CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

As mentioned in Chapter-1, major objective of the study is to study coordination and responsiveness issues of supply chain management in Indian Small and Medium Enterprises (SMEs). To achieve these objectives, study identifies major priorities while forming supply chain strategy, problems faced by SMEs during implementation of SCM and risks SMEs feel while working in supply chain. In addition to this, present study also identifies the importance of different factors for improving coordination in supply chain of SMEs, importance of selection and evaluation of key suppliers, involvement of key suppliers and customers in decision making. Present study also identifies different issues leads to distortion of actual demand, level of IT application, types of IT tools/modern technologies used and critical success factors for implementation of SCM in SMEs. Finally it will try to analyze the effect of different SCM issues on performance under criterions such as customer service and satisfaction, innovation and growth, financial and internal business parameters. For studying these issues, input data were collected from industry by questionnaire based survey. Detailed methodology adopted for analyzing industry data is explained in present chapter.

In this chapter, first research methodology for this study and its justification will be described. After this, development of questionnaire and its administration will be discussed. Finally description of statistical tools being used for analysis of data will be discussed.

3.2 Research methodology

In this study, empirical research methodology is used to analyze various issues related with coordination and responsiveness of supply chain in Indian SMEs. Data were collected from various organizations of different sectors and regions of India. Research methodology adopted for this is given in Figure 3.1.
On the basis of literature review and gap analysis, issues for study were identified. After identification of these issues, preliminary framework for developing the questionnaire was prepared. Questionnaire was finalized on the basis of pilot survey of forty organizations, discussion with academicians and professionals from industries during visits and inputs from literature. Questionnaire was mailed to about one thousand and five hundred organisations of different categories, sectors (auto components, plastics, electrical, electronic, light engg. and others.) and regions for collecting responses. In spite of continuous e-mails, telephones, reminders and personal visits to plants, only two hundred and ninety one responses were received. Out of these forty responses were rejected due to incomplete information provided by the respondents. So only two hundred and fifty one complete responses were received and further used for data analysis.

Data collected from survey are analyzed by using various statistical tools such as one sample t-test, correlation and regression analysis. Research propositions are framed and tested for finding effects of different factors on others and on performance of SMEs. For statistical testing SPSS (version 17.0) software is used. For analyzing various issues of coordination and responsiveness in depth, two case studies from different sectors are carried out by SAP-LAP methodology.

On the basis of the results from survey and discussion with experts from industry and academia, different critical success factors (CSFs) of coordination and responsiveness are identified. Interpretive Structural Modeling (ISM) of these CSFs is done to establish structural relationship between various factors and to integrate issues from implementation point of view.
In this study, empirical research is used to study various coordination and responsiveness issues of supply chain management in Indian SMEs. Surveys are fairly common in empirical production and operation management research (Malhotra and Grover, 1998). The term “empirical” (which means knowledge based on real world observations) is used
here to describe field based research, which uses data gathered from naturally occurring situations or experiments, rather than via laboratory or simulation studies (Flynn et al. 1990). Empirical research provides a powerful tool for building or verifying theory.

Survey involves the collection of information from a large group of population. It relies on self-reports of factual data, as well as opinions. Survey research methodology has often been used to compute data from business organizations (Malhotra and Grover, 1998). Flynn et al. (1990) indicated that survey designs with questionnaire are most commonly used methodology in empirical research. The survey was structured to elicit response on various issues of coordination and responsiveness of SCM in Indian SMEs.

The case study methodology was used due to exploratory nature of this research. Case studies provide an in-depth, relatively unstructured, approach to develop frameworks and theories. The purpose of the case studies is to evaluate or even adjust the framework that is based on literature. According to Yin (1989), the case method is suited to situations where the research is attempting to answer a “how?” question as well as or instead of a “what?” question. It is also suited to situations where phenomenon and the context in which they exist are difficult to separate. These conditions apply to present research also.

Case research has emerged as effective methodology for research in fast changing market. According to Lewis (1998), to cope with the growing frequency and magnitude of changes in technology and managerial methods, operations management researchers have been calling for greater employment of field based research methods. There are several challenges in conducting case research: it is time consuming, it needs skilled interviewers, care is needed in drawing generalisable conclusions from a limited set of cases and in ensuring rigorous research. Despite this, the results of case research can have very high impact. Unconstrained by the rigid limits of questionnaires and models, it can lead to new and creative insights, development of new theory and have high validity with practitioners-the ultimate user of research (Voss et al., 2002). Meredith (1998) cites following advantages of conducting case research.
• The phenomenon can be studied in its natural setting and meaningful, relevant theory can be generated from the understanding gained through observing actual practice.

• The case method allows the questions of why, what and how, to be answered with a relatively full understanding of the nature and complexity of the complete phenomenon.

• The case method lends itself to early, exploratory investigations where the variables are still unknown and the phenomenon not all understood.

Various researchers have used case study for their research (Gunasekaran and Cecille, 1998, Gunasekaran et al., 2001, Dangayach and Deshmukh, 2001, Taylor et al., 2004, Al-Najjar and Alsyouf, 2004, Cassel et al., 2006, Arshinder et al., 2007, Thakkar et al., 2008, Kumar et al., 2012 and Singh et al., 2012). Case studies are done using SAP-LAP methodology. This methodology consists of two steps. In the first step, the SAP analysis, the dynamic parameters of a case are highlighted through the three dynamic interface of any business system. These interfaces are situations (S), actors (A), and processes (P). The second step is LAP synthesis. LAP has three components. These are learning issues (L), actions recommended (A), and anticipated improvement in performance (P).

For developing relationship between different variables of a complex system, ISM has emerged as an effective methodology. Interpretive structural modeling (ISM) is an interactive learning process. The method is interpretive in that the group’s judgment decides whether and how items are related, it is structural in that, on the basis of the relationship, an overall structure is extracted from the complex set of items, and it is modeling in that the specific relationship and overall structure are portrayed in a digraph model. ISM methodology helps to impose order and direction on the complexity of relationships among elements of a system (Sage, 1977). Detailed explanation of SAP-LAP and ISM methodology will be illustrated in Chapter 5 and 6 respectively.
3.4 Development of questionnaire

On the basis of discussions with industry professionals and literature review, preliminary questionnaire was developed for pilot survey of forty organizations. Final questionnaire is framed on the basis of information obtained from pilot survey, interactions with industry professionals and experts from academia. The questionnaire contained four sections. Section A dealt with general information about organization and priorities while forming SC strategy, problems and risks faced by organization while working in SC. Section B dealt with factors of coordination improvement, suppliers and customer locations, supplier selection and evaluation, involvement of customers and suppliers for decision making on different issues, factors responsible for distortion of actual demand, level of IT application for different functions in organization. Section C focused on type of IT/modern technologies used and critical success factors of SCM implementation in SMEs. Section D focused on performance parameters of customer service and satisfaction, innovation and growth, financial and internal business improvement.

Annexure was given with questionnaire; it contained guideline for response and terminology used in the questionnaire to reduce unknown bias. The final questionnaire is presented as Appendix A1. Brief about various questions of survey is given in Table 3.1. In this study, executives were asked to rate the intensity of each factor for their respective organization on a five point Likert scale (1-Lowest, 5-Highest). Reason for adopting this interval scale is that it can be ranked. Interval scale indicates the relative amount of trait (Best and Kahn, 1986). Interval measures may be added or subtracted and compatible with various statistics (Flynn et al., 1990).

Table 3.1: Brief of Survey Questions

<table>
<thead>
<tr>
<th>Q. No.</th>
<th>Variable</th>
<th>No of items</th>
<th>Cronbach's alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>A10</td>
<td>Priorities for Supply Chain strategy</td>
<td>13</td>
<td>0.836</td>
</tr>
<tr>
<td>A11</td>
<td>Problems</td>
<td>13</td>
<td>0.914</td>
</tr>
<tr>
<td>A12</td>
<td>Risks</td>
<td>11</td>
<td>0.624</td>
</tr>
<tr>
<td>B1</td>
<td>Coordination improvement</td>
<td>13</td>
<td>0.917</td>
</tr>
</tbody>
</table>
3.5 Validity and reliability

Flynn et al. (1990) and Malhotra and Grover (1998) identified some norms for survey research. These norms were followed for present study also. This study is exploratory cross sectional in nature since data collection is done at one point of time and it is focused on analyzing various issues of coordination and responsiveness. The unit of analysis in this study is an organization. As suggested by Malhotra and Grover (1998) a random sample of organizations were drawn. It is important that the questionnaire instrument be valid and reliable. The validity measures two things. First, does the item/scale truly measure what it is supposed to measure? Second, does it measure nothing else? Reliability measures the extent to which a questionnaire repeatedly administered to the same people will yield the same results. Thus it measures the ability to replicate the study (Flynn et al.1990).

(a) Content validity

Content analysis is a judgment by expert, of the extent to which a scale truly measures the concept that it intended to measure (Flynn et al.1990). To assess the content validity a “dry run” was made and few questionnaires were pilot tested with leading practioners,
consultants and academicians. Based on their feedback, final questionnaire has been evolved.

(b) Construct validity

Construct validity measures whether a scale is an appropriate operational definition of a concept (Flynn et al., 1990). Most of the contents of the questionnaire were taken from the literature (Noble, 1997, Morita and Flynn, 1997, Dangyach and Deshmukh, 2001, Gordan and Sohal, 2001, Chaston et al., 2001 etc., Arshinder et al., 2007, Thakkar et al., 2008). These contents are tested for construct validity.

(c) Reliability/Internal consistency

Inter item analysis is used to check the scales for internal consistency or reliability. Cronbach’s coefficient alpha is calculated for each scale, as recommended for empirical research in operation management (Flynn et al.1990, Malhotra and Grover, 1998). SPSS software is used for calculation of Cronbach’s alpha. Cronbach’s alpha values of each item are calculated for two hundred and fifty one responses received. Items having Cronbach’s alpha less than 0.5 were excluded. According to Nunally (1978), Cronbach’s alpha values more than 0.5 are considered adequate for an exploratory study like this.

3.6 Survey administration

About one thousand five hundred organizations from different sectors, categories and regions were contacted for collecting responses. Survey was done among Indian SMEs from different sectors such as auto component, plastic and electronics etc. All of them were having investment in plant and machinery as per definition of SMEs in context of India. Authors conducted a pilot survey of forty SMEs for finalizing the questionnaire. Although questionnaire was sent by post or e-mail but most of the SMEs for pilot survey were contacted on personal basis by taking appointment from the management. Annexure was given at the end of questionnaire; it contained guidelines for responses and terminology to avoid unknown bias. These organizations were selected from directories available at Confederation of Indian Industries, Auto Component Manufacturers
Association, Federation of Indian Chambers of Commerce and Industries and Directorate of Industries (Government of NCT Delhi). For this study, respondents were selected fulfilling the criteria of SMEs and those belonging to manufacturing sectors. In spite of continuous e-mails, telephones, reminders and personal visits to plants, three hundred and ten responses were received. Out of them only two hundred and fifty one responses were complete in all respect and usable for analysis. Most of the respondents were at the level of production manager or business head. A detailed profile of the corresponding firms is shown in Figure 3.2. SPSS 17 software has been used to analyze the collected responses.

![Figure 3.2. (a, b) Profile of responding organizations](image)
3.7 Statistical tools used for analysis of data

Both quantitative and qualitative tools are used in this research for analysis of data. Quantitative tools include descriptive statistics, reliability analysis, correlation analysis, regression analysis. Results were obtained using SPSS (version 17.0). Qualitative tools are based on development of case studies.
3.7.1 Descriptive statistic

Descriptive statistics include mean, standard deviation, standard error etc. This is used for computing sector wise and overall statistics for various issues of coordination and responsiveness of SMEs. For this purpose, different type of t-tests is used. Different types of t-tests used in this study are one sample t-test, independent sample t-test and paired sample t-tests.

3.7.2 Correlation analysis

Correlation analysis is performed to assess the correlation between various strategies and performance of organization. The Pearson correlation coefficient (r) is calculated. The Pearson correlation coefficient describes the extent to which an increase or decrease in one variable is accompanied by a corresponding increase or decrease in other variable (Sharma, 1996).

3.7.3. Regression analysis

Regression related a factor or factors to a specific outcome (Sharma, 1996). For each performance factor, the technique of least square was used to estimate the simple regression coefficient (bi) and multiple regression coefficients.

3.8 Concluding remarks

The importance of coordination and responsiveness of supply chain has been growing among Indian SMEs after globalization of market. The coordination and responsiveness issues related with SMEs have been captured through questionnaire based survey methodology. The data analysis has been done with the help of statistical tools such as t-test, correlation and regression analysis. For depth understanding of coordination and responsiveness issues, case study approach has been adopted. For modeling of coordination and responsiveness factors, interpretive structural modeling approach has been considered. The next chapter will focus on descriptive analysis of various issues related with coordination and responsiveness issues of supply chain in Indian SMEs.