CHAPTER 3: RESEARCH METHODOLOGY

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CHAPTER 3: RESEARCH METHODOLOGY

This chapter starts with statement of the problem followed by the methodology of research which begins by stating the objectives of the study, research design and instrument administered, sampling procedure, the stating of the hypotheses, method of analysis and limitations of the study.

EXHIBIT 4 SCHEMA OF RESEARCH

![Diagram of research methodology]

- Literature survey
- Identification of problem
- Pilot study
- Development of data collection tool
- Refinement of questionnaire
- Data collection by mail
- Reliability analysis
- Data analysis using factor analysis, correlation, T test and regression

Source: Developed by researcher
3.1 INTRODUCTION TO RESEARCH DESIGN

This chapter deals with the methodology adopted for the research. The chapter highlights the steps involved, sample size and sampling method, instruments used for research and method of analysis. The chapter also defines the hypothesis used in the research.

Research methodology refers to the research process, the procedural framework within which the research is conducted. This methodology as defined by Leedey and cited by Remenyi et al. (1998) is 'an operational framework within which the facts are placed so that their meaning may be seen more clearly'.

Some methods provide data, which are quantitative and some that are qualitative. This study is mainly based on quantitative research methods. Quantitative methods are those, which focus on numbers and frequencies rather than on meaning and experience. Quantitative methods (e.g. experiments, questionnaires and psychometric tests) provide information, which is easy to analyze statistically and fairly reliable. Quantitative methods are associated with the scientific and experimental approach and are criticized for not providing an in depth description.

Qualitative methods are ways of collecting data, which are concerned with describing meaning, rather than with drawing statistical inferences. What qualitative methods (e.g. case studies and interviews) lose on reliability, they gain in terms of validity. They provide a more in depth and rich description.

3.2 RESEARCH DESIGN

3.2.1 STATEMENT OF THE PROBLEM

The studies indicate that although implementing ISO 9000 quality management system has a positive impact on the performance of the organisations, the management expectations are rarely met (Brown et al., 1998; Lee, 1998; Quazi and Padibjo, 1998; Casadesu's and Heras, 2001; Singels et al., 2001; Yahya and Goh, 2001), although problems may also arise (Brown et al., 1998; Joubert, 1998; Kanji,
1998; Quazi and Padibjo, 1998; Singels et.al., 2001; Yahya and Goh, 2001), Idris et.al. (1996), Collyer (1996), Devos et.al. (1996), Withers and Ebrahimpour (1996), Lipovatz et.al. (1999), Erel and Ghosh (1997), Raynor and Porter (1991), Haversjo (2000). The implementation is expected to result in positive impacts on customer satisfaction, quality and cost of production and also on the culture and morale of employees in the organisation. However no such study has been carried out on the garment manufacturing industry in the Indian context, although this industry is one of the largest industries of India, earning a considerable amount of foreign exchange. So as to overcome the drawbacks of earlier studies, the researcher carried out an empirical study to delineate management expectations involved in implementing ISO 9000 quality management system as also its impact on select performance measures with special reference to garment manufacturing industry.


- Customer satisfaction
- Production cost
- Enhancement in product quality

3.2.2 NEED OF STUDY

The studies show that the principal reasons of the organisations opting for ISO 9000 are customer pressure, entering into export markets and image of the organization (Idris et.al. (1996), Collyer (1996), Devos et.al. (1996), Withers & Ebrahimpour (1996), Lipovatz et.al. (1999), Erel & Ghosh (1997), Raynor & Porter (1991), Haversjo (2000), Tang & Kam (1999), Carlsson et.al. (1996), Lipovatz et.al. (1999), Pfeifer (1993), Buttle (1997), Gustafsson et.al. (2001), Gunnlaugsdottir (2002), Terziovski et.al. (2003), Litsikas (1997), Poksinska et.al. (2002), Williams (2004), (Brecka, 1994). However internal Improvements are not the significant objectives.
As a result, the expected benefits of the ISO 9000 are not apparent even after certification.

A successful implementation of a quality system may generate, on the one hand, a differentiation, and on the other hand, low costs (Belohlav, 1993; Grant, 1995). In this respect, the adoption of ISO 9000 has been justified in terms of the many internal and external benefits it can generate (Brown et al., 1998; Lee, 1998; Quazi and Padibjo, 1998; Casadesu’s & Heras, 2001; Singels et al., 2001; Yahya and Goh, 2001), although problems may also arise (Brown et al., 1998; Joubert, 1998; Kanji, 1998; Quazi & Padibjo, 1998; Singels et al., 2001; Yahya & Goh, 2001). Nevertheless, with a correct application of the standard the advantages will doubtless outweigh the disadvantages.

The process of implementing ISO 9000 is a change process, which requires attitudinal change at all levels in the organizations. However each change is associated with the resistance in various forms and also other types of problems.

The effective implementation of ISO 9000 requires the acceptance of change of all levels. In the absence of this acceptance, the implementation process becomes eyewash and the organizations fail to reap the performance benefits of ISO 9000. As a result, the expectations of the management in implementing ISO 9000 are not met. The successful implementation of ISO 9000 requires handling of problems encountered in a manner to ensure smooth transition.

Another issue related to the implementation of ISO 9000 quality management system is the sustainability of the improvement in performance over a period of time. The improvements are sustainable only if the developed and adopted systems are followed consistently and are not discontinued after the certification. The certification bodies, in their surveillance audits, have observed that, in many cases the level of implementation has significantly fallen after certification.

Studies show that ISO 9000 quality management system has a significant impact on the performance of organizations (Motwani et al. (1996), Yung (1997), Mo & Chan (1997), Atherton & Austin’s (1996), Wayhan et al. (2002), Jones et al. (1997), Deming, (1986); Juran, (1982); Inshikawa, (1986). The basic performance indicators, as per the studies are customer satisfaction, improvement in quality and
effective cost control. The studies also show that the process of implementing ISO 9000 quality management systems is not without problems and obstacles.

The present study aims at the understanding the expected benefits of implementing ISO 9000 quality management system with respect to improvement in performance and also to study the problems associated with implementing ISO 9000 quality management system with specific reference to garment manufacturing industry.

Garment manufacturing industry in India is one of the largest export segments and contributes significantly to the foreign exchange (16%) of India. The implementation of ISO 9000 in this industry has been very popular with more and more industries opting for the same. However so far no study has been conducted on the real impacts of implementing quality management systems in this industry. This fact motivated the researcher to undertake the present study.

3.2.3 RESEARCH OBJECTIVES


The study broadly attempts to investigate into the motivations for implementing ISO 9000 in the garment industry, the expected benefits, realized benefits and level of satisfaction due to implementing ISO 9000. The study also highlights the problems
associated with the implementation of ISO 9000 and their relation with the satisfaction levels.

- To identify the motives of the management for implementing ISO 9000 in the organisation
- To identify the problems associated with the implementation of ISO 9000 in the garment industry.
- To identify the impacts of ISO 9000 implementation on the performance measures
- To study the satisfaction of management as a result of ISO 9000 implementation in the garment industry
- To compare the implementation of ISO 9000 in large and small organisations

3.2.4 HYPOTHESES

On the basis of literature survey, 7 hypotheses were framed.

The motivation for ISO 9000 implementation is often claimed to be a significant factor for business success. Empirical evidence shows that the motivation for undertaking ISO 9000 certification is often external reasons (such as, marketing advantages, customer expectation and competitive pressures), instead of internal reasons (such as improving the quality of products and services (Breka, 1994; Ho, 1994; LRQA, 1993). However, more recent research indicates that manager's motivation for seeking ISO 9000 certification has shifted significantly from external to internal reasons. For example, market related reasons for certification do not rank high as motivators to gain ISO 9000 certification (Breka, 1994; Feng, 2000; Gotzamani & Tsiotras, 2001). Companies which seek ISO 9000 certification for external reasons are likely to fail or gain fewer benefits because of their narrow focus. On the other hand, companies that seek certification to improve their quality of products and services tend to gain greater benefits from the ISO certification process. On the basis of literature following hypotheses are formed
H1 There is no specific motive for implementing ISO 9000 in garment manufacturing companies

H2 There is no difference in the motivating factors for adopting ISO 9000 in small and large organisations

The process of ISO 9000 certification is not always smooth. Most companies have encountered problems during and after the process of certification.

Goetsch & Davis (1998), Kantner (1997), and Mo & Chan (1997) have highlighted some of the implementation problems, namely, the failure to provide adequate controls over documents and the data in them, the failure to define responsibility and authority for personnel, and inadequate training.

Some common post-implementation problems include having a cumbersome unworkable document control process that leads to the failure to carry out management reviews of the quality system to ensure system effectiveness, and the audit programs failing to provide feedback to management on compliance with the quality policies and procedures.

Other challenges associated with implementation include gaining management and employee commitment, and problems with interpretation of standards, with assessors and consultants, and with documentation (Brown and Van der Wiele, 1995a, b).

H3 There are no problems faced by garment manufacturing companies in implementing ISO 9000

H4 There is no correlation between the problems faced in implementation of ISO 9000 and the management satisfaction as a result of implementing ISO 9000

Elmuti (1996) believed that ISO 9000 enables firms to improve quality, operational efficiency and internal communication, provide uniform products and achieve a competitive edge, and hence results in greater customer loyalty and market share, and even higher stock prices. This view suggests that different dimensions of firm
performance are related. When implemented well, Hackman & Wageman (1995) suggested that effective quality management may improve operational performance, resulting in several competitive advantages, including better business performance. Flynn et.al. (1995) found that better operating performance indicates lower defect rates, reduced cost of quality, higher productivity, on-time delivery and customer satisfaction. Additionally, the empirical findings of Ahire & Dreyfus (2000) and Forza & Flippini (1998)

H5  There is no correlation between satisfaction of management and impacts of ISO 9000 on performance measures of the organisation

H6  There is no difference in management satisfaction as a result of implementation of ISO 9000 in large and small organisations

H7  There is no correlation between the motivations of the management for implementing ISO 9000 and the satisfaction derived out of it

3.3 DEVELOPMENT OF RESEARCH INSTRUMENT

In order to fulfill the requirement of study, a series of data needed to be collected. The literature study revealed various issue relating to the adoption and implementation of ISO 9000 quality management systems. The issues identified indicate the motives of implementing quality management system, expected benefits of ISO 9000, impact of implementation of ISO 9000 on the performance measures of the organisations and the problems encountered in implementing the quality management system.

The data collection instrument development was initiated with conducting interview with the chief executives of 10 garment manufacturing companies, certified for ISO 9000. The interview was open question based. During the interview, questions were asked on various aspects of ISO 9000 implementation viz. motivations, problems faced in implementation, impacts of ISO 9000 implementation and satisfaction derived from implementing ISO 9000.
Questionnaires are a useful research tool when a large sample or even a population need to be surveyed. This is because each person was asked to respond to the same set of questions, this provides an efficient way of collecting responses from a large sample. Other advantages of questionnaires are that they require less skill and sensitivity to administer than interviews and they reduce the possibility of interviewer bias.

Open format questions are those that ask for unprompted opinions. In other words, there is no predetermined set of responses, and the participant is free to answer however, he chooses. Open format questions are good for soliciting subjective data or when the range of responses is not tightly defined. An obvious advantage is that the variety of responses should be wider and more truly reflect the opinions of the respondents. This increases the likelihood of receiving unexpected and insightful suggestions, for it is impossible to predict the full range of opinion. It is common for a questionnaire to end with and open format question asking the respondent for ideas for changes or improvements. This type of questionnaire provides qualitative data.

Closed questions, are also known as fixed response. This type of questions force the respondent to choose one or more responses from a number of possible replies provided in the question. These types of questions provide quantitative data. There are two broad groups of closed questions they are dichotomous and multiple choice.

Dichotomous questions allow only two possible answers, for example, yes/no, true/false etc. This is the simplest of all closed questions. Multiple-choice questions present a list of possible responses from which the respondent may choose. Multiple-choice questions must be designed carefully to incorporate all possible answers. By offering an "other, please specify" category, that can be collected, that was not originally conceived, or responses that do not fit neatly into the imposed structure.

The type of questions that was used in this investigation was closed questions. All of the questions were closed ended questions as they offer many advantages in both time and money. By restricting the answer set, it is easy to calculate percentages and other hard statistical data over the whole group or over any subgroup of participants. Closed format questions also make it easier to track opinion over time by administering the same questionnaire to different but similar participant groups at
regular intervals. Finally closed format questions allow the researcher to filter out useless or extreme answers that might occur in an open format question.

On the basis of interviews, a structured questionnaire was developed for the purpose of data collection. The questions were based on the findings of the literature survey and findings of the interview of chief executives of 15 garment manufacturing companies. The reference for the questionnaire was taken from the study “ISO 9000 implementation in Turkish industry” by Erdal Erel and Jay B. Ghosh (1997). However the questionnaire developed was not similar to the same.

The questionnaire responses were collected on a 5 point Likert scale. The language of the questionnaire was English, because the respondents were chief executive officers of the organizations and for this target respondent, English was considered to be the most appropriate language.

The survey started with a question about the manager’s satisfaction with ISO 9000. This question used a five-point Likert scale. A score of 5 implied a very satisfied manager and a score of 1, a very dissatisfied manager. Six questions about the level of difficulties associated with the implementation of ISO 9000 were measured using a five-point Likert scale, with the descriptors between 1 and 5. A score of 1 implied that the manager considers the problems to be extremely easy to overcome and a score of 5 implied that problems are extremely difficult to overcome. Eleven questions about the importance of achieving expected improvements were measured on a five-point Likert scale. A score of 5 implied that the manager believed that achieving the expected improvements in a particular area is extremely important and a score of 1 implied that achieving the expected improvements is extremely unimportant. A total of eleven questions about the level of success in achieving improvements were measured using a five-point Likert scale, with descriptors between 1 and 5. A score of 1 implied that the manager believed that the organization was in a much worse position in that area compared with the beginning when ISO 9000 was implemented. A score of 5 implied that the manager believed that the organization was in a much better position in that area compared with the beginning when ISO 9000 was implemented.
The questionnaire addresses the following dimensions.

1. The profile of the organisation
2. The motives for implementing organisation
3. The perception of impacts of implementing ISO 9000 on the organisation
4. The performance measures of the organisations
5. The impact of implementing ISO 9000 on the performance measures
6. The problems associated with implementing ISO 9000
7. Satisfaction derived from implementing ISO 9000

The developed questionnaire was discussed with experts in the field including the auditors of certification bodies, consultants of ISO 9000 and chief executive officers of the organisations. The questionnaire was then suitably modified and amended in the light of suggestions received.

3.4 PILOT STUDY

The pilot testing was conducted in a series of steps. Before the final survey instrument was set up, a preliminary questionnaire was developed and tested to validate the scale items to be used in the study. Pilot testing of the measurement instrument was necessary to validate the items and the whole scale. This is because some of the measurement items were developed or modified for the purposes of this research and because the questions in the instrument were newly compiled to form a new questionnaire.

The pilot testing was conducted in a series of steps. Before the final survey instrument was set up, a preliminary questionnaire was developed and tested to validate the scale items to be used in the study. The initial task in developing the scale was to devise the item pool from previous studies. Then, the preliminary survey questionnaire was distributed to chief executive officers of garment manufacturing units to gain their feedback regarding the content, layout, wording and ease of understanding the measurement items. They were also asked to offer suggestions for improving the proposed scale and to edit the items to enhance
clarity, readability, and content adequacy. The feedback was taken into account in revising the questionnaire.

The questionnaire was designed finally with the help literature (prescriptive, conceptual, empirical and practitioner) based on pilot survey. Personal discussions were held. The discussion points were noted down. The result of the discussion was used in development of the questionnaire. The instrument has been refined several times based on the pilot findings and on the comments and suggestions of the experts.

The questionnaire was used on 15 sample units personally to test the questionnaire for its adequacy. The selection of units for the pilot study was based upon convenience of approach. 10 units in the pilot study were in the category of large organisations and 5 in the category of small organisation. The garment manufacturing units used for pilot survey were located in the Delhi NCR region. The format was suitably amended on the basis of pilot survey. The observations of pilot survey were also incorporated in the main study.

The initial survey was carried out in 15 garment manufacturing organisations. The chief executive officers of these organisations were interviewed. The interview comprised of questions from the following areas

- Motives for adopting ISO 9000
- Problems faced in implementing ISO 9000
- Performance measures of the organisation
- Significance of these performance measures
- Impact of ISO 9000 on the performance measures
- Overall satisfaction level due to implementing ISO 9000

On the basis of interview, the original questionnaire was modified. The discussion during the initial survey revealed six motives for implementing ISO 9000 as

- **Growth in Sales**: Growth in sales refers to the increase in total sales volume of the organization.
- **Better Quality of Products**: Better quality of products refers to production of garments with fewer defects. The defect in garments include non
conformance to specifications like measurements and physical defects like stitching defects, stains, wrong labeling, shade variation etc.

- **Better Process Control:** Better process control refers to control over production processes and production parameters. The better process control results in consistent quality of product and reduction of cost by reducing waste generated and avoiding repeated processing.

- **Better MIS:** Management information system is the formal system of communication in the organization. The formal communication system ensures the availability of right information to the employees and management at right time reducing the probability of wrong processing.

- **Better Employee Satisfaction:** Employee satisfaction is the perception of employees towards the job assigned to them. Better information system leads to employees understanding their work and its significance and results in greater satisfaction.

- **Competitiveness:** Competitiveness refers to development of an edge over the national and international competitors.

The discussion revealed six problems associated with implementing ISO 9000 as follows

- **Lack of Competent Personnel:** The personnel in the garment organizations are skilled to carry out the specific operations. However very few are with formal education in management. Such personnel find it difficult to understand the implementation and significance of quality management system and are unable to adopt them in the work.

- **High Volume of Documentation:** ISO 9000 is a documented system. Every activity of the organization needs to be documented in the form of standard operating procedures. The development of these procedures involves a deep understanding of the operations and requires a lot of efforts by management and employees. The management and employees find it difficult to spare time and effort for documentations.

- **Need of Too Many Records:** ISO 9000 is an auditable system. It requires demonstration to the conformance to documented system. As a result, for each activity undertaken, records need to be maintained. The employees in
the garment organizations are not used to maintenance of accurate and
detailed records.

- **Employee Resistance**: ISO 9000 implementation is a cultural change. It
requires change in the methods and attitude towards work and quality. It
makes the systems transparent and results in greater accountability. As such
this change is resisted by the employees.

- **Too Complicated Requirements**: the management of the garment units
considers the requirements of the standard as too complex to understand.
Some of the requirements like internal audit, management review,
calibration, data analysis, corrective actions and preventive actions are very
new to the management and they are unable to understand their compliance.

- **Inability to Integrate ISO 9000 with Operations**: ISO 9000 is a product
neutral standard equally applicable to any manufacturing and service
organization. The implementation of ISO 9000 results in a heavy set of
documents and a number of records but the management and employees are
unable to interpret the standard as per the specific requirements of the
operations.

Eleven measures of organizational performance were identified as

- **Sales Turnover**: Sales turnover is the total volume of revenue generated as a
result of producing and selling the goods

- **Volume of Complaints**: The volume of complaints refers to the number and
frequency of customer complaints after the shipment has been sent to the
customers. The complaints could be for quality, packaging, late delivery etc.

- **Late Shipments**: The garment industry of India is involved in international
trade to a large extent one of the specific requirements of export is on time
shipment. Non compliance to delivery schedule results in concessions,
complaints, discounts, order cancellation or lost business.

- **Costing verses Actual Cost**: The prices quoted for the product are on the
basis of expected cost of raw material and production. However the actual
cost of production tends to go high because of waste, repeated processing,
production of defectives etc. Minimum difference between the anticipated
cost and actual cost of production ensures planned profitability for the organisation.

- **Rejection\%**: Rejection is the identification of defective goods which do not conform to specifications and cannot be repaired. For example, wrong shade in the garment is a type of defect that cannot be repaired. Rejection can take place in-house or after the goods have been sent to the customer.

- **Rework\%**: Rework is the operations required to correct the defective products. It requires processing of goods on the machines repeatedly and adds to processing cost.

- **Employee Turnover Rate**: Employee turnover rate is the frequency of employees leaving the job. High employee turnover rate requires frequent recruitment and training of new employees.

- **Excess Purchase**: Excess purchase refers to the requirement of purchase of raw material above the quantity required for production. The excess purchase is resorted to provide a buffer for anticipated rejections, waste, and rework.

- **Machine Downtime**: Machine downtime refers to loss of effective machine operational time due to breakdown or repair of the machines. Absence of an effective maintenance system results in greater machine downtime which has an impact on lead time and cost of production.

- **Absenteeism**: Absenteeism refers to unauthorised absence of the employees from duty.

- **Productivity**: Productivity refers to the output produced versus various inputs like raw material, labour, etc.

### 3.5 VALIDITY OF SCALE

Information about reliability and validity was necessary in order to determine whether the variables were stable and accurate and whether they truly measure what they set out to measure.

According to Hair *et al.* (1995) validity is the degree to which a measure accurately represents what it is supposed to. A category is considered to have content validity if there is general agreement from the literature that the ISO 9001 standard has measurement items that cover all aspects of the variable being measured. Since,
selection of the initial measurement items was based on extensive review of international theoretical and empirical-quality management literature, it was considered to have content validity.

3.6 RELIABILITY OF SCALE

Cronbach's alpha is a measure of reliability. Mathematically, reliability is defined as the proportion of the variability in the responses to the survey that is the result of differences in the respondents. That is, answers to a reliable survey will not differ because respondents have different opinions, not because the survey is confusing nor has multiple interpretations. The computation of Cronbach's alpha is based on the number of items on the survey (k) and the ratio of the average inter-item covariance to the average item variance.

Reliability of scale for impacts of ISO 9000 on performance measures was found to be 0.791 and that of scale for motives for implementing ISO 9000 was 0.631.

A high value of alpha i.e. 0.791 and 0.631 establish the reliability of the scale used in the study.

3.7 SAMPLE AND DATA COLLECTION

3.7.1 SAMPLING FRAME

Sampling frame is the entire group of entities that are being considered for the purpose of research. A population is the aggregate of all the elements that share common set of characteristics and that comprise the universe. A sample is a subgroup of population selected for participation in the study. The census approach is used when the time available is large, population size is small, variance in characteristics is large and attention to individual cases is not desirable. Since the population of interest was limited in the study with adequate time available, census approach was adopted for data collection.
The present study was based upon the implementation of quality management systems and its impact on select performance measures in the garment manufacturing organizations. Hence the sampling frame for the study was the garment manufacturing units which have implemented ISO 9000 quality management systems at least one year prior to study. Only those units which had achieved ISO 9000 at least one year prior to study were considered so that the satisfaction derived from implementation can be studied.

The list of ISO 9000 certified garment manufacturing units obtained from Office of Textiles Committee, M/o Textiles, Govt. of India, comprised the broad sample frame.

3.7.2 SAMPLING UNIT

The sampling units were the garment manufacturing units which were certified for ISO 9000 at least one year prior to study.

The chief executive officers of the sampling unit were the targeted respondents.

3.7.3 DATA COLLECTION

The population of interest (sample universe) comprised of 147 ISO 9000 compliant units located in different geographical regions of the country. The data for population was obtained from the list of certified and under implementation garment manufacturing units from the website of Textiles Committee (www.textilescommittee.nic.in).

Survey methods by mode of administration can be classified into three categories

- Telephone interview
- Personal interview
- Mail interview

Telephone Interviews have the advantage of flexibility of data collection, better sample control, moderate response rate, effective in obtaining sensitive data, speed and moderate cost. However they have the drawback of low question diversity and low quantity of data.
Personal Interviews offer many advantages as compared to telephonic or mail survey. They have the advantage of high flexibility of data collection, high diversity of questions, high sample control, high quantity of data and high response rate. However the personal interviews suffer from a number of drawbacks also like high cost and high potential for interviewer bias.

Mail Surveys offer low flexibility of data collection, low sample control, low response rate but the mail interviews offer the advantages of low cost, higher speed and low potential for interviewer bias.

The large geographical spread necessitated the adoption of mail survey technique. The mail survey technique was chosen so that the organisations in different parts of the country could be included in the study. The technique has the advantage that a large number of sampling units can be covered in the study. However, the mail survey technique has the drawback of low rate of response.

The data was collected in three stages.

In the first stage, the 147 questionnaires were mailed to various companies with a request to respond. In a span of three months only 12 responses were received.

In the second stage, the reminder was sent without questionnaire. The respondents were also contacted telephonically to request for responses. 31 responses were received in a span of 2 months.

In the third stage, the reminder with the questionnaire was mailed again. Attempt was made to contact personally on telephone. Help was taken from the officials of textiles committee posted in different regional offices to persuade respondents to send the responses. In this wave, a total of 35 responses were received. So the total responses received were 78.

The response rate of the questionnaire was significantly high because the researcher, has been associated with the industry for quite long.
3.8 METHOD OF ANALYSIS

The statistical tools used for analysis of the data were factor analysis, t test and correlation.

Reliability and Validity of the Instrument

Reliability refers to the consistency of measurement results and the extent to which they are accurate, error free, and stable. Reliable measurement results are reproducible and generalizable to other measurement occasions. Reliability evidence most often is reported as a correlation coefficient. In classical test theory reliability is defined mathematically as the ratio of the variation of the true score and the variation of the observed score. Unfortunately, there is no way to directly observe or calculate the true score, so a variety of methods is used to estimate the reliability of a test. (Goodwin, 1997).

Researchers make inferences from measurement results about how much of the variable being measured is present. Validity refers to the extent to which these inferences are sound. A researcher's interpretation of a score is valid if it yields accurate conclusions about the variable. Validity, therefore, is not a characteristic of the research instrument itself, the term refers to the ways a researcher interprets and uses measurement results. Researchers make inferences from measurement results about how much of the variable being measured is present. Validity refers to the extent to which these inferences are sound. A researcher's interpretation of a score is valid if it yields accurate conclusions about the variable. Validity, therefore, is not a characteristic of the research instrument itself, the term refers to the ways a researcher interprets and uses measurement results.

In order to assess reliability, the Cronbach alpha was determined for each construct (factor) identified through factor analysis. If the Cronbach alpha is greater than 0.7, the construct is deemed reliable. (Teo et al., 1999).
3.8.1 Factor Analysis

Factor analysis is a multivariate statistical procedure primarily used for data reduction and summarization—large number of correlated variables is reduced to a set of independent underlying factors. This technique is used because it analyzes the structure of interrelationships among large number of variables by defining a set of common underlying dimensions, known as factors or dimensions. This leads to summarization and data reduction. Factor analysis is an interdependent technique in which all variables are simultaneously considered, each related to all others and still employing the concept of the variate, the linear composite of variables. The original variables are dependent variables that are functions of some underlying and latent set of dimensions that are themselves made up of all other variables (Gorusch, 1983).

Factor analysis helps in understanding the complex relationships, which is otherwise not possible with bivariate and univariate methods. The other benefit of this technique is that researcher gets insight into empirical estimation of relationships with conceptual foundation and interpretation of results. An important tool in interpreting factors is factor rotation. Rotation means that the factors are turned about the origin until some other position has been reached. This redistributes the variance from earlier factors to later ones to achieve a simpler, theoretically more meaningful factor pattern.

In this research, we have used varimax rotation with which maximum possible simplification is reached. With varimax rotational approach there tend to be some high loadings close to -1 or +1 and some loadings near 0 in each column of the matrix. The logic is that interpretation is easiest when the variable and the factor correlation are close to -1 or +1, thus indicating a clear positive or negative association between the variable and the factor close to 0, indicating a clear lack of association. Thus, varimax rotation gives clear separation of factors.

Factors with eigenvalues greater than 1.0 and rotated factor loadings of 0.40 or greater were retained. Despite the fact that, with a sample size greater than 350, a factor loading of 0.30 can be considered significant in this research, Hair et al. (1998) suggest that factor loadings of 0.50 or greater are practically significant. After extracting the Eigen values, rotation of principal components is done through varimax rotation. After the number of extracted factors is decided upon, the next
task is to interpret the name of the factors as shown below. This is done by the process of identifying which factors are associated with which of the original variables.

EFA was performed on the scale to check as to whether all items load on a single construct.

Communalities indicate the amount of variance in each variable that is accounted for. Initial communalities are estimates of the variance in each variable accounted for by all components or factors. For principal components extraction, this is always equal to 1.0 for correlation analyses. Extraction communalities are estimates of the variance in each variable accounted for by the components.

The variance is explained by the initial solution, extracted components, and rotated components for each of the factors. First section of these tables shows the Initial Eigenvalues. The Total column gives the eigenvalue, or amount of variance in the original variables accounted for by each component. The % of Variance column gives the ratio, expressed as a percentage, of the variance accounted for by each component to the total variance in all of the variables. The Cumulative % column gives the percentage of variance accounted for by the first n components. For example, the cumulative percentage for the second component is the sum of the percentage of variance for the first and second components. For the initial solution, there are as many components as variables, and in a correlations analysis, the sum of the eigenvalues equals the number of components. In the analysis, eigenvalues greater than one were extracted, so the principal components which have eigenvalues greater than one form the extracted solution. The second section of the table shows the extracted components. They explain much of the variability in the original variables (questions), so we can considerably reduce the complexity of the data set by using these components, with only a few percent loss of information. The rotated component matrix helps to determine what the components represent.

The principal components method of extraction begins by finding a linear combination of variables (a component) that accounts for as much variation in the original variables as possible. It then finds another component that accounts for as much of the remaining variation as possible and is uncorrelated with the previous component, continuing in this way until there are as many components as original
variables. Usually, a few components will account for most of the variation, and these components can be used to replace the original variables.

3.8.2 T Test

T-tests are kind of like little F-tests, and similar to Z-tests. It's appropriate for smaller samples, and relatively easy to interpret since any calculated t over 2.0 is, by rule of thumb, significant. t tests can be used for one sample, two samples, one tail, or two-tailed. t test was conducted to study the significance of difference between the small and large organizations with respect to time taken for implementing ISO 9000 and management satisfaction with the results of implementation. The companies with an annual turnover of up to 5 crores were considered to be small and for turnover more than 5 crores were considered as large companies.

3.8.3 Correlation

Correlation Analysis is used as a statistical tool to ascertain the association between two variables. With the help of correlation analysis we can be very specific by measuring the degree of relationship between the concerned variables. When dealing with the joint variation of two or more variables, a natural question arises as to whether the variables are related and how close the relationship is. Correlation measures the strength of relationship of two variables whereas regression gives the mathematical relationship of the (two) variables. When high values of one variables are associated with high values of the other variable and low values of one variable are associated with low values of another, then they are said to be (directly or) positively correlated. On the other hand, if high values of one tend to accompany low values of the other, they are (or) negatively correlated. If the values follow a random arbitrary pattern then we may conclude that there is no linear relationship between them.

To establish the relation between various parameters, correlation tool was used. Coefficient of correlation was calculated for understanding the relation between parameters under study.
3.8.4 REGRESSION

Regression is a way to estimate (or predict) a parameter value (e.g. the mean value) of a dependent variable, given the value of one or more independent variables. $y =$ dependent variable while $x_1, x_2, x_3...x_i =$ independent variables Thus, we are estimating the value of $y$ given the values of $x_1, x_2, x_3...x_i$.

Thus, regression is an estimation technique.

To establish the relation between various parameters, correlation tool was used. Coefficient of correlation was calculated for understanding the relation between parameters under study.

T test was conducted to study the significance of difference between the small and large organisations with respect to time taken for implementing ISO 9000 and management satisfaction with the results of implementation. The companies with an annual turnover of up to 5 crores were considered to be small and for turnover more than 5 crores were considered as large companies.

Regression was used for estimating the relation between the satisfaction from ISO 9000 and various identified performance measures.

The reference to the statistical tools was taken from “Principles of textile testing” by J E booth and Rai university open courseware. SPSS software was used for creating the data base and carrying out the statistical analysis of the data.

3.9 LIMITATIONS OF THE STUDY

Though a number of precautions have been taken to increase the reliability of the present study, yet the researcher feels that there are certain limitations which may be given due consideration:
• Mail surveys have the drawback of low response rate. The response rate in mail surveys is not expected more than 50%. Since the data collection was through mail, 100% responses could not be ensured.

• Data collection being through mail, it can not be ensured whether the responses were really given by the targeted respondent. The chief executive officers might have assigned the task of giving responses to some junior level managers.

• The respondents may have given a biased picture of ISO 9000 than the actual implications. The responses might have been on the basis of what they expected rather than what actually happened.

• The response may be biased as individual views may have overshadowed the facts. Same level of impact might have been assigned a different rating scale due to difference in perception.

• Due to cost and time constraints, personal interview of respondents was not possible. Personal interview of the respondents might have added new dimensions to the study and revealed more facts.

• The sincerity of respondents in answering the questions can not be ascertained. The respondents might have been very casual in giving responses and may have just given the overall view in place of their assessment of each question.

• If the personal interview was possible, the respondents may have given more in depth views.

• The study was focused on single industry. The results of the study may not be applicable to other industries because of inherent differences in different industries.

• Quality of responses may have improved in personal interview approach. The personal interview might have made it possible to have more in depth knowledge of the impact and problems of implementing ISO 9000.

• There is possibility of respondent bias. He could have given answers, which were desirable to him.

• The results of this study pertain to garment manufacturing units only and could be different from the results of other manufacturing and service industries.
- The impact on performance measures could be a result of changing business scenario and not necessarily due to implementation of ISO 9000.
- The study was limited to the views of the chief executive officers only and the views of employees were not considered. The employees might have given a different picture of ISO 9000.
- The customers were not a part of the study. ISO 9000 being a quality management system for the customers, their views might have added new dimensions to the study.

**EXHIBIT 5 CONCEPTUAL FRAMEWORK OF THE STUDY**

Source: Developed by researcher