METHODOLOGY
CHAPTER III

METHODOLOGY

The various techniques and approaches employed in achieving the objectives of the study are discussed in this chapter under the following sub heads:

3.1 The salient features of the study area

Karnataka occupies a predominant position in the production of silk in the country accounting for about 50 per cent of the total raw silk production.

3.1.1 Powerlooms

It is estimated that there are around 16 lakh looms in the decentralised powerloom sector in the country, spread over around 4 lakh units with an average holding of around 4 looms. The majority of these looms are conventional, ordinary shuttle looms with virtually no process or quality control devices or attachments.

Out of the total 28,853 silk powerlooms operating in the country during the year 2002-03, about 25,000 of them
are operating in Karnataka alone (Source: Sericulture & Silk Industry Statistics – 2003, Central Silk Board).

As per the “Census of Powerloom – 1996”, there are 88,566 powerlooms in Karnataka, out of which 48,341 looms are working. Around 70 per cent of the total number of looms is spread over the districts of Bangalore (Urban) and Bangalore (Rural). Out of the 88,566 powerlooms operating in various districts of the state, about 25,000 of them are silk powerlooms. The district-wise distribution of powerlooms in Karnataka is given in Annexure 7.

3.1.2 Cocoon Markets

Cocoons, being a perishable commodity, have to be marketed promptly after harvest otherwise the silkworm moth emerges from the cocoon shell and makes it unsuitable for reeling the yarn. As mentioned earlier, the Indian silk industry has a strong presence of government in all the sectors. And marketing of cocoons and raw silk is also not an exception to this. The government interventions in marketing were introduced in the late seventies through the establishment of cocoon markets and silk exchanges (Balasubramanian, 1985). The role of regulated markets
vis-à-vis that of private trading channels in the Indian context has been examined by Charsley (1992). There have been a few studies on the behaviour and functioning of these markets during the past. In the present scenario of liberalisation and globalisation, the changing nature of export and domestic demand poses new challenges for the existing marketing system. So the markets have to be efficient and responsive to meet these challenges.

Cocoons produced by the rearers are sold in the regulated cocoon markets established by the state governments in traditional sericultural states such as Karnataka, Andhra Pradesh and Tamil Nadu. The market of mulberry silk cocoons is officially regulated in all major silk producing states except West Bengal. It is obligatory for all cocoon transactions to take place at these notified markets where only licensed rearers and reelers can conduct business. The sale of cocoons at these markets is by open auction to the highest bidder provided the rearer agrees to the price. A one per cent market fee is collected from the rearer and the reeler on each transaction.
Weighing and payment is effected by market officials immediately.

3.1.3 Silk Exchanges

Raw silk being a high value commodity has to be marketed at the appropriate time otherwise it will block capital and creates problems for the reeler. The objectives and mode of operation of the silk exchanges are similar to those of the cocoon markets. The reelers (as sellers) and merchants and/or weavers (as buyers) have to be registered with the exchange. Prices are determined in open auction, weighing and immediate payment are effected officially. The market fee, collected from buyers only, is credited to a Silk Price Stabilisation Fund which is used to provide the facilities at the exchanges. Reelers not happy with the price can pledge their silk and obtain a loan on the assessed value of the silk. Like in the cocoon markets, it is obligatory for all transactions to take place at these exchanges where only licensed reelers and traders/weavers can conduct business. But it has been observed that, over the years the percentage of raw silk transaction to the estimated production in Karnataka is declining.
The cocoon markets and the silk exchanges are maintained by the state government. Apart from collecting the marketing cess and facilitation of sales through open auction, there is no other interference by the government in cocoon marketing, while in the case of silk marketing, the government has established an agency, the Karnataka Silk Marketing Board (KSMB) with the objective of price stabilisation.

3.1.4 Karnataka Silk Marketing Board (KSMB)

The Karnataka Silk Marketing Board (KSMB) was set up by the Government of Karnataka in the year 1979 after the establishment of cocoon markets and silk exchanges. The main objective with which KSMB was established was to provide stabilisation to silk yarn prices and to ensure adequate supply of yarn to the weavers at reasonable prices. KSMB was expected to provide price support and act as ‘buyer of last resort’. KSMB was set up with a paid up capital of Rs. 2.00 crores and was constituted as a company so as to allow it to borrow money from financial institutions for its operations. The authorised Share Capital of the Company at present is Rs. 40.00 crores out
of which the paid up Share Capital is Rs. 31.45 crores. The entire Paid up Share Capital is held by the Government of Karnataka. KSMB is head quartered at Bangalore with its procurement centres at important reeling clusters in Karnataka.

KSMB has 13 purchase branches / outlets, all in Karnataka which are located at Bangalore, Ramanagaram, Kanakapura, Vijayapura, Chamarajnagar, Kollegal, Kolar, Sidlaghatta, Chikkaballapur, Chintamani, Guledagudda, Jewargi and Gadag-Betageri. The company has 15 sales branches / outlets situated in the states of Karnataka, Andhra Pradesh and Tamil Nadu, namely, Bangalore, Guledgudda, Ilkal, Gadag-Betageri, Molakalmuru, and Kollegal in Karnataka; Dharmavaram, Hyderabad, Pochampally and Janagam in Andhra Pradesh; Salem, Arni, Kumbakonam, Kancheepuram and Panchukalipatti in Tamil Nadu. KSMB's clientele ranges from small weavers to master weavers, twisters, traders, Co-operative Societies, Government Institutions, Sarvodaya Sanghas and Certified units of Khadi and Village Industries Commission. The
purchases made by KSMB over the years in the silk exchanges are presented in Annexure 8.

Annexure 8 shows the annual production and transaction figures of raw silk in Karnataka for the past 20 years. It can be seen that the transaction of raw silk in the silk exchanges have been around 20 per cent of the total production of Karnataka. Out of the total quantity of raw silk transacted in the silk exchanges, KSMB purchases have been around 15 – 20 per cent over the years. It has declined to around 10 per cent of the total quantity transacted in the silk exchanges.

3.2 Selection of Tested Raw Silk Lots, Cocoon Markets and Silk Exchanges

Karnataka has been selected for this study since around 25,000 powerlooms operating on silk out of the total 28,853 silk powerlooms in the country are operating in the state.

3.2.1 Selection of Tested Raw Silk Lots

The test results of raw silk lots from reelers, twisters, weavers and traders were randomly selected for the study.
The corresponding selling price of each of the individual lot was also collected to study the price – quality relationship.

### 3.2.2 Selection of Cocoon Markets

Though there are more than sixty cocoon markets in Karnataka, bulk of the cocoons are transacted in Ramnagaram. The other major cocoon markets are Siddlaghatta and Kolar which are situated in Kolar district of Karnataka. Hence these three major cocoon markets, viz., Ramnagaram, Siddlaghatta and Kolar cocoon markets have been selected for this study.

### 3.2.3 Selection of Raw Silk Exchange

There are more than a dozen silk exchanges in Karnataka, but the silk exchange at Bangalore is the major one and the biggest in India. Hence Bangalore silk exchange has been selected for the study.

### 3.3 Sources and Collection of Data

To achieve the objectives of the study, primary data and secondary data were collected for the period from 2001 to 2004.
3.3.1 Raw Silk Lots

435 lots of filature raw silk test results were collected from reelers, traders and weavers during 2002 and 2003 to study the price-quality relationship.

3.3.2 Cocoon Markets and Silk Exchange

The data on the cocoon markets and the silk exchange was collected from the records of Ramnagaram, Kolar and Siddlaghatta cocoon markets and Bangalore silk exchange for the period from April 2001 to March 2004. Daily average prices of cocoons and raw silk were collected in order to study the market dynamics and also to forecast the prices.

3.3.3 Imported Raw Silk Prices

The data on the prices of imported raw silk was collected for the period from April 1995 to December 2004. The monthly average landed prices of imported raw silk at Bangalore were collected and the corresponding domestic filature raw silk prices for the same period were collected from the Bangalore silk exchange.
3.3.4 Karnataka Silk Marketing Board (KSMB)

The data on KSMB was collected during the period from April 2001 to March 2004 for the analysis. Monthly average purchase prices and monthly quantities purchased by KSMB during the period were collected.

3.4 Analytical Framework

The following statistical / analytical tools were utilized for meeting the objectives of the study:

3.4.1 Linear Multiple Regression

Linear multiple regression was carried out on the filature raw silk test results collected from reelers, traders and weavers to identify the important parameters influencing the price of raw silk.

The functional form used was of the following type:

\[ Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + u \]

Where,

\[ Y = \text{Price of raw silk (Rs/kg)} \]

The explanatory variables were:

1. Winding breaks (breaks/hour)
2. Size
3. Size Deviation

The selection of the variables was based on the mechanical tests to which the raw silk is subjected. Usually the reelers, weavers and traders subject their raw silk lots to Limited Test which includes only the winding test and size test. From the winding test, the winding breaks are determined while from the size test, size deviation and maximum deviation are calculated. Hence winding breaks, size deviation and maximum deviation along with size i.e., denier are the variables considered in the regression analysis. Thomas (1996) studied the contribution of various quality attributes like denier, cleanness, cohesion, winding breaks, weight of skein, degumming losses and uniformity to the value of silk yarn.

3.4.2 Auto Regressive Integrated Moving Average (ARIMA)

Since the data were known to be highly autocorrelated and non-stationary, the normal techniques of regression analysis could not be applied. Time series analysis viz. Auto Regressive Integrated Moving Average (ARIMA) was applied.
Time series models should serve the twin objectives of identifying the stochastic process of the series and predicting its future values as accurately as possible. The Box-Jenkins model developed by Box and Jenkins (1976) fulfils these two conditions. This is a model based on a class called the Auto Regressive Integrated Moving Average (ARIMA) models. Auto Regressive (AR) and Moving Average (MA) and mixed Auto Regressive Moving Average models has been studied for many years, but Box and Jenkins popularized their use and demonstrated how they could be combined to analyse non-stationary and seasonal data.

The Box-Jenkins procedure is concerned with fitting ARIMA models to a given set of data. The fitting of the Bow-Jenkins model primarily consists of four stages, namely model identification, estimation, diagnostic checking and modification.

Model identification: This step involves identifying the model, that is, to find out the appropriate values of p, d and q. The chief tools in identification are the autocorrelation function (ACF) and the partial correlation
function (PACF), and the resulting correlograms which are simply the plots of ACF and PACF against the lag length.

**Estimation:** Having identified the appropriate $p$ and $q$ values, the next stage is to estimate the parameters of the autoregressive and moving average terms included in the model.

**Diagnostic checking:** Having chosen a particular ARIMA model and having estimated its parameters, the next step is to see whether the chosen model fits the data reasonably well, for it is possible that another ARIMA model might do the job as well. One simple test of the chosen model is to see if the residuals estimated from the model are white noise; if they are, then the particular fit is accepted, if not, the process is started all over again. Thus, the Box-Jenkins methodology is an iterative process.

Many a times, two or three suitable models are estimated and the best one is chosen based on the Akaike Information Criterion (AIC) and the Schwartz Bayesian Criterion (SBC) [Stewart, 1991]. These criteria measure how well the model fits the time series. Akaike Information
Criterion is for auto regression models while Schwartz Bayesian Criterion is a more general criterion. The model with the lowest AIC and SBC is considered the best.

*Residual analysis:* Analysis of the residuals of the fitted ARIMA model gives valuable insights into the adequacy of the model. The sample auto-correlation function of the residuals, indicates the 'lack of fit' of the model. The Box-Pierce Q statistic is suggested as a better method for testing the overall significance of the residuals since, the auto-correlation function of the residuals at lower lags tend to be under estimated.

### 3.4.3 Nominal Protection Coefficient (NPC)

Nominal protection coefficients are computed to determine the extent of comparative advantage enjoyed by the commodity in the context of free trade. The coefficients shed light on whether a country has comparative advantage in the production of that commodity in a free trade scenario or not.

The nominal protection coefficient (NPC) is defined as the ratio of the domestic price to the world reference price of the commodity under consideration.
Symbolically,

\[ NPC = \frac{P_D}{P_R} \]

Where, \( NPC \) = nominal protection coefficient

\( P_D \) = domestic price of the commodity in question

\( P_R \) = reference price of the commodity in question i.e., what the producer would have received in the case of free trade

In this study, the domestic price is approximated by what the producers of the relevant commodity receive, the world reference price is derived from the international price, adjusted for transport cost (both foreign and domestic) and marketing and trading margins, including any processing necessary to make the domestic commodity equivalent to the internationally traded commodity.

If the nominal protection coefficient (NPC) is greater (lesser) than one, then the commodity is protected (disprotected or in effect, taxed), compared to the situation what would prevail under free trade.
NPC basically helps in measuring the divergence of domestic price from the international price and thus determines the degree of protection (incentive) / disprotection (disincentive) of the commodities in question. NPC can be estimated under two main scenarios, i.e., under importable scenario and exportable scenario. If one is interested in knowing whether a particular commodity is an efficient importable substitute, it is the importable scenario which is more relevant. If the NPC under this scenario is less than the unity, the commodity is an efficient import substitute. And, if one is interested in knowing whether a particular commodity is an efficient exportable commodity, it is the exportable scenario which is more relevant.

The differences in methodology of working out import parity and export parity prices result in competitive export price (under exportable scenario) being lower than competitive import price (under importable scenario). This is because under importable scenario, competition is deemed to take place at domestic port and therefore international transportation costs accord a natural
protection to domestic commodity; while under exportable scenario, competition is assumed to take place at foreign port and therefore domestic commodity has to be extra efficient to the tune of international transportation costs at least. The two hypotheses therefore yield different estimates of protection.

The NPC of raw silk is defined as the ratio of domestic price of raw silk to the international price. The NPCs of raw silk has been estimated under the importable scenario as under:

The point of competition between production and imports (from China port) was taken for the importable hypothesis.

The international reference price under this hypothesis would thus be calculated by adjusting the FOB (free on board) price at China port by adding insurance and maritime freight from China to the relevant Indian port (Mumbai), and then by adding domestic transport costs, marketing and trading margins to the Indian port to the specific region. The resulting international reference price
is compared with the domestic price (domestic prices were approximated by wholesale prices of the state), to derive the NPCs of raw silk.

3.4.4 Partial Equilibrium Methods

The welfare losses / gains both to the producers and consumers were estimated using the partial equilibrium method which was followed by Lutz and Scandizzo (1980).

Price distortions on domestic as well as international market and domestic agricultural policies will have an impact on income of producers, consumers and government revenues. These distortions are created on account of protectionistic policies followed by the governments. With liberalisation these policy distortions will change. The extent of price discrepancies is computed. Partial equilibriums methods can readily be used to evaluate the impact of the price changes on demand, supply and welfare.

The basic analytical structure of the partial equilibrium models are summarized as follows: The following formulae are applied for different prices affecting producers and consumers:
Net Social Loss in production (NSL_p)
= \( \frac{1}{2} (Q_w - Q) (P_w - P_p) = \frac{1}{2} t_p n_s V \)

Net Social Loss in consumption (NSL_c)
= \( \frac{1}{2} (C - C_w) (P_w - P_c) = \frac{1}{2} t_c n_d W \)

Total Net Social Loss (NSL)
= NSL_p + NSL_c

Welfare Gain of producers (WG_p)
= Q_w (P_w - P_p) - NSL_p

Welfare Gain of consumers (WG_c)
= C (P_w - P_c) - NSL_c

Net effect of liberalisation on welfare in the State
= Q_w (P_w - P_p) - C (P_w - P_c)

where,

Q_w = Production at world prices
Q = Production at domestic prices
P_w = Border prices
P_p = Price faced by domestic producers
P_c = Price faced by domestic consumers
t_c, t_p = Proportion of tariff in domestic price at the consumer (t_c) or the producer (t_p) level
n_s = Elasticity of domestic supply
n_d = Elasticity of domestic demand
v = Value of production at Pp
w = Value of consumption at Pc
C_w = Consumption at world prices
C = Consumption at domestic prices
The basic parameters needed in this evaluation are the elasticities of supply and demand. The evidence on silk supply elasticity and demand elasticity is unfortunately weak. In the present study, the supply elasticity and demand elasticity of raw silk considered are based on the discussions held with the experts and academicians in the field of sericulture and silk industry. For calculation of production and consumption values, the raw silk prices at Bangalore Silk Exchange were used. The world reference prices were derived from the international price, adjusted for transport cost (both foreign and domestic) and marketing and trading margins in order to make the domestic commodity comparable with the internationally traded commodity.