CHAPTER I

INTRODUCTION, METHODOLOGY AND DESIGN OF STUDY

Tea is one of the most popular beverages in the world. It is one of the oldest industries in India, a large organized sector and has been an integral part of the economic development of the country. India has the second largest area under tea after China and is also the largest producer, consumer and third largest exporter of tea in the world at present. It was the largest exporter of tea for a long time till recently. In 2002, India's production was 826.17 million kg with an area under tea of 511,940 ha out of which 201.00 million kg was exported valued at Rs. 1753.39 crores and 625.17 million kg was retained for domestic consumption. Assam is famous all over the world for tea. The name ‘Assam’ is synonymous to the best quality tea in the world for people outside the state. Assam produced 432.51 million kg of tea in 2002 in an area under tea of 270,163 ha which were 52.35 per cent of total production and 52.77 per cent of total area under Indian tea respectively. Since its beginning about more than one hundred and seventy years back, tea industry is a part of Assam’s way of life with major contribution in socio-economic sphere of the state. It is popularly called as ‘tea—the green gold’ and ‘Pride of Assam’. In fact, an analysis of tea in Assam depicts the socio-economic development of the state of Assam.

1.1 Origin of tea in Assam

Tea originated in China and it became popular as a beverage in many European countries, particularly in the United Kingdom. The East India Company traded in tea and imported huge quantities to London for internal consumption in 17th and 18th century. The East India Company had to depend entirely on China for its supply of tea. But problems arose in trade with it in the beginning of 19th century and thus, search for new source of tea started.
Map 1: Tea growing regions and auction centres of India
Tea plants (*Camellia sinensis* (L) O.Kuntze, Family: Theaceae) were discovered in Assam way back in 1823. The indigenous people of Assam were drinking tea for its medicinal properties. The credit for discovery of tea in Assam goes to three persons—Beesa Gam, a tribal head of Upper Assam Village, an Assamese working with the British, the famous patriot Maniram Dewan and Robert Bruce, an English infantry officer. However, there still exists some controversy about the discoverers of tea in Assam. The discovery of tea in Assam is discussed in details in Chapter III of the thesis. Mr. Robert Bruce is widely recognized as the discoverer of tea in Assam. However, the tea plants did not get recognition as indigenous tea plant till 1834. Originally, tea seeds brought from China were tried in Assam for cultivation. But tea plants were found to be growing wildly in Assam and the tea made from them were found to be quite good. Till that time, China was the sole tea manufacturing country in the World and the need of exporting tea from other countries and finding new areas arose when the East India Company’s trade monopoly with her ended in 1833. The Company turned its attention to find an alternative source for its supply of tea.

In the years that followed, tea growing wild in Assam got recognition as real tea plant and the British extensively cultivated tea in the virgin tracts of Assam. With such a beginning, Assam tea has grown enormously in area and production over the years to emerge as the World’s best subsequently.

### 1.2 Development of tea industry of Assam—production, productivity and tea labour

The tea industry of Assam had major changes since independence. First, changes in ownership pattern took place over the years. Secondly, area and production of tea had increased considerably during the last fifty five years mainly due to improvement of tea cultivation practices and technological developments. In 1947, India produced 254.80 million kg of tea in an area under tea of 309,959 ha. Assam produced 150.37 million kg (52.69 per cent) in 155,674 ha area under tea in 1951 (figures for 1947 not available). The tea industry of Assam had registered very
Map 2: Tea growing areas of Assam
Fig. 1: Share of Assam tea to all India area (1951-2002)

Fig. 2: Share of Assam tea to all India production (1951-2002)

Fig. 3: Comparison of Assam yield to all India (1951-2002)
significant growth over the years. The increase in area and production in 2002 for Assam tea during last fifty one years i.e. over 1951 were 73.54 per cent and 187.63 per cent respectively. The productivity (kg made tea per ha) has increased from 966 in 1951 to 1,601 in 2002, an increase of 65.74 per cent. The total area under tea, production and productivity for all India level also increased from 316,870 ha, 285.40 million kg and 901 kg/ha in 1951 to 511,940 ha, 826.17 million kg and 1,614 kg/ha in 2002, increases of 61.56 per cent, 189.48 per cent and 79.13 per cent respectively (Table 1). Assam used to produce one fourth of World tea till recently and at present (2002) accounts for 13.96 per cent of world production of 3099.29 million kg. At present, due to global competition from other tea producing countries and resultant fall in exports, quality is turning out to be the most vital factor.
Table 1: Production, area under tea and productivity of tea in Assam and India (1951-2002)

| Year | All India | | Assam |
|------|-----------||----------|
|      | Area (ha) | Production (m kg) | Yield (kg/ha) | Area (ha) | Production (m kg) | Yield (kg/ha) |
| 1951 | 316,870   | 285.40              | 901            | 155,674   | 150.37              | 966         |
|      |           | (49.13)              |                |           | (52.69)              |             |
| 1960 | 330,738   | 321.08              | 971            | 162,367   | 157.50              | 970         |
|      |           | (49.09)              |                |           | (49.05)              |             |
| 1970 | 354,133   | 418.52              | 1,182          | 180,065   | 215.16              | 1,195       |
|      |           | (50.85)              |                |           | (51.41)              |             |
| 1980 | 381,086   | 569.17              | 1,474          | 200,569   | 300.70*             | 1,499       |
|      |           | (52.63)              |                |           | (52.83)              |             |
| 1990 | 416,269   | 720.34              | 1,731          | 230,363   | 388.18              | 1,643       |
|      |           | (55.34)              |                |           | (53.89)              |             |
| 1995 | 427,065   | 756.02              | 1,770          | 226,280   | 402.62              | 1,779       |
|      |           | (52.98)              |                |           | (53.26)              |             |
| 2000 | 504,366   | 846.92              | 1,679          | 266,512   | 449.22              | 1,686       |
|      |           | (52.84)              |                |           | (53.04)              |             |
| 2001 | 509,770   | 853.92              | 1,675          | 268,983   | 453.94              | 1,688       |
|      |           | (52.77)              |                |           | (53.16)              |             |
| 2002 | 511,940   | 826.17              | 1,614          | 270,163   | 432.51              | 1,601       |
|      |           | (52.77)              |                |           | (52.35)              |             |

(Figures in parentheses indicate percentage to all India)

Source: Tea Statistics, Tea Board, Kolkata.

It is seen from Table 1 that Assam is maintaining about 52 per cent share of all India production and area under tea since 1951.

The tea labours of Assam originally brought by the British from various parts of India viz. Bihar, Orissa, Madhya Pradesh etc. at the time of starting tea plantation.
about 150 years back are the vital human resources of this labour intensive industry. The industry of Assam employed a total of around six lakh labours and more than six and half lakh people were bonafide dependents of resident workers alone (2000). An unique feature of the tea industry is that about half of the labour force constitute of women. About 20 lakh people of Assam are estimated to be directly or indirectly dependent on tea industry.

Analysis of the growth in area, production and productivity aspects of the tea industry of Assam and employment of labours are presented in Chapter IV and V respectively.

1.3 Marketing of Assam tea and Guwahati Tea Auction Centre

Marketing of tea is done through various modes, the most important among them being time-tested auction system. The Guwahati Tea Auction Centre of Assam established in September, 1970 is the largest Indian tea auction center. Beginning with a modest sale of 9.098 million kg of tea at an average price of Rs. 5.68 per kg in 1970-71, it has registered a stupendous growth over the years and sold 140.96 million kg of tea in 2001-02 at an average price of Rs. 63.17. It not only caters to the need of the tea industry of Assam, but also to the tea industry of the North-Eastern States and earlier to North Bengal. However, there are now developments in marketing system of tea and the modes of sale of tea by the tea estates is undergoing changes in the recent years. A detailed analysis of marketing of Assam tea with special reference to Guwahati Tea Auction Centre has been made in Chapter VII.

1.4 Tea Quality

Assam tea is most sought after internally in India and all over the world for its rich, strong liquoring quality characteristics. Since the initiation of tea cultivation in Assam, it is producing unique quality tea due to its agro-climatic factors, planting materials, field management practices and technological developments. Bulk of
export of Indian tea comes from Assam and the unique quality of second flush of Assam is beyond comparison in the whole World. The findings on these aspects of tea quality are presented in Chapter VI.

1.5 Contribution of tea industry to the economy of Assam

Tea is not only the most important cash crop, major source of revenue and employment, but also the most important industry of Assam. The annual production of Assam tea of 453.94 million kg and average auction price of Rs. 71.00 per kg (private and other sales excluded) in the year 2001 implied that the annual turnover of the tea industry and the tea trade as a whole in Assam was about Rs. 3223 crores. Similarly, it was about 2,800 crores in the year 2002.

The Government of Assam collects revenues from the tea industry of Assam through taxes collected under The Agricultural Income Tax Act, The Assam General Sales Tax Act, The Central Sales Tax Act and the Assam Taxation (on specified Land Act), 1990. The total amount of tax collected from the tea sector in 1999-2000 was Rs. 122.48 crores which constituted 13% of the total tax collection of the state. The Guwahati Tea Auction Centre contributed a large sum of money to the State Government's coffer by sales tax collected on sale of tea in the auction center. A large amount of revenue also comes from other ancillary industries to the state's exchequer. However, it has come down drastically during 2000-01 to 2003-04 due to sharp fall in tea prices, which is a matter of great concern to Government of Assam.

Many other ancillary industries like coal, fuel, construction, fertilizer and other agrochemicals are dependent on tea industry to a great extent. The tea industry also had immensely contributed in growth of the infrastructure sector of the state. The Chapter VIII has an in-depth analysis of contribution of tea industry to the economy of Assam.

1.5.1 Small tea growers of Assam

The advent of a large number of small tea growers in the recent years is a very significant development in the tea industry and socio-economy of Assam. The latest statistic published by the Directorate of Tea, Government of Assam puts the estimate of such small tea growers in Assam at 28,585 cultivating tea in an area of 27,878 ha producing 257.6 million kg green leaf in 2000-01. The small tea growers had employed 5,139 staffs and 103,308 labours in the small gardens. The green leaves are purchased by big tea estates having factories nearby and a total of 135 bought leaf tea factories had come up to cater to the produce of these growers till that period. The concept of tea gardens in small scale (According to Tea Board, a person or group having 10.12 ha of area under tea is treated as small grower) tea garden is rather a new phenomenon in Assam. As per the records available, the first commercial small tea garden was established in Golaghat District in 1978. Tea cultivation in small holdings is providing employment to large number of unemployed youths, generating additional earning of farmers, contributing large quantities to the state’s total production and thereby, helping the state’s economy. These small tea growers are gradually getting organized.

In 2002, there were 138 bought leaf factories in Assam to cater to the need of the small tea growers producing 46.82 million kg of tea.

1.6 Review of literature

Review of literature is a major ingredient of research work on which the researcher has to rely to understand and analyze the subject of research. A large number of literatures were reviewed for the purpose of the study from books on tea, research papers from journals and newspaper articles and reports and from proceedings of different seminars. The review was confined to the areas concerning the objectives of the study and are presented under different sub heads viz. production and productivity, marketing, economic importance, tea quality, tea labours, impact on socio-economic life of Assam etc. An exhaustive review of literature has been covered in Chapter II.

1.7 Objectives

The general objective of the study is to analyse the growth and development of the tea industry of Assam with the aim to assess the scope for overall development of the tea industry of Assam.

The specific objectives of the study are as follows:

i) to study the growth of the tea industry of Assam with respect to area, production and productivity of tea;
ii) to analyse the employment and productivity of labours of tea industry Assam;
iii) to study the marketing of Assam tea and problems associated with it;
iv) to study the agro-climatic factors and field management practices affecting production of quality tea in Assam;
v) to ascertain the quantum of revenue earned by Government of Assam, employment generation and overall contribution of the tea industry to the economy of Assam;
vii) to study the problems and prospects of tea industry of Assam; and
viii) to suggest measures for development of tea industry of Assam.
1.8 Period of study

The study is a broad based one covering the period since discovery of tea in Assam to 2002. However, the analytical study is confined to 32 year period of 1970-2002. The complete data for 2002 on all aspects of the study were not available.

1.9 Need of the study

The study aims to analyse the growth and development parameters of the important tea industry of Assam which are very useful for all sectors of the economy of the state in particular and of the country in general. The study on problems and prospects of tea industry of Assam aims to help in policy decisions and planning of the tea industry to enhance its efficiency and performance. The study on marketing of Assam tea helps to evolve policies on marketing development to meet the challenges of the future. The in-depth analysis of contribution of the tea industry to the economy of Assam brings out vital spheres of the economy of the state as tea industry is a major contributor to the state’s exchequer. Quality is the most important parameter of Assam tea. The analysis of agro-climatic factors and field management practices responsible for quality gives vital direction to the tea industry in its pursuit of quality.

In fact, the findings of this detailed analytical study is aimed to give direction in planning of Indian tea industry as a whole, predict and understand the future trends on the basis of the past performance and also to help to formulate measures to develop the tea industry in a systematic way for overall development of the state of Assam.
1.10 Hypotheses

It is proposed to test the following hypotheses.

i) The tea industry of Assam is growing satisfactorily in area, production and productivity.

ii) Growth of labour employment and productivity of the tea industry of Assam is satisfactory.

iii) Agro-climatic factors and field management practices are vital for production of quality tea.

iv) The Guwahati Tea Auction Centre is efficiently selling tea of Assam and the country.

v) Tea industry contributes significantly to economic development of Assam.

1.11 Methodology

The choice of sampling design and the tools of analysis were determined based on the specific objectives of the study, hypotheses and the characteristics of the universe of the study.

Both primary and secondary data were collected for analysis of the specific objectives. Primary data were collected by mostly direct contact method and the prepared questionnaires were also sent by post for that purpose.

The primary data collected were used for analysing the problems, prospects and challenges before the tea industry of Assam and to study the agro-climatic factors and field management practices responsible for production of quality tea in Assam, marketing of Assam tea etc. The secondary data were used for analysing growth in area, production, productivity of tea, marketing of tea etc.
The data collection was carried out as follows.

i) Time series data on area, production, productivity and sale of tea etc. (1947-2001-02) were collected from statistics of Tea Board, J. Thomas & Co. Pvt. Ltd., International Tea Committee and Directorate of Tea, Assam; and particularly on sale of tea through Guwahati Tea Auction Centre from its Statistics Cell.

ii) Primary data collected from sample tea estates of Assam for ten years (1990-2000-01) on problems and prospects, agro-climatic conditions and field management practices determining production of quality tea, marketing of tea etc. with the help of schedules through structured interviews and also by mailing of questionnaires.

iii) Primary data collected from sample participants of Guwahati Tea Auction Centre for ten years (1991-2000-01) using questionnaires.

iv) Information collected from libraries and interviews with Tea Board, Indian Tea Association, Tea Association of India, Tea Research Association, tea labour unions etc. on different aspects of Assam tea industry.

For period of 1970 to 1980, it was found that there existed difference between the data available from the two sources of India for the same reference period. Though Tea Board was the official body for maintaining statistics, the statistics of J. Thomas & Co. Pvt. Ltd. was acceptable to the persons involved in tea trade. Thus, it required special efforts to collect all the data required for the study. However, the main source was the Tea Board Statistics.

1.12 Sampling design / Design of study

Simple sampling design was used for the study due to the nature of universe. The study was confined to two tea districts of Assam i.e. Cachar and Dibrugarh out of the ten tea districts viz. Darrang, Goalpara, Kamrup, Lakhimpur, Dibrugarh, Nowgong, Sibsagar, Karbi Anglong, North Cachar and Cachar. The administrative districts and tea districts of Assam are different. Dibrugarh district tea estates produced high quality teas fetching premium prices whereas Cachar tea estates realized medium
level prices in the market. The topography and climate of these two tea districts are also different. There are 39,139 tea estates in Assam (according to figures available for 2000) under these 10 tea districts. The number also includes large number of small tea growers of the state. Till 1993, the Tea Board statistics showed the total number of tea estates of Assam at 850. Since 1994, the figures include small tea growers of the state also. Thus, the number has increased to such a large number. There were 280 (1993) and 21,383 (2000) tea estates in Dibrugarh and 121 (1993) and 205 (2000) tea estates in Cachar district. A sample of 10 per cent tea estates were selected out of them by simple random sampling method which came to 28 tea estates in Dibrugarh and 12 tea estates in Cachar.

Adequate care was also taken to ensure that the sample includes all kinds of tea estates i.e. large (above 250 ha), medium (100-250 ha) and small (below 100 ha) and with sterling company, Public Limited Company, private ownership and state Government owned corporation etc. The large number of small tea growers of Assam (area up to 10.12 ha) were not included in the scope of data collection. However, their problems were discussed with Directorates of Tea, Assam, small tea growers’ Association and a few small tea growers.

For study on marketing of Assam tea, data were collected from the participants of Guwahati Tea Auction Centre also. The statistics Department of the auction centre which has got the responsibility of keeping records was the prime source of information of all kinds relating to the auction centre and auction sale of tea in Assam, in general. Information were collected from the 9 brokers operating in the auction centre (2000), 21 buyers (7 each of large, medium and small) out of a total of 287 buyers operating in Guwahati Tea Auction Centre (2000) by simple random sampling method, allowing for replacement.

Information on different aspects of Assam tea were also collected from Tea Board, Guwahati Regional Office, Tocklai Experimental Station, Tea Research Association’s Jorhat and Silcuri (Silchar) and Dikom (Upper Assam) branches,
Directorate of Economics and Statistics, Government of Assam and others related to the tea industry for a deep insight into the study.

1.13 Period of data collection and conduct of field study

The study was an extensive one and general data collection and field study with the help of schedules/questionnaires was conducted during the period 2000-2003. The collection of secondary data from various sources, the main sources being Tea Board statistics and statistics of Guwahati Tea Auction Centre, were carried out during the period 1997 to 2003.

1.14 Tools of Analysis

Simple tabular analysis like average, percentage analysis were carried out for different comparative studies on various important aspects of the Assam tea industry. The suggestions of the respondents contacted with the help of questionnaires were also studied with the help of frequency tables.

1.14.1 Time series analysis

Time series analysis was used extensively to study the growth of Assam tea industry with respect to area, production and productivity of land and labour and the pattern of price variation and quantities of tea marketed through various channels and Guwahati Tea Auction Centre in particular. The time series refers to a sequence of movement of a variable over time. Unlike regression based econometric tools, time series methods do not attempt to establish any causation among econometric variables.

Time series analyses recognize the dependence among the successive observations and evolutionary behavior to the system studied. They characterize the ‘memory’ of
the particular system considered on which are superimposed the 'noises'. Given a set of data \((X_t/t = 1 \ldots T)\) where \(T\) is some finite number, the time series methodology tries to model the process that most likely generates the set, given that the set itself is perhaps a possible realization of a stochastic process. Most of the models reply upon the autocorrelation of the series to determine the mechanism generating the series.

The aim of the present study is to understand the pattern underlying the various components of Assam tea industry with regard to production, productivity and marketing etc. For these analyses, some of the time series tools used are discussed here.

### 1.14.1.1 Decomposition of time series data

Decomposition of time series data is carried out to unearth the 'hidden' patterns. Four major components, namely, trend factor \((T)\), cyclical factor \((C)\), seasonal factor \((S)\) and a fourth 'pure noise' \((U)\) are generally identified.

If \((X_t/t = 1, 2 \ldots ; T)\) is the finite time series of random variable \(X\), the classical decomposition assumes that the series is generated by the multiplicative process,

\[
X = T \times C \times S \times U
\]

and proceeds to distill the components.

### 1.14.1.2 Trend

Most of the economic variables show a tendency to grow over time. It is assumed that the underlying true secular trend is marked by the random fluctuations superimposed upon it. Trend analysis seeks to identify the secular trend. Given the
series \( X_t / t = 1,2, \ldots T \), trend \( X_t^T \) can be most generally modeled as,
\[
X_t^T = f(t)
\]
On which are superimposed the noises, collectively represented by \( U_t \), giving the series \( X_t \).
\[
X_t = f(t, U_t).
\]

The above specific form is an empirical one, predominantly a linear and an exponential trend is used. In this study, linear trend, a special case of the general polynomial trend and exponential trend are attempted.

While the selection of any specific trend model is influenced to some extent by the purpose of analysis, the coefficient of determination provides some guidance about the appropriateness of the model selected.

1.14.1.3 Polynomial trend

The general form of polynomial trend is given by
\[
X_t = \sum_{i=0}^{p} a_i t^i + U_t
\]
where 'p' is the power of the polynomial.

In particular, when \( p = 1 \), the model becomes linear and it was extensively used for analysis of trend in the present study.

\( p = 2 \), which gives quadratic function was also attempted for the study. As it would be discussed subsequently, wherever any time series analysis tool demands that it be applied to a 'stationary' series, the trend elimination for that was based on the linear model.
1.14.1.4 Exponential trend (Compound growth rate)

The growth implied by the slope of the linear trend is constant and as such the model may not portray reality adequately when ‘t’ is large. Further, $a_t$ being related to the units of the series $X_t$, cross comparison with the growth rates of related series become tedious. These problems are overcome to some extent when the series is defined by a compound growth rate ‘r’ from its base value $X_0$ when $t = 0$ by the relationship,

$$X_t = X_0 (1 + r)^t$$

The least square estimation of the above form, more plausible in many economic series, is accomplished by taking logarithms on sides and rearranging terms.

$$\log X_t = \log X_0 + [\log (1+r)] t$$

$$X_t = a_0 + a_1 t$$

Where, $X_t = \log X_t$, $a_0 = \log X_0$ and $a_1 = \log (1+r)$

Now, the value of $r$ is readily obtained.

Since $a_1 = \log (1+r)$

$\text{Antilog } a_1 = 1 + r$

$$r = (\text{antilog } a_1) - 1$$

In terms of annual growth rate

$$r = [\text{(antilog } a_1) - 1] \times 100$$

Also, the equation can be expressed as

$$X_t = X_0 (1+r)^t$$

with constant growth rate in exponential form as

$$X_t = e^{\alpha} + \beta t$$

Where $\beta = 1 + r$

The above equation is expressed in continuous time formulation as

$$X_t = X_0 e^{\beta t}$$

$$\beta = \frac{1}{X_t} \frac{dX_t}{dt}$$ is instantaneous rate of growth of $X$ at any time $t$.

Taking logarithm of the equation $X_t = X_0 e^{\beta t}$
\[ \log X_t = \log X_0 + (\beta \log e)^t \]

Comparing the above equation with the previously obtained equation
\[ \log X_t = \log X_0 + [\log (1+r)] t \]

Shows that
\[ (\beta \log e)^t = [\log (1+r)] t \]
\[ \beta \log e = \log (1+r) \]
\[ \beta = \ln (1+r) \]

Here \( \beta \) is the rate with continuous compounding.

In terms of annual growth rate,
\[ r = (e^\beta - 1) \times 100 \]

### 1.14.1.5 Seasonal variation

It is the periodic movement which occurs within a period of a year and it repeats itself year after. Seasonal fluctuations have a regular periodic pattern and are predictable to a certain degree. In this study, the seasonal variation in monthly average prices of tea were studied in Guwahati tea auction centre and compared with similar computation for Calcutta tea auction centre.

#### Methodology of computation of seasonal indices

The methods involves a set of sequential steps involving simple mathematical applications as shown below.

**Step 1:** Computation of 12 month centered moving averages for the monthly average price series of tea in auction centre.

**Step 2:** Obtaining the percentage series of actual prices to moving average prices, and arranging them by month.

**Step 3:** Calculating the modified mean for each month, and eventually arriving at the seasonal (monthly) indices through an adjustment factor.
This is called ratio-to-moving average method. Seasonal indices are useful for the following:
(a) they can establish the pattern of past changes,
(b) they are useful for projecting the past pattern into the future, and
(c) on establishing the seasonal pattern that exists, they can be applied to eliminate its effect from the time series.

1.14.1.6 Pattern

The basic set of relationship and the underlying process over time is referred to as the pattern in the data.

1.14.2 Garette's ranking technique

Garette's ranking technique was used to analyse the problems and prospects of Assam tea industry and marketing of Assam tea by producing tea estates, participants of Guwahati tea auction centre etc. The order of merit given by the respondents were converted into ranks by using the following formula.

\[ \text{Per cent position for factors } i = 100 \left( \frac{R_{ij} - 0.5}{N_j} \right) \]

where, \( R_{ij} \) = Rank given for the factor \( i \) by \( j \) th individual
\( N_j \) = Number of factors ranked by the \( j \) th individual

The respondents were asked to rank the problems in the order of importance and the present position of each rank thus obtained was converted into scores by referring to the table given by Garett.

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Then for each factor, the scores of individual respondents were added together and divided by the total number of respondents for whom scores were added. These mean scores for all the factors were arranged in descending order and ranks were given to the problems their order of importance.

1.14.3 Measures of dispersion

In order to measure the scatter of the values items of a variable in a series around the true value of average, statistical devices called measures of dispersion are calculated, the important ones are:

(i) range, (ii) mean, and (iii) standard deviation.

1.14.3.1 Range

Range is the simplest possible measure of dispersion and is defined as the difference between the values of the extreme items of a series. Thus,

\[ \text{Range} = (\text{Highest value of an item in a series}) - (\text{Lowest value of an item in a series}) \]

Range gives only a rough measure of variability very quickly, but the drawback is that range is affected very greatly by fluctuations in sampling.

1.14.3.2 Mean deviation

Mean deviation is the average of difference of the values of items from some average of the series.

\[ \text{Mean deviation from mean} (\delta_{X}) = \frac{\sum (X_i - \bar{X})}{n} \]

where, \( \delta = \text{Symbol for mean deviation} \)

\( X_i = i^{th} \text{ value of the variable X} \)

\( n = \text{number of items} \)

\( \bar{X} = \text{Arithmetic average} \)
1.14.3.3 Standard deviation

Standard deviation is the most widely used measure of a series and is commonly denoted by symbol ‘σ’. Standard deviation is defined as the square root of the average squares of deviation, when such deviations for the values of individual items in a series are obtained from the arithmetic average.

\[ \sigma = \frac{\sum (X_i - \bar{X})^2}{n} \]

When the standard deviation is divided by the arithmetic average of the series, coefficient of standard deviation is obtained which is a relative measure and is often used for comparing with similar measure of the series. If this coefficient of standard deviation is multiplied by 100, coefficient of variation is obtained which is regarded as a satisfactory measure of dispersion in a series. The square of standard deviation, known as variance, is used in the context of analysis of variation.5

1.14.4 Correlation analysis

Correlation analysis studies the joint variation of two or more variables for determining the amount of correlation between two or more variables. It is a tool of factor analysis. Factor analysis seeks to resolve a large set of measured variables in terms of relatively few new categories. As the factors are linear combinations of data, the co-ordinates of each observation or variable is measured to obtain the factor loadings which represent the degree of correlation between the particular variable and the factor. The factor loadings are derived by the same principle of least squares. The factor loadings are then placed in a matrix of correlations between the variables and the factors.

Correlation coefficient is the statistical tool that is used to measure the mutual

relationship between the variables. Karl Pearson's formula for correlation coefficient is given by:

\[ r = \frac{1}{n} \frac{\sum (X - \bar{X})(Y - \bar{Y})}{\sigma_X \sigma_Y} \]

It is also given by

\[ r = \frac{\sum UV - \left( \frac{\sum U}{n} \right) \left( \frac{\sum V}{n} \right)}{\sqrt{\left( \sum U^2 - \left( \frac{\sum U}{n} \right)^2 \right)} \sqrt{\left( \sum V^2 - \left( \frac{\sum V}{n} \right)^2 \right)}} \]

Correlation coefficient greater than or equal to 0.5 signifies strong correlation.

1.14.5 SWOT analysis

In order to study the tea industry of Assam, SWOT analysis was carried out. Various strengths, weaknesses, opportunities and problems (threats) faced by the tea industry of Assam with regard to plantation, tea labours, Government policy, finance, R&D activities etc. were analysed.

1.14.6 SCP analysis

An analysis of the tea industry of Assam including Guwahati tea auction centre was done for its structure, conduct and performance.

1.16.6.1 Market structure

Market structure is those characteristic of the market which strategically influence the nature of competition and pricing within the market. The characters most
emphasized as strategic aspects of market structure are (i) the degree of sellers’ concentration, (ii) the degree of buyers’ concentration, (iii) the degree of product differentiation and (iv) condition of entry to the market, referring to the relative ease or difficulty of new seller’s entering the market. 6

Market structure is the competitive environment of the market process that affects the manner of determining prices, total amount traded, market shares among sellers, market shares among buyers and any other results or dimensions of the market process. The market structure is based on (i) size distribution of sellers and buyers, (ii) product differentiation, (iii) condition of entry and (iv) collusion, regulation and any other factor that affect market behaviour. 7

1.14.6.2 Market conduct

Market conduct is the pattern of behaviour of the enterprises and their aggregate relationship in the market. The variables studied were

i) pricing behaviour including buying and selling behaviour and arrangements for buying and selling,

ii) locational effect,

iii) changing behaviours as influenced by policy.

1.14.6.3 Performance analysis

Market performance is the reflection of the impact of structure and conduct of


product prices, costs and the volume and quantity of output. Measures of performance like comparison in production, productivity, quantity sold through auction centre, price realization etc. for strength of competition with other tea growing areas of India, all India and with other auction centres of India were done for the present study using rends, seasonal indices and compound growth rate etc.

1.15 Statistical test

All statistical tests with the help of ‘t’ and ‘F’ statistics were carried out for five percent and one percent level of significance.

1.16 Limitation of the study

The whole study was mainly conducted within a span of five years although the preparation for it started much earlier. Being posted outside Assam during most of this period, it was difficult to carry out data collection in Assam. The most important problem was that the head offices of most of the tea companies were located outside Assam in Kolkata, mainly. The offices of the tea estates and other respondents in Assam refused to disclose many figures, mostly pertaining to financial aspects and also to comment on critical issues due to their fear of higher ups in the organizations in the head offices. Some respondents found it difficult to answer specific questions and avail data due to their inability to spare time because of inadequate manpower. The attitude of some of the respondents were lukewarm maintaining that the records were kept in Kolkata head office leading to difficulties.

Response was not received from all the samples selected and then the option of replacement was applied. The social obligation of the tea industry, a sensitive issue for the people of Assam, was not studied which has the possibility of a separate study.

Data on export of Assam tea and foreign exchange earning etc. were not available.

In spite of the best efforts, all aspects also could not be covered. There is still scope for improvement.
1.17 Structure of the thesis

The thesis is organized under the following chapters.

Chapter I: Introduction, objectives, methodology, design of study and need of the study.

Chapter II: Review of literature - production and productivity of tea, marketing of tea, tea labour, tea quality, contribution of tea industry to economy of Assam etc.

Chapter III: Brief history of the, origin and historical background of tea in Assam, tea industry in India.

Chapter IV: Analysis of the growth in area, production, productivity of tea industry of Assam.

Chapter V: Tea labours – analysis of employment and productivity.

Chapter VI: Field management practices and agro-climatic factors affecting production of quality tea in Assam.

Chapter VII: Marketing of Assam tea- an analysis with special reference to Guwahati Tea Auction Centre

Chapter VIII: Contribution of tea industry to the economy of Assam.

Chapter IX: Problems and prospects of tea industry of Assam.

Chapter X: Summary of findings and conclusion.