other Indian vegetable markets.

$H_1$: Arrivals of Cauliflower is significantly low in Bangalore compared to all other Indian vegetable markets.

The dummy variables ANOVA regression model with four dummies was constructed to find significant difference in average arrival of cauliflower. Even though, there were five markets, four dummies (N - 1) were used in order to avoid the dummy variable trap. The Bangalore was considered as benchmark for the analysis.

$$CF_A = \beta_0 + \beta_1D_1 + \beta_2D_2 + \beta_3D_3 + \beta_4D_4 + e$$

Where $CF_A =$ Arrivals of Cauliflower

$\beta_0 =$ Value of bench mark

$\beta_1 =$ Difference between bench mark and Chennai

$\beta_2 =$ Difference between bench mark and Delhi

$\beta_3 =$ Difference between bench mark and Kolkata

$\beta_4 =$ Difference between bench mark and Mumbai
\[ D_1 = \text{One if Chennai, zero is not Chennai} \]
\[ D_2 = \text{One if Delhi, zero is not Delhi} \]
\[ D_3 = \text{One if Kolkata, zero is not Kolkata} \]
\[ D_4 = \text{One if Mumbai, zero is not Mumbai} \]

\[ C_{FA} = 934.692 + 293.365D_1 + 787.317D_2 + 257.683D_3 + 305.096D_4 \]

\[ t : \begin{array}{ccccc}
10.015 & 2.223 & 5.965 & 1.952 & 2.312 \\
\end{array}
\]

\[ \text{Sig.: } 0.000 \quad 0.027 \quad 0.000 \quad 0.051 \quad 0.021 \]

\[ F = 9.335, \quad \text{Sig.: 0.000} \]

In the above equation, Bangalore market was considered as benchmark and the average arrivals of cauliflower in Bangalore market was 934 MT per month. \( \beta_1 \) explains the difference between benchmark and arrivals in Chennai and it was 293 MT per month and this difference is statistically significant. Therefore, the average arrivals of cauliflower in Chennai was significantly higher than Bangalore market. \( \beta_2 \) explains the difference between benchmark and arrivals in Delhi and it was 787 MT per month and this difference is statistically significant. Therefore, the average arrivals of cauliflower in Delhi was significantly higher than Bangalore market. \( \beta_3 \) explains the difference between benchmark and arrivals in Kolkata and it was 257 MT per month. However, this difference is not statistically significant. Therefore, the average arrivals of cauliflower in Kolkata was significantly higher than Bangalore market. \( \beta_4 \) explains the difference between benchmark and arrivals in Mumbai and it was 305 MT per month and this difference is statistically significant. Therefore, the average arrivals of cauliflower in Mumbai was significantly higher than Bangalore market. Accordingly, the null hypothesis is rejected and alternative hypothesis is accepted. Hence, Arrivals of Cauliflower is significantly low in Bangalore compared to all other Indian vegetable markets.
Hypothesis No. 4:

$H_0$: Price of Cauliflower is not significantly low in Bangalore compared to all other Indian vegetable markets.

$H_1$: Price of Cauliflower is significantly low in Bangalore compared to all other Indian vegetable markets.

The dummy variables ANOVA regression model with four dummies was constructed to find significant difference in average price of cauliflower. Even though, there were five markets, four dummies (N - 1) were used in order to avoid the dummy variable trap. The Bangalore was considered as benchmark for the analysis.

$$CF_p = \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + e$$

Where $CF_p =$ Price of Cauliflower

$\beta_0 =$ Value of benchmark

$\beta_1 =$ Difference between benchmark and Chennai

$\beta_2 =$ Difference between benchmark and Delhi

$\beta_3 =$ Difference between benchmark and Kolkata

$\beta_4 =$ Difference between benchmark and Mumbai

$D_1 =$ One if Chennai, zero is not Chennai

$D_2 =$ One if Delhi, zero is not Delhi

$D_3 =$ One if Kolkata, zero is not Kolkata

$D_4 =$ One if Mumbai, zero is not Mumbai

$$CF_p = 908.644 + 970.173D_1 + 2155.288D_2 + 952.587D_3 + 6034.202D_4$$

$t$ : (2.484) (1.875) (4.166) (1.841) (11.664)

$\text{Sig.}$ : (0.013) (0.061) (0.000) (0.066) (0.000)

$F = 41.952$, $\text{Sig.}: 0.000$
In the above equation, Bangalore market was considered as bench mark and the average price of cauliflower in Bangalore market was Rs. 908 per quintal. $\beta_1$ explains the difference between bench mark and price in Chennai and Rs. 970 per quintal. However, this difference is not statistically significant. Therefore, the average price of cauliflower in Chennai was significantly higher than Bangalore market. $\beta_2$ explains the difference between bench mark and price in Delhi and it was Rs. 2155 per quintal and this difference is statistically significant. Therefore, the average price of cauliflower in Delhi was significantly higher than Bangalore market. $\beta_3$ explains the difference between bench mark and price in Kolkata and it was Rs. 952 per quintal. However, this difference is not statistically significant. Therefore, the average price of cauliflower in Kolkata was significantly higher than Bangalore market. $\beta_4$ explains the difference between bench mark and price in Mumbai and it was Rs. 6034 per quintal and this difference is statistically significant. Therefore, the average price of cauliflower in Mumbai was significantly higher than Bangalore market. Accordingly, the null hypothesis is rejected and alternative hypothesis is accepted. Hence, price of Cauliflower is significantly low in Bangalore compared to all other Indian vegetable markets.

**Hypothesis No. 5:**

$H_0$: Arrival does not significantly causes price of cabbage in Bangalore market.

$H_1$: Arrival does significantly causes price of cabbage in Bangalore market.

The Granger Causality Test has been conducted to find whether price could cause arrival or arrival could cause price of cabbage in Bangalore market.

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Obs.</th>
<th>F-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAB does not Granger Cause CPB</td>
<td>115</td>
<td>4.82446</td>
<td>0.0034</td>
</tr>
<tr>
<td>CPB does not Granger Cause CAB</td>
<td>1.10580</td>
<td>0.3501</td>
<td></td>
</tr>
</tbody>
</table>

The Granger Causality Test has been identified the causation of the arrival on price of cabbage in Bangalore market at three lags. Therefore, arrival significantly causes price at five percent level. Accordingly, the null hypothesis is rejected and alternative hypothesis is accepted. Hence, current year price has been determined by last three months arrival of Cabbage in Bangalore market.
Hypothesis No. 6:

**H₀**: Price does not significantly causes arrival of cabbage in Kolkata market.

**H₁**: Price was significantly causes arrival of cabbage in Kolkata market.

The Granger Causality Test has been conducted to find whether price could cause arrival or arrival could cause price of cabbage in Kolkata market.

<table>
<thead>
<tr>
<th>Null Hypothesis:</th>
<th>Obs.</th>
<th>F-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAK does not Granger Cause CPK</td>
<td>115</td>
<td>1.04152</td>
<td>0.3773</td>
</tr>
<tr>
<td>CPK does not Granger Cause CAK</td>
<td></td>
<td>3.20271</td>
<td>0.0262</td>
</tr>
</tbody>
</table>

The Granger Causality Test has been identified the causation of the price on arrival of cabbage in Kolkata market at three lags. Therefore, price significantly causes arrival at five percent level. Accordingly, the null hypothesis is rejected and alternative hypothesis is accepted. Hence, price was significantly causes arrival of cabbage in Kolkata market.

Hypothesis No. 7:

**H₀**: The cost of production of cucumber is not lower than other vegetable crops.

**H₁**: The cost of production of cucumber is lower than other vegetable crops.

**Types of Crops and Cost of Production**

<table>
<thead>
<tr>
<th>Types of Crop</th>
<th>N</th>
<th>Duncan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Subset for alpha = 0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Cucumber</td>
<td>40</td>
<td>50824.15</td>
</tr>
<tr>
<td>Ridge Gourd</td>
<td>40</td>
<td>60939.88 60939.88</td>
</tr>
<tr>
<td>Ladies Finger</td>
<td>40</td>
<td>71077.38 71077.38 71077.38</td>
</tr>
<tr>
<td>Beans</td>
<td>40</td>
<td>78132.52 78132.52</td>
</tr>
<tr>
<td>Tomato</td>
<td>40</td>
<td>80294.25 80294.25</td>
</tr>
<tr>
<td>Cabbage</td>
<td>40</td>
<td>85103.02</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>40</td>
<td>85255.58</td>
</tr>
<tr>
<td>Sig.</td>
<td></td>
<td>.073   .099  .244</td>
</tr>
</tbody>
</table>

Means for groups in homogeneous subsets are displayed.
It has been found from the ANOVA that one of the crops is significantly different from other crops in terms of cost of production. However, which crops is significantly different from other crops was not found from ANOVA test. Hence, the multiple comparison Duncan test has been conducted to find the significant difference among the crops in terms of cost of production. It has been found from the Duncan test that, there is no significant difference among cauliflower, cabbage, tomato, beans and ladies finger in terms of cost of production. There is no significant difference in terms of cost of production among ridge gourd, ladies finger, beans and tomato. However, there is significant difference in terms of cost of production of ridge gourd was significantly lower than cabbage and cauliflower. There is no significant difference in terms of cost of production among cucumber, ridge gourd and ladies finger. However, there is significant difference in terms of cost of production and the cost of cucumber was significantly lower than beans, tomato, cabbage and cauliflower. Accordingly, the null hypothesis is rejected and alternative hypothesis is accepted. Therefore, the cost of production has been low in growing cucumber.

**Hypothesis No. 8:**

**H₀:** Net productivity of ridge gourd is not higher than other vegetable crops.

**H₁:** Net productivity of ridge gourd is higher than other vegetable crops.

### Types of Crops and Net Productivity

<table>
<thead>
<tr>
<th>Crops</th>
<th>N</th>
<th>Subset for alpha = 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Tomato</td>
<td>40</td>
<td>20323.997500</td>
</tr>
<tr>
<td>Cucumber</td>
<td>40</td>
<td>24796.500000</td>
</tr>
<tr>
<td>Beans</td>
<td>40</td>
<td>41541.950000</td>
</tr>
<tr>
<td>Cabbage</td>
<td>40</td>
<td>44846.077500</td>
</tr>
<tr>
<td>Ladies Finger</td>
<td>40</td>
<td>48663.500000</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Ridge Gourd</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Sig.</td>
<td></td>
<td>.303</td>
</tr>
</tbody>
</table>

Means for groups in homogeneous subsets are displayed.
It has been found from the ANOVA that one of the crops is significantly differ from other crops in terms of net productivity. However, which crops is significantly differ from other crops was not found from ANOVA test. Hence, the multiple comparison Duncan test has been conducted to find the significant difference among the crops in terms of net productivity. It has been found from the Duncan test that, there is no significant difference between cauliflower and ridge gourd in terms of net productivity. There is no significant difference in terms of net productivity between ladies finger and cauliflower. However, significantly lower than ridge gourd, meantime, significantly higher than other vegetable crops. There is no significant difference in terms of net productivity among beans, cabbage and ladies finger. However, net productivity of tomato and cucumber, significantly lower than other vegetable crops. There is no significant difference in terms of net productivity between tomato and cucumber, however, significantly lower than other vegetable crops. Accordingly, the null hypothesis is rejected and alternative hypothesis is accepted. Therefore, the net productivity is more in growing ridge gourd.
Section C

6.3 Policy Imperatives of the Study:

The following section presents major policy imperatives of the study;

- The study identified the increasing trends in land utilization for horticultural crops. Within the horticulture crops, vegetables occupies the major share. The vegetable crops are perishable commodities and have short period markets. Hence, there is a need of separate policy and programmes to protect the interest of vegetable growers.

- The study identified that the Indian vegetable markets are highly disintegrated. As a matter of fact, there has been wide and significant difference in arrival of vegetables as well as price of vegetables. Therefore, the Indian vegetable market not really functioning in order to derive the benefits to neither growers nor consumers. Hence, it is the responsibility of the Indian government to integrated vegetable markets in order to regulate the supply and demand behaviour to ensure stabilized price and granted returns to vegetable growers.

- The study identified that the growing of cucumber, ladies finger and ridge gourd have cost advantages. Therefore, the farmers can grow these commodities to realize the cost advantages.

- The study also identified that the cauliflower and ridge gourd have given higher returns to farmers. Therefore, the farmers can grow cauliflower and ridge gourd to make maximum profit. However, it is safe to grow ridge gourd since it has got both cost advantages and revenue advantages.

- It has been identified by the focus group discussion that the vegetable markets are not free from the middlemen’s and commission agents. These middlemen’s and commission agents really control the arrival of vegetables and played dominate role in fixing the price of vegetables. As a matter of fact the vegetable growers have to be under the mercy of these commission agents for supply of vegetables, fixation of price and even to receive the money for their sales. Therefore, government and the respective authorities have to take necessary action to remove this middlemen and commission agents from the vegetable marketing system. In order to protect the interest of farmers and for the perfect functioning of vegetable markets.
It has been identified from the group discussion that the vegetable markets are suffering from lack of infrastructure facilities. These markets have not facilitate accommodation, storage facilities, sanitation facilities, particularly for women, which has restricted to enter of women in vegetable markets. Therefore, these facilities have to be given to encourage women vegetable growers to participate in vegetable market.

6.4 Conclusion:

The present study examined and analyzed the land use patterns, market behaviour of vegetables, cost and benefits of growing of vegetables and also problems associated in growing and marketing of vegetables. Horticulture has been found as a prominent income earning activity as an effective supporting alternative to traditional agriculture. Within the horticulture crops, vegetables have larger scope and wider practical implications. Growing vegetable is handy and even small farmers can grow vegetables to have better income. By removing the hurdles in the vegetable marketing system, growing of vegetables can be made profitable.