3.1 Research Design

A research design is a master plan specifying the methods and procedure for collecting and analyzing the needed information. It is a framework or blue print that plans the action for research projects. The objectives of the study determined during the early stages of the research are included in the design to ensure that information collected is appropriate for solving the problems. The investigators specify the sources of information, the research methods and techniques, and the schedule of the research. In this chapter, an attempt is made to explain the terms, methods and techniques used for efficient and effective analysis. These are explained as hereunder:

3.1.1 Definitions and Research Questions

Literature survey helped us to understand the current state of retail industry, factors affecting retail SC performance, SCP, CA, OP, and KPI for modeling supply chain performance. The detailed discussion regarding these terms is as hereunder:

3.1.1.1 Definitions

Definition 1

Current State of the Retail Industry

Current state of retail industry is the degree of competition in terms of market share, turnover and major players in the arena.
We have elaborated this definition in chapter 4.

**Definition 2**

Supply Chain Practices

*Supply chain management practices are the set of activities undertaken by an organization to promote effective management of its supply chain* (Li et al., 2007). These are also defined as the set of procedures and guidelines that organizations follow for competitive advantage in the market.

We have elaborated this definition in chapter 6.

**Definition 3**

Metric

*A metric is a measurement, taken over time, which communicates vital information about a process or activity.*

We have elaborated this definition in chapter 7.

**Definition 4**

Model

*A model is a representation to understand the actual situation that makes better decisions or simply to understand the actual situation better.*

We have elaborated this definition in chapter 8.

**3.1.1.2 Research Questions**

**Research Question 1**

*What is the current state of Indian organized retail industry?*

1.1 *How many players are there in the industry?*

1.2 *What is the industry sale and growth pattern?*
Research Question 2

What are the factors affecting supply chain performance?

2.1 What is supply chain performance?

2.2 How we can identify the factors affecting supply chain performance?

2.3 How we can classify the factors affecting supply chain performance?

Research Question 3

What is the impact of supply chain practices on competitive advantage and organizational performance?

3.1 What are supply chain practices?

3.2 How we can classify them?

3.3 What are competitive advantage factors?

3.4 What are organizational performance factors?

3.5 What is the relationship between supply chain practices, competitive advantage and organizational performance?

Research Question 4

How we can develop metrics for successful supply chain performance measurement?

4.1 What are supply chain performance indicators?

4.2 What are the indicators affecting supply chain performances of organized non-livestock retail industry in India?

4.3 How we can classify them?

Research Question 5

How we can develop and validate a model for measuring SC performance of organized non-livestock retail industry?
5.1 What are various modeling methods for supply chain performance and their limitations?

5.2 What are the available models and their limitations?

5.3 How we can select a methodology for modeling supply chain performance?

5.4 How can we test and validate the model for organized non-livestock retailing?

3.1.2 Research Methods

A research method is an action plan for getting from the initial set of questions to be answered to some set of conclusions about these questions. It guides the investigator in the process of collecting, analyzing, and interpreting observations. It is a logical model of proof that allows the researcher to draw inferences concerning casual relations among the variables under investigation. The research design also defines the domain of generalisability that is whether the obtained interpretations can be generalized to a larger population or to different situations (Yin, 1994). There are different means to classify research methods. Kothari (1990) classified the research methods as:

1. **Exploratory research**: It is termed as formulative research studies. It is used to formulate the problem for more precise investigation of the working hypothesis from an operational point of view.

2. **Descriptive and diagnostic research**: Descriptive research studies are concerned with describing the characteristics of a particular individual or a group. Diagnostic research study is concerned with the frequency with which an event or an activity occurs or its association with other events or activities.
3. **Hypothesis testing**: It is generally known as experimental method. Here, researchers test the hypothesis for causal relationship between variables.

Malhotra (1993) classified the research methods as *qualitative* and *quantitative*. Qualitative research attempts to quantify qualitative data and uses statistical analysis to test the hypothesis that the researcher begins with. On the other hand, quantitative research produced findings without the use of statistical procedures (Newman, 1997). The qualitative research provides insights and understandings, while quantitative research generalizes them (Perry, 1998).

Yin (1994) defined the *case study* research method as, “An empirical enquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidences are used”. Moballegi and Shivraj (2007) quoted that case study method provides a complete understanding of an event or a situation. This comprehensive understanding is arrived at through thick description of the entity being evaluated, the characteristics of the people involved in it and the nature of the community in which it is located.

The research strategy could be exploratory, descriptive, or explanatory. There may be exploratory case studies, descriptive, or explanatory case studies (Yin, 1994). There may also be descriptive experiments, exploratory and explanatory experiments. This classification does not imply that there are sharp boundaries between the strategies, but they are overlapping among them. The basic comparison between various research methodologies is shown in Table 3.1.
Table 3.1
Relevant situation for different research strategies

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Form of Research Questions</th>
<th>Requires Control of Behavioral Events?</th>
<th>Focus on Contemporary Events?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>How, Why?</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Survey</td>
<td>Who, What, Where, How many, How much?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Archival Analysis</td>
<td>Who, What, Where, How many, How much?</td>
<td>No</td>
<td>Yes/No</td>
</tr>
<tr>
<td>History</td>
<td>How, Why?</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Case Study</td>
<td>How, Why?</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

(Source: COSMOS Corporation)

In this research, we adopted both quantitative and qualitative research method. The quantitative research was required to examine the current state of retail industry in India it also helped to select respondents for the qualitative analysis of questionnaires. The reason for selecting both the methods was the quantitative and qualitative nature of the research objectives. However, major part of the research was based on qualitative analysis.

3.1.3 Define the Sample Size

It was very difficult to determine the population variance. The variance was calculated based on pilot survey (Cochran, 1997). The variance found in the pilot study was used to investigate the sample size being investigated. The value of the sample size is calculated (Barbetta et al., 2004) as follow:

\[ N = \left(\frac{ZS}{E}\right)^2 = \left(1.96\times77.4/9.4\right)^2 = 261 \text{ respondents} \]

The reliability level is 95% and an error \(E=9.4\), \(Z=1.96\), pretest standard deviation (S) was 77.40. Where:
N = the initial sample size

S = the standard deviation of population = 77.40

E = the acceptable magnitude of error or maximum sampling error tolerated = 9.4 at 95% confidence level.

As a general rule, there should be at least five times number of observations per variable to be analyzed and more acceptable sample size would be 10:1 ratio (Hair et al., 2009). Here, we have maximum 25 variables under single independent objective; hence the sample size of 250 was acceptable. However, in this study we used sample size of 401-402 for data analysis keeping in mind the requirements of SEM.

### 3.1.4 Implementation of Sampling Plan

A list of expected respondents was prepared based on India Retail Reports (2007 and 2009), organizational websites, Retail Telephone Directory 2009, Prowess database maintained by CMIE and, journal and magazines on retail. The respondents so selected were, picked randomly and asked for their willingness to response. Later, they were mailed the questionnaire and followed for response.

### 3.1.4.1 Advantages of the Type of Sampling Process and Research Method

The probability sampling method used in this research has the advantages over other methods, so that statistical analysis can be generalized from the population being investigated. Also the chances of respondent bias shall be eliminated. The method of collecting information from the respondent using Internet and e-mail has disadvantage of low response rate. In this method, the respondents selected on probability basis were followed by telephonic conversation to tell the objectives of the study and the importance of the research. They were also verified for the
knowledge of SCM and the dealing with it. Then the questionnaires were mailed and followed for response telephonically.

3.1.5 Sample Characteristics

A survey questionnaire was used based on strong literature support as a primary research instrument and a total of 560 questionnaires were distributed. It was found that 40-41 questionnaires were found incomplete out of received 442 responses, thereby, yielding the response rate of 72%. The unit of analysis consisted of organized NLR industry and items of analysis were the retail professional dealing with SCP in this industry. The target population of the study was organized NLR personnel engaged with SCM in the major cities of Punjab, viz. Patiala, Ludhiana, Jalandhar, Amritsar, Mohali, Kharar, Morinda, Samrala, Ropar, Bathinda, Gurdaspur, Faridkot, Chandigarh, Fatehgarh Sahib, Kurali, Mansa, Moga, and Muktsar, etc. The respondents were also selected from New Delhi and Gurgaon. The broader detailed respondents’ characteristics are shown in Table 3.2 as hereunder:

Table 3.2
Profile of respondents

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Designation and Number</th>
<th>% of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Level (100)</td>
<td>CEO=2; President=1; Vice President=1; Business Head=3; General Manager=3; Senior Officers=68; Quality Head=22</td>
<td>CEO=0.5; President=0.25; Vice President=0.25; Business Head=0.75; General Manager=0.75; Senior Officers=16.9; Quality Head=5.5</td>
</tr>
<tr>
<td>Middle Level (134)</td>
<td>Manager (Marketing)=25; Manager (Supply Chain)=16; Manager (Quality Assurance)=18; Officer (MIS)=16; Coordinator (MIS)=10; Deputy Manager (Marketing and Sales)=21; Deputy Manager (Purchase)=28</td>
<td>Manager (Marketing)=6.2; Manager (Supply Chain)=4.0; Manager (Quality Assurance)=4.5; Officer (MIS)=4.0; Coordinator (MIS)=2.5; Deputy Manager (Marketing and Sales)=5.2; Deputy Manager (Purchase)=7</td>
</tr>
<tr>
<td>Lower Level (168)</td>
<td>Store Manager=90 Store Supervisors=78</td>
<td>Store Manager=22.4 Store Supervisors=19.3</td>
</tr>
</tbody>
</table>
3.1.6 Non-Response Bias

Non response bias was evaluated using two methods. The first method tested for significant differences between early respondents and late respondents. The late respondents were considered as surrogate for non-respondents (Armstrong and Overton, 1977). F-tests were performed using locational position. The population was divided into three areas: Top (Punjab), Middle (New-Delhi) and Lower (Gurgaon). Results show that no significant differences exist for the responses among Top, Middle, and Lower areas.

3.1.7 Scale Development and Testing

Scale testing is one of the important pre-requisite for data analysis. The following considerations were made in this research for unidimensionality, reliability and validity:

1. **Uni-dimensionality**: It refers to the existence of a single concept underlying a group of measures and is important to assess before structural model testing is done (Gerbing and Anderson, 1988). Assessment was based on screen plots and Eigen values greater than 1.0 for first dimension and Eigen values less than 1.0 for second values supports the constructs exhibit unidimensionality. So, the each item should load on single factor.

2. **Reliability**: It is the assessment of consistency among multiple measures of a variable. Reliability represents the systematic variance of the constructs (O’Leary and Vokurka, 1998). First method is to test and re-test, by which consistency would be measured between the responses for an individual at two points for checking the variability in response at a time. Second method is reliability of internal consistency, which applies to the consistency among the variables in a summated scale. Here, the rationale for internal consistency is that the individual items or indicators of the scale should be all measuring the same construct and highly inter-
correlated. However, the single measure is not perfect, so, we shall rely on a series of diagnostic measures to assess internal consistency as hereunder (Hair et al., 2009):

a) Item-to-total correlation (correlation of the item to summated scale) ≥0.5

b) Inter-item correlation (Correlation among items within a factor) ≥0.3

c) Reliability coefficient (Cronbach’s alpha) ≥0.6 general constructs and ≥0.4 for broadly defined constructs.

d) The reliability measures derived from confirmatory factor analysis focus on construct reliability where:

\[ \text{Construct Reliability} = \frac{\text{sum of squares of factor loading}}{(\text{sum of squares of factor loading} + \text{sum of error variance terms for constructs})} = \frac{\sum_{i=1}^{n} \lambda_i^2}{(\sum_{i=1}^{n} \lambda_i^2 + \sum_{i=1}^{n} \delta_i)} \geq 0.6 \]

Also various fit indices like TLI, CFI, and RMR etc. may also be considered for SEM.

e) The constructs should have minimum loading of two items.

f) The Eigen value should be ≥1.0.

g) Bartlett’s test of sphericity: a test for the presence of correlation among variables. It provides the statistical significance that the correlation matrix has significant correlation among at least some of the variables. The value is acceptable for p (level of significance) ≤0.05.

h) The value of Cronbach’s alpha greater than 0.7 is considered reliable (Nunnally, 1978). Van de Venn and Ferry (1980) suggested that the alpha value may be low (0.4) for broadly defined constructs. While several researchers suggested 0.6 should be often used as practical lower bound (Flynn et al., 1994). In this research, analysis was performed to retain and delete scale items for developing a refined reliable scale. Here, inter item correlations and Cronbach’s alpha was used. Inter-item correlations show the extent to which an item is correlated to another item of the set under consideration. Here, the items with low inter-item correlation are considered for
deletion (Netemeyer et al., 2003). Also, the Eigen values greater than one was considered. The Cronbach’s alpha of the scale was above 0.7 which was a good indicator to go ahead for factor analysis and structural equation modeling (Cronbach, 1990).

2. Validity: It is the extent to which a scale or set of measures accurately represent the concept of interest. It includes the following:

Content validity: The content or face validity is the subjective agreement among professionals that a scale logically appears to reflect accurately what it purports to measure. The consultations with consultants and practitioners in retail SCM have done this validity. Once the scale was developed it was tested through pre-pilot and pilot survey. Late, large scale data survey was done.

Convergent validity: It refers how well the item measures relate to one another with respect to common concept and was exhibited by having significant factor loadings (≥0.5) of the measurement hypothesized, constructs and high correlation among items (≥0.3) within a construct (Anderson and Gerbing, 1984).

Discriminant validity: It represents how well an item measure relates to its hypothesized constructs vs. other constructs in the model (Kerlinger, 1973). It is also interpreted as how much two conceptual concepts are distinct. The empirical test here again was the correlation, but this time the summated scale was correlated with a similar but conceptually distinct measure. Now, the correlation was low demonstrating that summated scale was different from other similar concepts.
Construct Validity: The validity establishes how much a measure confirms a network of related hypotheses generated from a theory based on the concepts. The results obtained from data analysis were consistent with theoretical logics. This was explained with the consonance of results with results existing in the literature. The communality ($h^2 \geq 0.5$) was good for sufficient explanation of the constructs.

Criterion Validity: The criterion validity is classified as either concurrent validity or predictive validity. Depending on the time sequence in which the ‘new’ measurement scale and the criterion measurement scale were correlated. To verify these two columns were selected for the single item rating and it was found that they were highly correlated. The predictive validity shows the gap when two measures differ on the time scale. This was done by repeated survey and it was found that there was not much difference in the results of two different time recorded responses. In this chapter, an attempt was made to develop a fool proof methodology for conducting the research. All the steps were well defined and executed in systematic manner to provide valuable insights for organized NLR.

3.1.8 Research Process

The research process consists of closely related activities to carry effectively research and the desired sequence of these steps. In this research the necessary steps are as follows:

1. **Problem definition:** The collected information from the seminars, conferences and discussions with leading consultants and practitioners in SCM and statistical analyst in India and abroad defined the research problem. The discussion has led to the suggestion that organized retailing is new in India and many national and international players are trying in it. It has vast potential and opportunities where research is needed to be explored. This led us to focus
attention on this sector. Also, this region is rich in agricultural production, despite good production it lack efficiency and effectiveness. So, we decided to focus on organized NLR based on research gap analysis.

2. **Literature survey**: The literature survey consists of the review of previous research findings, theories and concepts. In this survey, we have gone for various national and international standard books on SCM, retailing, research methodologies, statistics and SC modeling. Besides this, we have collected research papers from international and national journal on-supply chain management, retailing, operations management, logistics management, operations research, decision sciences and simulation modeling, etc.

3. **Questionnaire design**: Based on the literature survey in consultation of consultants and practitioners in organized NLR, the questionnaire was designed and it was sent for pre-pilot survey to the leading practitioners and consultants in organized NLR in India. The questionnaires were received back with recommendations and suggestions to improve them. Based on the recommendations and suggestions, pilot survey was done and questionnaires were improved. Later, it was improved and the large scale survey was done.

4. **Number of organizations and respondents selected**: The unit of analysis consists of organized non-livestock retailers operating in principal cities of Punjab, Chandigarh, Gurgaon and New Delhi. Based on ‘Retail Report 2007’, organizational websites, ‘Retail Pitch, Dec, 2007’ Retail Telephone Directory, PROWESS and ‘Retail Report 2009’, top players in this industry were selected for analysis. The telephone numbers and addresses were collected from the secondary sources for company CEOs’, Presidents, Vice-Presidents, General Managers, Managers and Supervisors etc. engaged with organized NLR. The respondents were selected
randomly based on the telephone addresses. The respondents so selected, were asked for their willingness to fill questionnaires. Later, questionnaires were mailed and followed for response. Some of them were also visited to provide better insights on the research problem. However, due to secrecy and confidentiality their names are not showed in the list of respondents, but publicly published data was shown in the research.

5. Data analysis and interpretation: The research was based on both secondary and primary data. The secondary data were collected from The Retail Report 2007, The Retail Report 2009, PROWESS, organizational websites, journal and magazines, etc. The data so collected was used to identify retail players, industry sales and growth and respondent selection etc. The primary data was collected using a questionnaire on five points Likert Scale for factors affecting supply chain performance, supply chain practices and their impact on organizational performance and key performance indicators. The approximate respondent bases of 560 were used for collecting the information on a well structured questionnaire on five points Likert scale. The technique of factor analysis was used to classify factors affecting SC performance and KPI. It was also used to group SCP used in this industry. Structural models were developed to test the hypothesis for impact of SCP on OP and CA and KPI using SEM. Also the technique of SEM was used to develop test and validate a SC performance measurement model based on key performance indicators.

3.1.9 Data Analysis

After collecting the information through questionnaire the data collected was digitized on SPSS spreadsheet. The technique of factor analysis (principal component analysis with Varimax Rotation) was performed to identify the underlying information under factors affecting SC
performance, supply chain practices and key performance indicators. AMOS 4.0 was used to test the hypothesis supply chain practices, competitive advantage and organizational performance. It was also used for testing hypothesis for performance indicators and developing, validating and testing the model for measuring SC performance of organized NLR industry. The primary data collected for organized NLR was analyzed for identifying growth by segments and various players in this industry.