CHAPTER IV

RESEARCH METHODOLOGY

4.1 Introduction

Research methodology is vital for any research work that includes research design, data collection, analysis and interpretation of results. The term ‘methodology’ comprises this whole process. The final results of a research depend on the methodology that is employed and it depends on the type of data needed to answer the research questions. Selecting an appropriate methodology for specific a research depends on the research objectives and research questions, which are answered through the research. The research methods must lead to comprehensive and clear results at the end of the research. This chapter outlines the research design, structure and the steps followed in the present research. The methods used in the collection of data, processing, analysing data and information used in the research are elaborated on, in the following pages.

The questionnaire, for example, is a measuring tool (Oppenheim, 1992), rather loosely; a questionnaire consists of a series of questions, checklists, attitude scales and a variety of other approaches in a structured sequence. They are used to provide descriptive and/or analytical information which is suitable for statistical analysis.

Questionnaires usually involve large samples (upwards of 300 cases) and are costly so it is essential to plan the research approach. Who to question, types of questions to ask, sample size, inherent biases, and so on are among the factors that affect questionnaire measurement, specification and procedures (Oppenheim, 1992). Questionnaires need exploratory work, design and planning before any specification can be established. A certain rigidity of questioning and sampling procedure is needed to maintain the statistical validity which makes them relatively inflexible. To take a social science example, questionnaire assessments of, say, consumption of fuel wood, fodder, and food grains are, for example, indirect unless a weighing measurement is included and are dependent on the accuracy of recall by the respondent (Oppenheim, 1992).

The methodology used in the study is an integrated methodology, where traditional, schedule-based data collection and processing is integrated with the
modern, statistical as well as qualitative analysis. The former complements the latter. The methodology which follows the traditions of social science and management research (Kundu, 1992; Wood, 1996) and the latest developments in socio-economic and management research have the following components:

1. Field survey (primary data – questionnaire survey).
2. Collection of documented data (secondary data – documentary from the departments of agriculture, horticulture, and HOPCOMS).
3. Statistical approaches (simple frequency and percentage analysis, correlational analysis and compounded annual growth rates).
4. Analysis and interpretation of data from fruits and vegetables producers (farmers of the study area) and consumers of fruits and vegetables from the HOPCOMS outlets in the city of Bengaluru).
5. Library research to assemble ideas for the thesis and also build a background for understanding the problem of analysis in the study through literature review.

4.2 The Research Design

Research design serves as a logical manual to guide a researcher in the course of data collection, analysis and interpretation. Stating clearly each step in the manual can help a researcher collect the right kind of data and analyse them in the right way to address the primary research questions. The research design has been developed in two simple stages:

1. An extensive review of literature on agricultural and horticultural research. HOPCOMS, organized retailing, and relevant literature for our research (a review of literature in Chapter II).
2. Interviews with farmer-producers who supply fruits and vegetables to HOPCOMS and consumers who benefit from HOPCOMS outlets where they buy their fruits and vegetables for their food-nutrient needs (see discussion in Chapter VI).
4.3 A Review of Research Design Approaches

The methodology used in the study is a social sciences methodology, where traditional, data collection and processing is integrated with the modern, statistical analysis. The former complements the latter. The methodology which follows the traditions of social sciences and management research (Kundu, 1992; Wood, 1996) and the latest developments in socio-economic and management research have the following components:

- Primary sources of data;
- Secondary sources of data;
- Techniques of socio-economic data representation, especially graphical;
- Statistical and other measurement techniques; and
- Library research.

Two types of data could be collected, primary and secondary data. Primary data are recognized as data that are gathered for a specific research in response to a particular problem through field observations and questionnaire-based interviews. Whereas the secondary data can be obtained from various kinds of documents such as research reports, annual reports of relevant organizations, Government Line Departments, books, and research articles published in reputed journals on the subject and theme of study (Schensul, Schensul, and LeCompte, 1999). In this study, both types of data have been used.

A survey is often classified by the kind of instruments used. There are many methods of collecting data such as observations, interviews or questionnaire survey. Saunders and others (2000) note that the greatest use of questionnaires is made by the survey strategy. Questionnaires can therefore be used for descriptive research such as that undertaken using attitude and opinion questionnaires and questionnaires of organizational practices enable us to identify and describe the variability in different phenomena (Lewis, Saunders, and Thornhill, 2009).

According to Yin (1994), there are six different sources for data collection: documentation, archival records, interviews, direct observations, participant observations and physical artefacts. All of these sources of evidence have both
strengths and weaknesses, but none is considered superior to the other. Yin (1994), therefore, recommends using several of them while a good research should thereby include as many sources as possible (Tellis, 1997). Case study is an ideal methodology when a holistic, in-depth investigation is needed (Feagin, Orum, and Sjoberg, 1991). Yin (1994) has identified some specific types of case studies: exploratory, explanatory, and descriptive. Stake (1995) included three others: intrinsic - when the researcher has an interest in the case; instrumental - when the case is used to understand more than what is obvious to the observer; and collective - when a group of cases is studied.

Triangulation is the application and combination of several research methodologies in the study of the same phenomena. It can be employed with quantitative and qualitative studies. At the present, triangulation method is used by most social science researchers to achieve better results from their research work. By combining multiple theories, empirical materials and research methods, the researchers can overcome the weaknesses or biases that come from a single method. Combination of two methodologies may also increase reliability and present a more accurate picture of the problem. Creswell stresses that the concept of triangulation was based on the assumption that any bias inherent in particular data sources, investigators, and methods would be neutralized when used in conjunction with other data sources, investigators, and methods (Creswell, 1994). Creswell further describes that a combined method of study is one in which the researcher uses multiple methods of data collection and analysis and also these methods might be drawn from ‘within methods’ approaches, such as different types of quantitative and qualitative data collection strategies.

If the social science researcher did not use qualitative research methods, he may overlook many phenomena that occur within the context of the settings. On the other hand, in the absence of quantitative methods, it is difficult to show the differences between different variables. So there are a number of benefits that can be achieved by triangulation of methods.

Interpretivists contend that only through the subjective interpretation of, and intervention in, reality can that reality be fully understood. The study of phenomena in their natural environment is key to the interpretivist philosophy, together with the
acknowledgement that scientists cannot avoid affecting those phenomena they study. They admit that there may be many interpretations of reality, but maintain that these interpretations are in themselves a part of the scientific knowledge they are pursuing. Interpretivism has a tradition that is no less glorious than that of positivism, nor is it shorter.

Quantitative research methods are research methods dealing with numbers and anything that is measurable. Quantitative research methodology calls for what is known as hard data in the form of numbers. Quantitative research methodology is about the collection of data in their numerical form. So they can be easily measured or counted. This research methodology is highly preferred by the positivist researchers who want to observe the social reality in terms of quantification and objectivity. By quantitative methods, researchers have come to mean the techniques of randomized experiments, paper and pencil “objective” test, multivariate statistical analysis, sample survey and the like (Cook and Reichardt, 1979; Neuman, 2000). In social sciences, quantitative research methods express different social phenomena in numbers.

Positivists on the other hand believe that reality is stable and can be observed and described from an objective viewpoint (Levin, 1988); that is, without interfering with the phenomena being studied. They contend that phenomena should be isolated and that observations should be repeatable. This often involves manipulation of reality with variations in only a single independent variable so as to identify regularities in, and to form relationships between, some of the constituent elements of the social world.

Predictions can be made on the basis of the previously observed and explained realities and their inter-relationships. Positivism has a long and rich historical tradition. It is so embedded in our society that knowledge claims not grounded in positivist thought are simply dismissed as unscientific and therefore invalid (Hirschheim, 1985: 33). This view is indirectly supported by Alavi and Carlson (1992) who, in a review of 902 science research articles, have found that all empirical studies are positivist in approach. Positivism has also had a particularly successful association with the physical and natural sciences. Some of the social science researches are no exception.
There has, however, been much debate on the issue of whether or not this positivist paradigm is entirely suitable for the social and management sciences (Hirschheim, 1985), many authors call for a more pluralistic attitude towards research methodologies (see for example, Kuhn, 1970; Bjørn-Andersen, 1985; Remenyi and Williams, 1996). While we would not elaborate on this debate further, it is germane to our study. Indeed, some of the difficulties experienced in academic research such as the apparent inconsistency of results, may be attributed to the inappropriateness of the positivist paradigm for the domain. Likewise, some variables, or constituent parts of reality, might have been previously thought unmeasurable under the positivist paradigm - and so went unresearched (Galliers, 1991).

4.4 Field Reconnaissance

Prior to setting up the research design, and deciding on triangulation, a reconnaissance of the city of Bangalore and the six districts of the State of Karnataka under study was carried out by the scholar, to have his focus on horticulture. Fruit and vegetable crops, their production and marketing through the HOPCOMS were anchored in some useful thinking on it. The reconnaissance did indeed make possible some good thinking on the part of the researcher to set down his methodology for the study. Some select farmer-producers who are members of the HOPCOMS, their farms where they produce fruits and vegetables, about 10 HOPCOMS outlets, both in the city and outside of it in the districts (Ramanagara and Kolar districts) and officials and staffs of the Department of Horticulture and HOPCOMS were visited with a view to gaining some relevant information on them, besides careful reading on the origin and development and growth of the HOPCOMS over the years since 1959. A deep knowledge was thus gained such that the research design discussed here could be set up and the questionnaires could be custom-designed for the purposes for which they were designed.

Initially, of course, a discussion was carried out with the officers at the Government line agencies, academic institutions and other relevant institutions. This was followed by informal interviews with some senior and frontline officials and policy makers in these organizations and institutions. These interviews were of a general nature and aimed at obtaining useful information on the functioning of the HOPCOMS, farmers’ arrivals with the fruits and vegetables at the procurement
centres, the procedures followed in the procurement and payment to the farmers, prices at the procurement centres, storage of the purchased produce at the godowns, their release for sale at the HOPCOMS outlets, the wastages, driage and losses and a gamut of other relevant aspects of the study including policies and difficulties and constraints in such an organized retail marketing of fruits and vegetables to the customers. The informal interviews enabled the scholar to appraise the officials about the objectives of the present study so as to solicit their cooperation for its execution.

4.5 Primary Sources of Data

The primary sources of data for the present study are the government and HOPCOMS officials and functionaries, the producers of fruits and vegetables in the six districts of our study, and the consumers of fruits and vegetables from the select HOPCOMS outlets in the city of Bengaluru. While the government (agricultural, horticultural) and HOPCOMS officials and functionaries have been met and discussed with for the purpose of understanding the history, growth and development of the HOPCOMS in Karnataka, especially their functions in Bengaluru, the farmers producing fruits and vegetables have been selected from the six districts of our study and the consumers of fruits and vegetables have been selected from 46 different localities in the four zones and in the jurisdiction of 7 HOPCOMS outlets in each of the zones of Bengaluru. In all 280 producer-farmers (Figure 4.1) and 356 consumers of fruits and vegetables (Figure 4.2) have been chosen for questionnaire based interviews. Two questionnaires, one for the producer-farmers and the other for the consumers have been custom-designed based on the reconnaissance of the study area and discussions with the government and HOPCOMS officials and functionaries and also the farmer-producers and consumers at random.

4.6 Sample and Sampling Methods

Sampling considerations pervade all aspects of research and crop up in various forms no matter what research strategy or investigatory technique we use. Robson (2002: 260) argues that it is unusual to be able to deal with the whole of a population in a survey, which is where sampling comes in;"a sample is a selection from the population". Particular attention needs to be given to the selection of the 'people sample' in planning a survey.
In quantitative methods, it is acceptable for researchers to use either probability or non-probability sampling (Creswell, 1998; 2003; 2005; Creswell and Plano, 2007). According to Robson (2002), in non-probability samples, you cannot make statistical inferences; however, it may still be possible to say something sensible about the population from non-probability samples. Creswell (2005) suggests that it is not always possible to use probability sampling in educational research; instead a researcher can use non-probability sampling, where the researcher selects individuals because they are available, convenient, and represent some characteristics the investigator seeks to study. This study employed a non-probability sampling, therefore.

In terms of sample size, Mertens (1998) notes that in quantitative research the optimum size is directly related to the type of research being undertaken; in some cases, the sample size will be determined by very practical constraints such as how many people are participating in a programme. In survey research, the researcher can use 100 observations for each major sub-group, and 20 to 50 for a minor sub-group. Further, purposive sampling, according to Scott (1997) rests on the researcher's judgement as to typicality or interest. The sample is built up to enable the researcher to satisfy the specific needs of the study. Also, Mertens (1998) states that if a purposeful sampling procedure is used, the researcher needs to provide sufficient detail about the people in the study to communicate to the reader their important characteristics.
4.7 Farmer-Producers Sample

The farmer-producers for the interviews have been randomly chosen from among the members of the HOPCOMS from each of the districts of our study, namely, Bangalore Rural, Bangalore Urban, Chikkaballapura, Kolara, Ramanagara and Tumkur. While 40 farmer-producers have been chosen from Bangalore Rural, Bangalore Urban and Ramanagara districts, 50 farmer-producers each have been chosen from Kolara and Tumkur districts, and 60 farmer-producers from Chikkaballapura district. The representation to the districts is proportional to the HOPCOMS members in the districts. Thus, a total of 280 farmer-producers have been chosen randomly from the list of HOPCOMS members for the study districts (Figure 4.1).
4.8 Consumers Sample

The consumers sample has been chosen rather systematically, although random, from the city of Bengaluru. For the purpose of selection of consumers for interviews, the city has first been divided into four zones by dividing the city both north-south and east-west. Seven HOPCOMS outlets each have then been randomly selected from each of the four zones and then the customers of the 28 HOPCOMS outlets (4 zones x 7 outlets = 28 outlets) of Bengaluru have been chosen (28 x 10 = 280) along with 76 consumers from the jurisdiction of the HOPCOMS headquarters office outlet (280 + 76 = 356 consumers). The headquarters office outlet serves much larger area and a much larger jurisdiction and population than the other chosen outlets (Figure 4.2).

Figure 4.2: Sample HOPCOMS Outlets (Locations) in Bengaluru City
(4 Zones x 7 Outlets = 28 Outlets x 10 Consumers = 280 Consumers and HOPCOMS HQ 76 Consumers)
HOPCOMS Headquarters at Lalbagh, Bengaluru City

4.9 Interviews

Interview is a qualitative research methodology. The flexibility of the method is that it provides a lot of information about changes over time and space, from various points of view. According to Nichols (2000), an interview is a mutual exploration of the issues, without the researcher imposing his or her ideas and in the structured interview; the researcher indeed has a prepared list of topics though still not a set list of questions. Also interviewing in planning is so much more than ‘having a chat’. There are three major forms of interviewing that exist. They are: structured; unstructured and semi-structured (Dunn, 2002). Interview method was one of the main, primary qualitative data collection methods of this research. This was the key component of data collection. Structured interviews were used to collect data regarding socio-demographic characteristics and opinions of farmer-producers and consumers on the theme(s) of the present research. These were supplemented by interviews from informants such as the officials and staffs of the Department of Horticulture of Government of Karnataka and also HOPCOMS administrative and other staffs to develop an understanding of a whole range of ideas. In the researcher’s opinion, the reliability of this method was beyond his expectations. Whenever misinformation was presented in the interview, he tried to correct it. A special attention was given to collect information on the ground realities of today and on the present and past situations by asking them about whatever they knew about the themes of research and also the research questions the scholar wanted to answer.
Farmer-Arrivals at the Bengaluru City Procurement Centre by Head Loads, Trucks, Lorries and Vans

Further, in research, there are various points of departure a researcher can choose from. In positivist approach, the researcher assumes that there is a truth to be discovered and that reality is value free, a-historical and cross-cultural. Science should, therefore, be neutral or value free. Further, a careful distinction between scientifically established objective meanings and subjective meanings are made.
4.10 Questionnaires

The questionnaire, for example, is a measuring tool (Oppenheim, 1992); a questionnaire consists of a series of questions, checklists, attitude scales and a variety of other approaches in a structured sequence. They are used to provide descriptive and / or analytical information which is suitable for statistical analysis. Questionnaires usually involve large samples (upwards of 300 cases) and are costly so it is essential to plan the research approach. Who to question, types of questions to ask, sample size, inherent biases, and so on are among the factors that affect questionnaire measurement, specification and procedures (Oppenheim, 1992). Questionnaires need exploratory work, design and planning before any specification can be established. A certain rigidity of questioning and sampling procedure is needed to maintain the statistical validity, which makes them relatively inflexible. To take an example, questionnaire assessments of, say, consumption of fruits and vegetables are, for example, indirect unless a weighting measurement is included and are dependent on the accuracy of recall by the respondent (Oppenheim, 1992).

Sjoberg and Nett (1968) highlighted the strengths and weaknesses of the structured and un-structured interview format. They also concluded that structured interviews provide a means to standardise responses, facilitate the verification of theories and hypotheses, and provide greater reliability than unstructured interviews. They also noted that structured interviews can introduce bias, as researchers may impose their own categories and may have a tendency to oversimplify reality.

4.11 Farmer-Producers Questionnaire

The farmer-producers questionnaire is structured in a way it could be answered in about 35-40 minutes. This is done realizing their busy schedules at the farm and also away from them. The first 6 questions are related to their personal details such as name and address, their level of education (no formal schooling to collegiate and higher education), occupation (business, agriculture / horticulture and employment), size of family (male and female adults, boys and girls, total), total annual income of the family 2012-13 (previous year to the survey) and also from agriculture, horticulture and from other sources, and landholding sizes (in acres and in terms of dry and irrigated land).
The next 4 questions seek answers from the farmers as to their cropping patterns (for top five crops), area under irrigated and dry, production from irrigated and dry and yield in tonne / acre (because acres is what the farmer-producers are familiar with and use on a daily basis) for both irrigated and dry for the top five crops inclusive of fruits and vegetables; variety of fruits and vegetables grown by the farmers (top five in both), the number of times they harvest fruits and vegetables (daily, twice a week, thrice a week, once a week), and the fruits and vegetables they sell soon after their harvest seeking the names of fruits and vegetables sold, place of sale, quantities sold in kilograms or tonnes, price per unit, and value or returns).

The questions that follow are by way of seeking information on HOPCOMS and the farmers’ dealing with the supply chain. The question 11 seeks information as to whether the farmers’ have storage facilities at their farms, with an Yes /No answer, followed by a question as to how frequently the farmers visit HOPCOMS for selling their fruits and vegetables (daily, weekly, twice weekly, bimonthly, monthly), and yet another on the time of payments for the farmers’ produce (immediately after sales, after a week, after 15 days, and after a month) by the HOPCOMS. The next question is obviously on the mode of payment, whether by cash or cheque or any other). The next one (question 15) is a vital one, seeking whether or not the farmers get fair prices for their fruits and vegetables at HOPCOMS. It is followed by a question on the sources of farmers’ information on prices in other markets (friends, local market, newspapers or radio, traders, and others). The next question (question 17) turns the attention to where they get their price information and if yes through who. The next question (question 18) is on what they practice or adopt as post-harvest methods / activities towards the sale of their produce: cleaning, grading, packaging, storing, transporting and processing? Question 19 is an elaborate one seeking details on the packaging system in place for fruits and vegetables, type of container used, capacity of the container and price of the container. The next three questions are on transportation, the farmers’ own (auto, lorry, van, truck or bus) and the products they carry to the procurement centre, place where the procurement centre is, place of sales centre, type of transportation and cost per km, for all possible products they transport to either procurement centre or sales centre; then, the next two questions are about hired transportation and HOPCOMS’ transportation in very much the same details.
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(modes: auto, lorry, bus, van, and truck; names of produce, place of procurement centre, sales centre, modes of transport and cost per km).

Farmers bring fruits and vegetables by bus to the City Procurement Centre

Then the farmer-producers’ questionnaire turns to some of the concerns of the farmers: loss during transportation due to lack of good roads, high transportation cost, lack of alternative facility, inadequate transportation, inefficient transportation and non-availability of exclusive modes of transport for transporting their produce at appropriate times. Question 23 seeks the information from the farmers as to their continuation with the production of the same combinations of fruits and vegetables, and if yes, are the reasons better yield, good income, easy to produce, assistance from HOPCOMS, and others; and if no, are the reasons no assistance from HOPCOMS, inadequate supply of inputs, delay in payments for the produce and any other. The next question is a logical step seeking answers as to where the farmers get credit for production and marketing (credit cooperative society, moneylender, local businessmen, commercial bank, and own money).

The next follows on with the year the farmer took the membership of HOPCOMS and then how did he come to know of HOPCOMS (friends, local market, mass media such as television, radio and print media, and traders). Then the questioning slips back to HOPCOMS, seeking from the farmers what post-harvest
facilities or incentives that the HOPCOMS provide them with (transportation, storage, grading, processing, export or any other) and goes further to seek several answers: as to whether the farmers get financial assistance from HOPCOMS, are they satisfied with the present system of working at the HOPCOMS, and what are the main reasons to sell their produce to HOPCOMS (better price, better services, nearer to their farm/land and any other). The last 2 questions are on whether or not the farmers want to suggest improvements in the present functioning of the HOPCOMS in regard to quality, price or cost, transportation, storage, grading, packaging, display and advertisement on the one hand and the farmers’ rating of the HOPCOMS, overall (excellent, very good, good, not bad, and poor).

Mangoes received at the Procurement Centre being graded and packed

The questionnaire for the farmer-producers is quite comprehensive and is designed to serve the purpose of this study, in regard to farmer-producers and their role in fruits and vegetable production and marketing. This questionnaire is in fact 31 questions long and quite simple to answer. The questionnaire was administered to the farmers in the local language, Kannada.

4.12 Consumers Questionnaire

The consumers’ questionnaire was also designed with a simple structure and ease of administration within a short time, in about 30 minutes or so, unless the
respondent seeks clarifications on the purpose of study and why he/she should be interviewed for it. There are only 25 questions, seeking relevant information from the customers of the HOPCOMS outlets, mainly in Bangalore city.

Consumers at a HOPCOMS Outlet in Bengaluru city

A HOPCOMS Outlet with fresh and variety of Vegetables
There are definite sections in the questionnaire with the first section seeking personal details of the customers, in the first five questions: name and address of the respondent, educational attainment, no formal schooling to collegiate and higher education, occupation, both main and subsidiary, size of the family (male and female adults, boys and girls and total family size), and total annual income of the family from whatever occupation the respondent is engaged in and the income of the others in the household, including their occupations and other sources.

An Official of the HOPCOMS weighs pine apples and account keeps on a ledger

The scholar at home on a festival day (a sort of Thanks Giving to Cattle). Note the bullocks are decorated with fruits, garlands and fineries on their horns.
In the next section, the name and address of the HOPCOMS outlet/s where the customers buy their fruits and vegetables (question 6), distance from their homes to the HOPCOMS outlets in km (question 7) and also the distance from the procurement centre to the outlets in km (question 8) are asked about. The next question seeks the answer to the modes of transport they use to visit / access the outlets: bicycles, two-wheeler, auto-rickshaws, four wheelers and any other. It is followed by a question on the frequency of visit to the outlet (daily, weekly, twice a week, once in 15 days and once a month) for purchases and followed by another on the average amount of money spent on fruits and vegetables from the HOPCOMS outlet. There is then a question (question 12) as to what fruits and vegetables are bought at the outlet by the consumers.

In the next section, the questions relate to the customers’ feelings of advantage or savings in purchasing fruits and vegetables at the outlet in comparison with other shops, followed by a question as to whether the customer gets required fruits and vegetables from the HOPCOMS outlet they buy from and if yes what are they and if not what fruits and vegetables are not available as required at the outlet. The customers are also asked as to whether they buy fruits and vegetables apart from the HOPCOMS and the names of such outlets (More, Reliance Fresh, Big Bazaar, Smart, Food World, Nilgiris, Hawkers or just simply shandy, street vendors and local market or others). The next solicitation is a specific one as to how long the customers have been purchasing fruits and vegetables from the specific HOPCOMS outlet they buy from, in months and years as the case may be. This question also seeks information from the customers as to the reasons why they buy fruits and vegetables from the HOPCOMS outlet: product related (choices, quality, fresh or new stocks and so on), prices related (bargain is possible, low prices, credit available, weight and discount), outlet related (better services, better packaging, better ambience, one-stop shopping, and variety), location related (close to home, proximity to work place, ease of access, attractive displays, and modes of payments), and other reasons (saves time, good will, home delivery and so on). Additionally, the question seeks information also on the customers’ sources of price information (neighbours, local market, mass media, traders and others). Of course, then the questions turn to consumers’ feelings of selling prices of fruits and vegetables being fair at the HOPCOMS when compared to
other sources and then on the knowledge of the consumers as to the prices of fruits and vegetables from other sources before they make purchases at the HOPCOMS.

A HOPCOMS Outlet specializing in fruits, especially varieties of banana

The next five questions on the consumers’ questionnaire are on the feeling of the consumers as to the purchase of fruits and vegetables from the HOPCOMS being more beneficial or advantageous compared to other sources (question 21) and if so reasons for their opinions. The reasons listed under the question number as many as 16: quality of fruits and vegetables is better; grading or standardization is better; reasonable price or cost of products; freshness of products is better; consumer is aware of and has knowledge about packaging; consumer compares the products of HOPCOMS with other market products; consumer knows the importance of supply awareness; consumer buys the products from the HOPCOMS on credit basis; consumer wants publicity or advertisement on HOPCOMS products; shopkeeper behaviour is good; consumer prefers the facility of direct marketing from the HOPCOMS; consumer knows the importance of fruits and vegetables in daily food/diet; consumer prefers the infrastructure of HOPCOMS outlets as being hi-tech (BB, RF); consumer is attracted to organized fruits and vegetables; consumer knows the aims and objectives of the HOPCOMS; and shopkeeper or HOPCOMS responds to consumers’ suggestions. In the next question, however, the consumer is asked for his/her suggestions to improve utility of quantity of services from the HOPCOMS (on
quality, price, transport, storage, grading, packaging, advertisement, display at outlets and others). It is followed by a question on the various problems facing HOPCOMS as known to the consumers as well as ‘overall’. The time spent at the HOPCOMS outlet while purchasing products (in minutes) as well as the consumers’ opinions as to the HOPCOMS Services (as being excellent, very good, good, bad, and poor) are also asked about from the consumers through the questionnaire.

Another HOPCOMS Outlet in Bengaluru City

4.13 Pilot Study

A pilot study was conducted using the two questionnaires, each with 30 farmer-producers and consumers in Bangalore Rural district, in the vicinity of HOPCOM outlets of the city. This was done essentially to test the relevance and adequacy of the questionnaires for collecting data towards assessing the usefulness and appropriateness of the questionnaires for the contexts they were designed. Proper instructions were given to the pilot respondents of the two groups before the administration of the questionnaires, separately and individually. This has enabled the scholar to identify the vague and ambiguous and also difficult to understand questions and replace them with appropriately worded, easy-to-understand questions in the final questionnaires used with the two select samples of the study later. Both before and after to the pilot study, three agribusiness experts in the academics were
consulted for improving the same. Their suggestions were duly incorporated in the questionnaires and then finalized for use in the surveys.

4.14 Questionnaire Surveys and Interviews

The questionnaire surveys and interviews were held face-to-face, free associationally, and by administering the questionnaires in the regional language (Kannada). The consumers survey was conducted earlier than the farmer-producers survey, for the consumers interviewed are concentrated in the city of Bengaluru and access to them was easy as they could be met at the HOPCOMS outlets where they bought fruits and vegetables. They were however met over a period of four months in 2013-14. The farmer-producers on the other hand are scattered across the six districts of the study and as such access to them was rather difficult. Besides, the interviews needed travels over long distances and were therefore time-consuming and also expensive. The interviews with the farmer-producers took about 6 months to complete and in 2014. The scholar had taken help and assistance from his colleagues and fellow researchers at the Institute of Development Studies for conducting the interviews and also for setting up the MSEXCEL databases for the study and analyses.

4.15 Secondary Sources of Data

According to Creswell (2005), documents have been used for gathering information in mixed methods designs. Documents have been used as complementary to other methods and fostered explanation and elaboration of results from those methods. The documents used in the study had come mainly from the HOPCOMS, Mysore Horticultural Society, and the Departments of Agriculture and Horticulture. All documents used are cited in the references section of the thesis. Most of the data sources were however accessed at the HOPCOMS Headquarters in Bengaluru and from the officials and functionaries of the HOPCOMS. The scholar spent nearly a year collecting all relevant, time-series and space-series (for a time period of 13-15 years and for procurement, storage, and marketing centres) data on fruits and vegetables crops (area, production, productivity, procurement, storage, sales and stocks) for the State of Karnataka and the six study districts. Data on India and the world were collected from various data compendia and reports of the Government of India and the World data compendia and research reports on fruits and vegetables. District at a Glance reports were very handy for census related data, even as the
scholar has used the Karnataka Census Operations’ library and offices at the City and
the district headquarters.

4.16 Statistical Methods

It is often useful to subject data to some simple statistical analysis. It may be,
for example, that such an analysis could be used to summarise the data; and to
transform them to aid understanding. The data can also be summarized in form of
index. Statistical analysis like regression and correlation, fluctuations and annual
trends over a period of time are also common. The data after analysis can be presented
in different formats: tables, graphs and charts, and even maps.

The data about which a statement or summary is to be made are called the
population, or sometimes the target population. Rarely are all data available to the
researcher. It may be physically difficult to collect all data of interest, or it may just be
financially impossible to collect them. Instead, a subset of the data called the sample
is selected and measured in such a way that conclusions about the sample may be
extended to the entire population. Statistics computed from the sample are only
inferences or estimates about characteristics of the population, such as farmer-
producers, and consumers as to what they do and how they benefit in respect of the
HOPCOMS, which is our concern in the study (see Helsel and Hirsch, 2002).

Among the statistical tools used in the study are: (a) the simple frequency and
percentage analysis of questionnaire survey data (mostly one-way tables); (b) the
regression and trend analysis, and (3) the Compound Annual Growth Rate (CAGR)
method. In order that the data are amenable to statistical analyses, the questionnaire
data have been converted into datasets using the MSEXCEL spreadsheets and the
analyses themselves have been performed using the SPSS package. The three methods
are described in some detail below.

4.17 Simple Frequency and Percentage Analysis:

For the purpose of description of sample and respondent related
characteristics, a frequency and percentage analysis has been done for all variables
extracted from the Farmer-Producer and Consumer questionnaires and put into the
datasets. First, a simple frequency of each of the fields with column percentages was
made and then some two-way tables using certain select pairs of variables were
carried out, in order to measure variations. The scholar began to explore the data, by measuring the central tendencies of the data, and more importantly, the dispersion of the data around the central tendency.

Frequency analysis is particularly useful for describing discrete categories of data having multiple choices or yes/no response formats. This analysis involves constructing a frequency distribution. The only technical requirement of the frequency analysis is that the categories of response be mutually exclusive and exhaustive. This means that the same observation cannot be counted as belonging to more than one response category. The frequency analysis must be exhaustive in the sense that all respondents must fit into a category. The tables so generated are numerous, and hence only a select number of tables are included in the text while others are interpreted so as to show the variations therein.

4.18 The Regression and Trend Analysis:

Regression is the measure of the average relationship between two or more variables in terms of the original units of the data. The term regression analysis refers to the methods by which estimates are made of the values of a variable from knowledge of the values of one or more other variables and to the measurement of the errors involved in this estimation process. Regression analysis is a statistical device with the help of which we are in a position to estimate (or predict) the unknown values of one variable from known values of another variable. The variable which is used to predict the variable of interest is called the independent variable or “explanatory” variable and the variable we are trying to predict is called the dependent variable or “explained” variable. The independent variable is denoted by \( X \) and the dependent variable by \( Y \). The equation is quite simply: \( Y = a + X^b \) where \( Y \) is the dependent variable, \( X \) is the independent variable, ‘\( a \)’ is the intercept and ‘\( b \)’ is the slope which determines the rate of change.

Where trends were fit for temporal data on the area under cultivation of fruit and vegetable crops, production of fruits and vegetables, value of production and profits over differential time periods, the regression lines were fit using the MSEXCEL version 13.0 which facilitates such fitting and calculation of \( R^2 \) and smoothing the curves as well. The equations for such fits are shown on the graphical representations of the temporal data as well.
4.19 Compounded Annual Growth Rate (CAGR):

Compound annual growth represents, in general terms, growth over a period of years, with each year's growth added to the original value. Sometimes called compound interest, the compound annual growth rate indicates how much income the investment is generating when you reinvest the returns. It is especially useful when your investment experiences significant fluctuations in growth from year to year, since a volatile market means an investment may see large returns one year, losses the next and then more moderate growth another year. It can be used not only to evaluate the performance of the investment, but to compare returns on different types of investments, such as stocks and bonds or stocks and a savings account. Business owners may use the CAGR to analyse the performance of a variety of business measures, including market share, expense, income and customer satisfaction levels. Note that the CAGR is an imaginary number used to describe the rate an investment would have grown if it had grown at a steady rate every year. There are some years where an investor/businessman received a better return than his/her final number and some years where she/he got a worse return. She/he is rarely ever going to get the same return every year.

CAGR is a business and investing specific term for the geometric progression ratio that provides a constant rate of return over the time period. CAGR is not an accounting term, but it is often used to describe some element of the business, for example, revenue, units delivered, and registered users. The rate dampens the effect of volatility of periodic returns that can render arithmetic means irrelevant. It is particularly useful to compare growth rates from different datasets such as revenue growth of companies in the same industry. The formula used here is:

\[
CAGR(t_0, t_n) = \left( \frac{V(t_n)}{V(t_0)} \right)^{\frac{1}{n-t_0}} - 1
\]

Where \(V(t_0)\): start value, \(V(t_n)\): finish value, \(t_n - t_0\): number of years.

Actual or normalized values may be used for calculation as long as they retain the same mathematical proportion.

In the present study, the CAGR method is used to see primarily the compounded annual growth rates, or in fact rates of change, in area under fruit and vegetable crops, production of fruits and vegetables, and value of production of fruits
and vegetables over differential periods of time in respect of the top ten countries and other countries of the world, India, Karnataka and the six districts of our study, including the case of top ten fruits and vegetables of the districts. The CAGR was computed using the online calculator in the present study.

The linear, log-linear, exponential and power functions are some of the important functional forms employed to study the growth rates. Different functional forms were tried in the past for working out growth rates in area, production and value of production having adapted the pattern of Chengappa (1981), Sikka et al. (1985) and Bieche et al. (1992). Some of the important forms tried were the linear growth model \(Y=a + bt\), exponential function \(Y = ab^t\) and quadratic function \(Y = a + bt + ct^2\). However, it is found that the exponential form of the function \(Y = ab^t\) is the better one and the most frequently used one. Growth is a measure of past performance of an economic variable. They are commonly used as a summary of trends in time series data. The growth function is of the form:

\[
y = ab^te^u
\]

where:
\[
y = \text{dependent variable for which growth is to be estimated}
\]
\[
a = \text{intercept}
\]
\[
b = \text{regression coefficient}
\]
\[
t = \text{time variable}
\]
\[
e = \text{exponent term (2.3018)}
\]
\[
u = \text{disturbance term}
\]

The logarithmic form of equation is \(\log y = \log a + t \log b+u\).

The compound growth rate (\(g\)) in percentage is computed from the relationship \(g = (\text{anti log of } \log b) - 1 * 100\) or \(g = (b-1)*100\)

The computed compound annual growth rates, using also SPSS besides online calculator, are interpreted in relation to area, production, value of production and profits data in respect of India, Karnataka and the six districts of our study for various time periods and fruits and vegetables and the discussion about them are in Chapters III and V of the thesis.

4.20 Data and Graphical Representation

Graphical representations and charts were simply created using the MSEXCEL ver 13.0 to illustrate the various survey data used and analysed using the
SPSS, to show both temporal and spatial variations in the aspects of our study and also to fit the regression trends of the temporal data.

4.21 Library Research

The methodology also includes the literature survey for which the University of Mysore Main Library, Libraries of the Government Departments such as the Department of Horticulture, and also those of the Karnataka Census Operations, and other library sources available in the city of Bangalore such as the Bangalore University, Institute of Social and Economic Change, and the Government of Karnataka. Besides, the internet was used / consulted, very extensively for data, documents, reports, and research papers accessible from the journals of repute from different countries. Research papers of free access online were also used in the reviews and in the assembling of ideas for the thesis.

4.22 Conclusion

Research methodology is vital for any research work that includes research design, data collection, analysis and interpretation of results. The term ‘methodology’ comprises this whole process. The final results of a research depend on the methodology that is employed and it depends on the type of data needed to answer the research questions. A ‘social sciences and management research method’ approach has been used in the study, blending the primary, secondary data collection and quantitative techniques of analysis for the purpose of inferring perspectives, understanding and also interpretation. As for qualitative methods, personal discussions with the agricultural, horticultural and HOPCOMS officials concerned and the data available have been used, both diligently and effectively. The methodology used in the study is an integrated methodology, where traditional data collection and processing are integrated with the modern, statistical as well as qualitative / participatory analysis. Interviews with the questionnaires were conducted in the six districts (for farmer-producers) and in the city of Bengaluru (for consumers) over a period of 10 months. Extensive travels were made by the scholar to conduct the interviews face-to-face. The scholar spent considerable number of months at the HOPCOMS headquarters for collecting time-space series data as well as at several major libraries of the Universities and agricultural and horticultural departments.