CHAPTER 4
RESEARCH DESIGN AND METHODOLOGY

4.1 Introduction

In the previous chapter, the researcher discussed the Literature Review. The aim of the literature review was to examine previous research and identify the gaps in current knowledge. This stage also assisted in determining the context of the research study and help position this work relative to previous works. It also assisted in the conceptualization of the research areas sufficiently to develop the main focus of the research, influence the research design and generate specific hypotheses to be tested. This chapter documents the various considerations relating to the Research Design and Methodology of the study.

Research design refers to the construction of plans and strategies designed in seeking, exploring and discovering answers to the research questions (Taylor, 2000). This chapter enumerates the exact steps followed as the researcher attempted to realize the research aims by answering the research questions. Most authors on research methods suggest that the chapter on research design and methodology typically covers the following areas: subjects or participants, instrumentation or measures, and procedures (Bennet, 1973; Charles & Mertler, 2002; Ogier, 1998; Rudestam & Newton, 1992; Slavin, 1992; Taylor, 2000). Ogier (1998) adds that the ethical considerations are also included in the discussion of methodology.

The first section discusses the “Research Objectives”. Next three sections discuss about “Methodology”, “Designing of Survey Instrument”, and “Sampling Process”, followed
by “Questionnaire administration”. This chapter concludes with a summary of the overall discussion.

### 4.2 Research Objectives

Following years of under-investment and ever increasing demands being placed upon it, Indian power sector is in woeful condition. The root of the problem with Indian power sector is as much a question of inadequate reforms as it is of insufficient investment. So far, India is losing out in the competition against other emerging economies to attract more foreign direct investment to its power sector. In recent years the government of India has allowed 100 percent FDI in the power sector under automatic route and introduced number of incentives and lucrative policy measures to attract major foreign investors into this sector. The recent World Investment Report 2007 ranks India as the second most-preferred destination for FDI by major transnational corporations (TNCs), next only to China. Despite these favorable developments, India has failed to attract a significant amount of FDI in this important sector.

The objective of the study is to understand the changing environment of the Indian Power Sector in relation to the global developments and to analyze the (1) determinants of FDI in Indian Power Sector (2) impacts of FDI on Indian Power Sector with a view of developing a framework for attracting FDI for sustainable development of energy.

The hypothesis arose as a result of prior thinking, examination of the available literature and discussion with the counsel of experts and interested parties.

Hypothesis 1 (H1): Institutional barriers to FDI in Indian Power Sector hinder FDI flows.
Hypothesis 2 (H2): Locational factors determine the flow of FDI in Indian Power Sector.

Hypothesis 3 (H3): FDI in power sector has the potential to improve energy efficiency.

Hypothesis 4 (H4): FDI flows will lead to adoption of global best practices

Hypothesis 5 (H5): FDI flows have a positive impact on Renewable sources of Energy.

Hypothesis 6 (H6): With greater FDI flow, demand supply gap will decrease.

Hypothesis 7 (H7): FDI in power sector has positive impact on socio-economic development

4.3 Methodology

Methodology refers to the principles and philosophy on which researchers base their procedures and strategies, and to the assumptions that they hold about the nature of the research they carry out. It consists of ideas underlying data collection and analysis. Methodology is more than method. The latter merely involves the procedures and techniques adopted by the researcher.

To analyze Determinants of FDI in Indian Power Sector, an integrative approach of considering macro-, micro-, and meso-economic variables is adopted. The macro-level envelops the entire economy, the micro-level denotes firms, and the meso-level represents institutions linking the two, for example government agencies issuing investment policy to enterprises.

This approach can be divided into two methods. The first method is a questionnaire survey. In a field study questionnaire, interviews and observations are taken to develop case studies. Case studies developed are analyzed by culling out typically rather than uniqueness of the situation. Focus on typicality leads to meaningful generalization and scientific
abstraction whereas uniqueness would preclude these. Case look deceptively simple, but they require thorough familiarity with the existing theoretical knowledge of the field of enquiry by the researcher and also skill to differentiate significant variables from insignificant ones (Duggal et al., 2001). Variables for questionnaire survey are identified by review of power sector specific studies pertaining to developing counties followed by a case study analysis on ST-CMS Electric Company through a powerful SAP-LAP (Situation, Actors, Process-Learning, Action, and Performance) framework for identifying real issues being faced by the investors. The second method is econometric analysis. The empirical framework employed for macroeconomic analysis of determinants of FDI in Indian Power Sector involves the use of a single econometric equation model for testing the relationship between the variables.

To analyze impacts of FDI on Indian Power Sector, a questionnaire survey approach is adopted and the variables for this study are determined through literature review.

4.3.1 SAP-LAP Analysis Technique

SAP-LAP is a holistic framework that aids the process of analysis to generate models for managerial enquiry and problem solving (Sushil, 2001). This methodology consists of two phases as follows. The case is described in SAP analysis through three basic components that define the dynamic interplay of reality in flexible systems management paradigm. These are Situation, Actor, and Process. They interact flexibly on multiple planes in the ambiguous reality and help us in understanding the reality.

Context: Context defines the background and the environmental norms that impinge upon the reality. The components operate it (Duggal et al., 2001).
Situation: The present status, potential for growth or decay, accelerating and decelerating forces, present and future state of the art, etc. taken together define the situation (Duggal et al., 2001). The situation is affected by the external factors but has no control on those external factors.

Actors: The participants who influence the situation and alter it by their actions or inaction are termed as actors (Duggal et al., 2001). Actors may be both extra and intra-mural, since both can influence the situation.

Processes: The procedural steps taken by the actors, which alter the situation, are termed as process. Some processes may be explicitly identifiable while some others would be implicit. Any dynamic behaviour that alters the situation has the potential of being a process.

Synthesis succeeds SAP analysis helping in identifying the learning issues. Learning issues emphasis the typicality of the situation as well as some features of its uniqueness. Learning issues also lead to action. While learning issues derived out of a particular case are applicable to similar other cases, this application should be preceded by proper adoption. Learning issues lead to Actions which when taken would lead to improved Performance. Improved performance is the sum of the SAP analysis and LAP synthesis as shown in Figure 3.1. The SAP-LAP paradigm has been used many researchers (Kak, 2004; Chatterjee & Chaudhuri, 2010; Rizk, 2008) to analyze the cases and learning issues.
4.3.2 Methodology for Questionnaire Survey

The function of a research instrument is to satisfy research objectives through the measurement of independent and dependent variables of interest (Churchill, 1995). The instrument was developed to measure (1) variables affecting FDI flows in Indian Power Sector and (2) variables in respect of the impact of FDI on Indian Power Sector. To ensure the accuracy, the questionnaires were designed by taking into account the following factors:

i) Academic literature, research articles and publications

ii) Pre-tested to ensure that the respondent understood the questionnaire in right perspective

The questionnaire was circulated to power sector experts and academicians with the request to provide feedback of their understanding of the questionnaire. Based on their
feed backs, necessary modifications were made to the questionnaire to make it more reliable. The questionnaires were administered to four categories of respondents:

i) Foreign Investors

ii) Indian Investors (Private Utilities)

iii) Public Utilities

iv) Policy makers & Regulators.

The reliability and validity of instrument has been established using appropriate tools and procedures. Data collected were analyzed using SPSS v17.0 (Statistical Programme for Social Sciences). Key statistical tests were carried out including Factor Analysis and Analysis of Variance (ANOVA).

Principal component factor analysis methodology with varimax rotation was used in order to categorize the questions into factors. The factor analysis is a generic name given to a class of multivariate statistical methods, whose primary purpose is to define the underlying structure in a data matrix. Broadly speaking, it addresses the problem of analyzing the structure of the interrelationships (correlations) among a large number of variables by defining a set of common underlying dimensions, known as factors (Hair et al., 1998). ANOVA was used for scoring and calibrating the factors in order of their magnitude or importance. In this procedure, one estimate comes from the differences among scores within each group. This estimate is considered a random or error variance. The second estimate of variance comes from differences in group means. This is considered a reflection of group differences. Where two of these estimates do not vary significantly, a conclusion is made that all of the group means come from the same
sampling distribution of means and that the slight differences between them are due to random error (Tabachnick & Fidell, 2001). Where, however, the group means differ significantly, a conclusion is made that they were drawn from different sampling distribution of means, and the null hypothesis that the means are the same is rejected.

4.3.3 Methodology for Econometric Analysis

The empirical framework employed for macroeconomic analysis of determinants of FDI in Indian Power Sector involves the use of a single econometric equation model for testing the relationship between the variables. The secondary data set consists of yearly observations for the period 1991 to 2010. The required secondary data set were obtained from the websites of World Bank, Asian Development Bank, Reserve Bank of India and Ministry of Commerce, Government of India. The electricity sector reforms were initiated by the government of India in 1991 with a view to attract private investment. Hence this period has been selected. The secondary data set collected were analyzed using SPSS v17.0. Key statistical tests were carried out including Correlation Analysis.

The dependent variables in the study is the ln of FDI (natural logarithm of FDI) inflow in Indian Power Sector in current USD and the independent variables that are expected to determine FDI flows are carefully chosen, based on the literature and availability of data for the selected period. The independent variables in the study include ln of Gross Domestic Product, ln of Wage rate, Inflation rate, Trade Openness, Exchange Rate (Indices of Real Effective Exchange Rate of the Indian Rupee), Infrastructure Index, Industrial Production Index, and Regulatory Quality Index. The Infrastructure index is constructed by indexing Electric Power Consumption (kwh per capita), Energy use (kg of
Considering the principal determinants of FDI, the equation is specified as follows.

\[
\ln(\text{FDI}) = b_0 + b_1\ln(\text{GDP}) + b_2\ln(\text{WAGE}) + b_3(\text{INFL}) + b_4(\text{TROP}) + b_5(\text{REER}) + b_6\text{IPI} + b_7(\text{INFI}) + b_8(\text{REGQ}) + e
\]

Where,

\[
\ln(\text{FDI}) \quad = \quad \text{natural log of FDI in Indian Power Sector in current US$}
\]

\[
\ln(\text{GDP}) \quad = \quad \ln \text{of Gross Domestic Product in current US$}
\]

\[
\ln(\text{WAGE}) \quad = \quad \ln \text{of workers remittances and compensation of employees received in US$}
\]

\[
\text{INFL} \quad = \quad \text{Inflation Rate, GDP deflator (Annual percent)}
\]

\[
\text{TROP} \quad = \quad \text{Trade Openness (the sum of service exports and imports divided by the value of GDP, all in current U.S. dollars)}
\]

\[
\text{REER} \quad = \quad \text{Indices of Real Effective Exchange Rate of the Indian Rupee 36-Currency Bilateral Weights with Base: 2004-05 = 100}
\]

\[
\text{IPI} \quad = \quad \text{Industrial Production Index}
\]

\[
\text{INFI} \quad = \quad \text{Infrastructure Index}
\]

The simple Infrastructure index is constructed by indexing electric Power Consumption (kwh per capita), Energy use (kg of oil equivalent per capita) and mobile & fixed-line telephone subscribers per 100 people.

\[
\text{INFI} = \sum Y_i / 3, \text{ where } Y_i = (X_{it} / X_{it-1}) * 100
\]

\[
\text{REGQ} \quad = \quad \text{Regulator Quality Index}
\]

\[
e \quad = \quad \text{Error term}
\]
As it is known that usually economic time series move together, therefore, if all the variables are included simultaneously in the equation there may be possibility of multicollinearity. To examine the variables which may not be included simultaneously in the equation, a bivariate correlation matrix for all the expected explanatory variables and the dependent variable was obtained. Based on the correlation matrix several variables were selected as the possible explanatory variables.

Figure 4.2 gives the flow chart of methodology described above and followed in the study.
Figure 4.2: Flow Chart of Methodology

**Literature Review**

to determine research gaps and conceptualize research focus

- Review of Power Sector Specific studies in developing countries
- Case Study on ST-CMS Electric Company to explore issues affecting FDI in Indian Power Sector using SAP-LAP analysis
- Identification of variables affecting FDI flows in Indian Power Sector
- Designing of survey instrument and its pre-testing

**Identification of variables affecting FDI flows in Indian Power Sector**

- Collection of Secondary Data from the websites of:
  1. World Bank
  2. Reserve Bank of India
  3. Ministry of Commerce, GoI
- Data Analysis and Testing including correlation analysis

**Data Analysis**
- Factor Analysis
- ANOVA- one way

**Results:**
Determinants of FDI in Indian Power Sector

**Discussion**

**Collection of Primary Data from stake holders:**
1. Foreign Investors
2. Indian Investors (Pvt. Utilities)
3. Public Utilities
4. Policy makers & Regulators

**Data Analysis**
- Factor Analysis
- ANOVA- one way

**Results:**
Impacts of FDI on Indian Power Sector

**Conclusion**
Recommendation
Further Research Options
4.4 Designing of Survey Instrument

A questionnaire permits a gathering of necessary data to enable segregation of respondents and answering the research questions. Because the basic purpose of the questionnaire is to meet research objectives and to answer research questions, the questionnaire design can be regarded as an important facet of the research process because it directly affects the quality of the data collected (Sommer & Sommer, 1991; de Vaus, 2001).

In this study, the questionnaire was designed keeping in view the objective of the study. Firstly, the questionnaire and response format were standardized so that stimuli were same for all respondents. Secondly, the questionnaire was designed in a way to provide comprehensible questions to motivate respondents to cooperate and complete accurately all the questions asked. Finally it facilitated and simplified administrative and data which are required for this study (Frazer & Lawley, 2000; Malhotra, 2007). For this study, the questionnaire employed the close-ended questions format, in which the respondent is asked to select an answer from among a list provided. The main strength of using such format is that close-ended questions are easy to ask, reduce interviewer bias, faster to administer, provide a greater uniformity of responses and are more easily processed (Kinnear & Taylor, 1996). The questionnaire comprised of three parts. The part one consists of general profile of the respondent. The second part consists of determinant factors affecting FDI in Indian power sector. The third part consists of Impact of FDI on Indian power sector. All the items were assessed on a five-point Likert scale where 1 represents “strongly disagree” and 5 represents “strongly agree”. The Likert scale is regarded as an itemised rating scale because each category of the scale is numbered
and/or briefly described (Churchill, 1995; Malhotra & Birks, 1999). To ensure the accuracy, the questionnaires were designed by taking into account the academic literature, research articles and publications. The questionnaire is shown in Appendix A.

### 4.4.1 Questionnaire format

The survey instrument is a close-ended questionnaire. A covering letter is placed in the first page of the questionnaire to explain the purpose of the study and to request the respondent’s co-operation regarding the interview. The questionnaire comprised of three parts. The part one consists of general profile of the respondent. The second part consists of determinant factors affecting FDI in Indian power sector. The third part consists of Impact of FDI on Indian power sector. In arranging the questionnaire, related questions were grouped together within the construct. This seemed logical, as it enabled easier variable connection for data analysis and was simpler for participants to have one question flow to another (Foddy, 1993). Many researchers agree with the recommendation that the questionnaire should begin with questions that reflect the major theme of the study.

### 4.4.2 Validity

One criterion for evaluating the soundness of a research instrument is validity, the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration. An assessment of validity would indicate how well a particular measure captures what it is designed to measure. It is important to point out that reliability and validity are closely related but they are not perfectly independent of one another. Reliability, although necessary for validity, is not in itself sufficient and can guarantee
validity, and vice versa (Rose & Sullivan, 1996; Hair et al., 1998). This means that a construct may be consistent (reliable) but not accurate (valid), or otherwise, it may be accurate but not consistent. A measuring instrument is considered to be valid if it does “what it is purported to measure” (Rust & Golombok, 1999). Validation of an instrument always demands empirical investigations, with the nature of the evidence required depending on the type of validity (Nunnally & Bernstein, 1994). Two types of validity are of applicable to this study: (1) content validity and (2) construct validity.

**Content validity**

Sometimes called face validity, content validity is a judgmental evaluation of how well the content of a scale represents the measures. There is no statistical criterion for assessing the degree of content validity. The justification of the selection of item statements to be included in the sets of scale intended to measure a construct that is content valid is very much subjective in nature. In this connection, Zikmund (2000) recommended that the scale items should be reviewed by experts to examine whether they cover the entire domain of the construct being measured. When it appears evident to experts that the measure provides adequate coverage of the concept, a measure has content validity.

In this study, the content validity of the measurement instrument was assessed by asking a few experts to examine it and provide feedback for revision. After they reviewed the questionnaire, changes were made to clarify and eliminate ambiguous statements in instructions and questions according to their recommendations. In addition, during the pilot test, each item statement was examined for its clarity and relevance to the purpose
of the research, which resulted in some modifications to the questions. Section 4.5.4 discusses in detail the pilot testing of the questionnaire.

**Construct validity**

Construct validity is the approach to validating a measure by determining what construct, concept or trait the instrument in fact measuring (Churchill, 1995). There are two categories of content validity, both of which are of interest in this study: convergent validity and discriminant validity. Convergent validity refers to the degree to which the scale correlates in the direction with other measures of the same construct. In other words, the items show homogeneity within the same construct. Discriminant validity, on the other hand, refers to the extent to which a measure is distinct from other measures, that is, it shows heterogeneity between different constructs (Malhotra & Birks 1999).

Ideally, we expect to see an item to be related with each other items that measure the same constructs (convergent validity), but to differ from items which measure different constructs (discriminant validity). Both types of validity in this study are assessed by using factor analysis. Such analysis provides an empirical assessment of the relationships among items in a variable in forming the conceptual and empirical foundation of a summated scale.

**4.4.3 Reliability**

Measures of variables should have reliability in order to draw valid inferences from the research. According to Malhotra & Birks (1999), systematic sources of error, because they “affect the measurement in a constant way and do not lead to inconsistency” do not have an adverse impact on reliability. However, random error would results in
inconsistency and leads to lower reliability. Thus reliability is “the extent to which measures are free from random error” (Malhotra & Birks, 1999).

The reliability of items has been assessed by computing the coefficient alpha or Cronbach’s alpha (Cronbach, 1951), that measures the internal consistency of the items. The value of alpha can range from 0 to 1. The nearer the value of alpha to 1, the better the reliability. However, the level of acceptable reliability is a contentious issue. For a measure to be acceptable, Cronbach’s alpha value should be above 0.7 (Nunnally & Bernstein, 1994). In the present study, Cronbach’s alpha values obtained for the dimensions has been in the range from 0.751 to 0.932 indicating good consistency among the items within each dimension.

4.4.4 Pre-testing

Pilot studies are often essential to establish that a questionnaire is well designed and will be able to achieve all the data gathering objectives of the main survey. Apart from being useful in evaluating the clarity, feasibility and comprehensiveness of a survey, pilot studies go a long way in testing the rigour and robustness of methodological frameworks for surveys. Pilot testing a questionnaire consists of trying it out on a small sample of persons having characteristics as similar as possible to those who will be included in the actual survey (Reynolds et al., 1993).

A pilot study has been conducted with a small sample size of 40 to ensure that the respondent understood the questionnaire in right perspective. The questionnaire was circulated to power sector experts and academicians with the request to provide feedback of their understanding of the questionnaire. Based on their feed backs, necessary
modifications were made to the questionnaire to make it more reliable and hence confirming the content validity.

4.5 Sampling Process

Sampling is a process of selecting a sufficient number of elements from the population so that by studying the sample, and understanding the properties or the characteristics of the sample subjects, the researcher will be able to generalise the properties or characteristics to the population elements. Sampling overcomes the difficulties of collecting data from the entire population which can be impossible or prohibitive in terms of time, costs and other human resources (Forza, 2002).

4.5.1 The Sample

The first step in selecting a sample is to identify the population from which the sample is to be selected. The basic principle of sampling is that by selecting some of the elements in a population, a researcher may draw conclusions about the entire population. A sample is a portion or a subset of a larger group called a population. The population is the universe to be sampled. A good sample is a miniature version of the population - just like it, only smaller (Fink, 1995). It is therefore important that the sample characteristics will be the same as those of the population. This is because in any research, results will refer to that defined population and to none other.

In this study, the target sample surveyed included are Foreign Investors, Indian Investors (Private Utilities), Public Utilities, and Policy makers & Regulators. The questionnaires were administered to four categories of respondents:

i) Foreign Investors
ii) Indian Investors (Private Utilities)

iii) Public Utilities

iv) Policy makers & Regulators.

4.5.2 Sample Size

Having defined the population of interest, the next concern is to determine the required sample size for this study. According to Forza (2002), determining sample size is a complex issue which is linked to the significance level and the statistical power of the test, and also to the size of the researched relationship. However, Burns (2000) & May (2001) are of the opinion that sample size is not necessarily the most important consideration when designing a survey. In fact, quantitative research does not always mean involving very large samples. While a large sample size would give a better accuracy in the findings (Kumar, 1999; Burns, 2000), it also increases the probability of committing non-sampling errors such as errors in administering the data collection.

A wide range of recommendations regarding sample size for factor analysis have been made. These are usually stated in terms of either the minimum sample size \( N \) for a particular analysis or the minimum ratio of \( N \) to the number of variables, \( p \) i.e. the number of survey items being subjected to factor analysis (MacCallum et al., 1999). Gorsuch (1983) and Brayant & Yamold (1995) recommended minimum five subjects per item, with a minimum of 100 subjects, regardless of the number of items.

4.5.3 The sampling procedure

To have a representative finding, the sampling technique used must be objective. This is an important attempt adopted by most researchers in order to provide a finding applicable
to the general. Using simple random sampling method, 225 questionnaires were distributed, and 164 questionnaires returned fully completed to the researcher.

4.6 Questionnaire administration

Having designed the sampling procedure, the discussion moves on how the survey was conducted. This is the phase where the researcher makes contact with the respondents, administer the data collection instrument, record the data and return the data for processing.

A personal interviewing technique was undertaken where there is a personal interface between the interviewer and respondents. The survey period stretched over four months from April 2009 to July 2009. The respondents were also assured that the study is conducted solely for academic purposes and all information obtained are treated as strictly confidential. The cover letter explained the purpose of the study, provided information on how to complete the survey, promised anonymity, and requested cooperation in the completion and return of the survey.

For those who agreed to participate in the survey, the questionnaire was handed over and explanations were given so to avoid bias and misinterpretation of the statements in the questionnaire. The respondents were shown the numbers (scales) and the assignment of each number to each category of option. This was clearly expressed because once they understood these rating scales, response to the questions asked will be much better.

The questionnaires were administered to four categories of respondents:

i) Foreign Investors
ii) Indian Investors (Private Utilities)

iii) Public Utilities

iv) Policy makers & Regulators.

Using simple random sampling method, 225 questionnaires were distributed, and 164 questionnaires returned fully completed to the researcher. That means there was a response rate of 72.88%. According to Mangione (1995) response rates in the 70% to 80% range are viewed as very good.

4.7 Summary

This chapter has provided discussion of the methodological approach to the study, which serves as the direction to fulfill the research objectives. Various considerations involved with the formulation of research design that applied a systematic approach to data collection. Each stage in research undertaking and its methodology has been described briefly, together with the procedures of collecting the required data.

A quantitative method was adopted in this thesis because it provides precision, reliability and testability. It also offers a high degree of generalisability of the findings from the sample to the population. Quantitative data can be measured more easily, patterns can be established more clearly and therefore any patterns, which are discovered, and generalizations made will be accurate since they are located within a large body of materials. The aim was to test a number of hypotheses that have been deduced from the study.
To ensure the validity of the findings from this study, the design of the questionnaire followed the principles of instrument design developed within the academic community. This included a rigorous process of generating items from the literature and assessing their representativeness. This was followed by a pilot testing in order to clarify the questions and the appropriateness of the proposed scales.

The next chapter discusses the analytical procedures of data analysis, indicating the reason for its use, the technical approach followed and assumptions of each technique applied.