CHAPTER 3

RESEARCH METHODOLOGY

This chapter explains the methodology used in this research work. It consists of the following sections such as research instrument design, survey methodology, instrument validation procedures and explanation of tools that are used to design and develop the framework. The research methodology is illustrated in Figure 3.1. The research instruments are called as Productivity and Quality Dimensions (PQD).

3.1 RESEARCH DESIGN

Gonsalves (1996) augured that any research work should begin with a structure or plan. It consists of entities or variables to be studied and deals with their relationship to one another. Empirical research methods, described by Flynn et al (1990), examined the various results of questionnaire collection, case study discussion, and field design and population analysis. The research study in focus started with data collection using the questionnaire. A Survey through questionnaire was conducted to gather information on important key aspects of productivity and quality in order to prioritize the field area of dying and chemical industries.

Figure 3.1 describes the various steps involved in research methodology. In an extensive literature review, most of the researchers enumerated both productivity and quality dimensions with respect to different kinds of framework. Hence the questionnaire collection and development of
research instruments have been based on productivity and quality dimensions. Mostly, this research work concentrates on the productivity related literature whereas a few also account for both productivity and quality related literature collection.

The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS) software. The results of data collection are applied in industry as case study. The case results have been wrapped up by the application of research tools. At the end of the research, a robust framework is developed and implemented by using research tools. The tools are Total Productivity Model (TPML), Total Productive Maintenance (TPM) and Theory of Constraints (TOC) with Productivity Cycle (PC).

3.2 SURVEY METHODOLOGY

Saravanan et al (2006) enunciated the usage of survey typed questionnaire as a research tool. The standardization of questionnaire plays an important role which allows the comparison between respondents. The questionnaire can be sent to many organizations at different locations, giving flexible time where respondents could choose their own time and it is a relatively fast way of collecting data. Moreover, the respondents could answer the questions based on their knowledge in the case of queries that are open-ended.

In this study, one of the objectives was to test the various questions to understand the level of risk priority failure analysis and find a solution for the highly risky event using the data obtained from the respondents. The highly risky event is solved by incorporating the scientific framework in the industry. The survey methodology was explained with various steps such as the selection of the population and sampling, designing the questionnaire it is fine-tuned to obtain the vital data.
3.2.1 Population and Sampling

In the chemical and allied industries, the respondents consisted of executive directors, quality managers, production managers, field chemical specialists and buyer agents. In the population study, the respondents have been identified and chosen because they are directly involved in the textile processes and resource handling, having firsthand knowledge and experience in productivity and quality dimensions. Conca et al (2003) applied these concepts in the production management organizations.

In the total population, a sample is a subset. It is one of the population characteristics. In this study, the questionnaire was given to 60 industries in all and then received with the data from 109 respondents. These industries account for partially failure industries, a few successful industries and fully failed industries among all types of textile and processing industries. The companies selected were from State Industries Promotion Corporation of Tamilnadu (SIPCOT), Erode, Tirupur district and a few industries from Karur district of Tamil Nadu, South India. The industries are small and medium enterprises that have implemented International Standards for two years or more, or have received quality awards certificate such as ISO 9000. The data have been collected from these types of standard organizations also. Antony et al (2002) selected these types of organizations in their research work.

3.2.2 Development of Research Instrument

Since the productivity management programme like implementation of quality has started gaining prominence, the practitioners are mainly interested in knowing in what ways the implementation of productivity programme will be beneficial to the organization. They are also interested in finding when they get back returns on investments while incorporating the productivity programme initiatives and what management
practices are to be given priorities. Against this backdrop, the present research work attempts to address the issues of productivity and quality programme in textile fabric organizations from the management’s perspectives.

Based on the extensive literature review, the research work has identified the research instruments to improve the productivity by applying scientific research tools. Based on the core problem, the empirical study has identified ten critically successful dimensions. The ten dimensions are called

**Figure 3.1 Research methodology**

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research instruments and they play a vital role in this research, namely Productivity and Quality Dimensions (PQD). The Productivity and Quality Dimensions are Management Principle (MP), Research and Development and Capital Utilization (RDCU), Supplier Performance (SP), Fabric Quality (FQ), Order and Customer Perception (OCP), Lack of Planning for Productivity (LPP), Labor and Work Force mix (LWF), Technical Instruments and Technology (TIT), Benchmarking (BM) and Maintenance of Assets (MA). A brief explanation of productivity and quality dimensions are explained in the next section.

3.2.2.1 Management Principle (MP)

In a manufacturing company, the management plays a significant role in shaping the productivity of the company. Ham and Williams (1986) emphasized that the top management should give prime importance to quality by providing sufficient money and manpower for implementation of quality management programs in the organization. Management Principle, commitment and leadership are essential requirements for the effective implementation of management practices in an organization. Ugboe and Kofi (2000) found that the top management commitment acted as a moderator between PQD and organizational performance.

Castle (1999) evaluated both aggregate levels and dissimilarities in educational experience and professional involvement of the top management team. These variables have given significant effect on the productivity and quality improvement activities. Kammerlind et al (2004) also indicated that the leadership skill grows by getting the work from various levels of people. The top level management and leaders have to sustain the focus of the organizations that are rooted in productivity and quality. This focus can be
accomplished only by changing all aspects of management including human resource management, customer relationships and strategic planning (Ebrahim et al 2005).

3.2.2.2 Research and Development and Capital Utilization (RDCU)

In any type of organization, Research and Development (R&D) and capital utilization of resources play a major role towards the development of an industry. Siegel (1996) advocated the utilization of human resources based on the skills and qualification of employees. Johnson et al (1996) identified and computed the results of an effective training program for employees in view of utilization of resources. The allocation of sufficient resources plays an important role in order to bring about a good utilization factor. Arawati (2004) and Ebrahim et al (2005) also paved the way with regard to the available infrastructure of human resource and predicted positively about the potential source of productivity improvement.

3.2.2.3 Supplier Performance (SP)

Howard and Lewis (2003) emphasized the importance of developing a database system for suppliers. Kumar et al (1995) also stressed the role of supplier performance in the view of productivity analysis. Johnson (2000) systemized the supplier performance in quality function deployment covering the entire product line and the needs of customers. Supplier relationship is strengthened by periodical communication through communication channels for raising the productivity level. The levels in hierarchy are just adequate for supervision and control of every fabric process. The supplier performances are demonstrated in service organizations while implementing total quality management program (Woon 2000). Martins and Aspinwall (2001) advocated the degree of importance to customer satisfaction and quality in day-to-day operations through supplier
performance. Azadivar and Shu (1998) evaluated the supplier performance through a few tools such as Data Envelop Analysis (DEA) and Analytical Hierarchical Process (AHP).

### 3.2.2.4 Fabric Quality (FQ)

Quality refers to the degree of excellence a product or service provides. Dutta (1989) deliberated upon the products playing a vital role in building a sound economy and assured that the quality of the products alone would pave the way for profitability in any industrial organization. Weiss (1984) likewise felt that quality management tools like bar charts and control charts monitored the fabric quality.

Kayis et al (2003) felt that quality was imperative to assess the customer’s perspective. In yet another instances, Todd and Mary (2001) exemplified that customer orientation is related to the positive outcome of the firm. Larry et al (2001) extended the business vision forms on the basis of strategic quality planning and decision-making. The effectiveness of cross functional teams with respect to productivity and quality has been addressed by Sohel and Schroeder (2002). As a result, the employees will be able to pay more attention to the organizational behavior in relation to quality management.

### 3.2.2.5 Order and Customer Perception (OCP)

The functional procedures of order and customers perception play important role in any type of organization. It also promoted the relationship between the work order processing, work planning and scheduling. The success of electronic commerce in bringing about the customer satisfaction was enlarged by Torkzadeh and Dhillon (2003). Stalk et al (1992) recommended the design of new products to maximize the order and
customers satisfaction. Sasser and Fulmer (1990) mentioned the management’s perspective or from the employee perspective but occasionally from the customer’s perspective. Nature of the defect in the product information has been observed by Mills and Moberg (1982).

Ryals and Payne (2001) explained the customer relationship management which is becoming a topic of increasing interest in marketing strategies. Quality, price, delivery and flexibility are the four main characteristics of any type of product that enhance the customer’s requirements DeMeyer et al (1989). Conca et al (2003) have explained the application and advantages over competitors in the market place although the most important element of total quality management such as customer focus is commonly explained as (Parasuraman et al 1985, Robson 1993).

3.2.2.6 Lack of Planning for Productivity (LPP)

Productivity is an overall measure of the ability to produce goods or services. Earlier Mali (1978) deliberated on the terms productivity, effectiveness and efficiency. In view of computations of productivity, Sink (1989) explained the actual output of production compared to the actual input of resources. It helped to enumerates and evaluates the current performance level of the work processes. This procedure improves the performance of the system. The various ways such as Plan-Do-Check-Action (PDCA) to improve the productivity were emphasized by many researchers (Stalk et al 1992, Kumar et al 1995).

According to Daugherty (1995), productivity accounts for the utilization of availability of all types of facilities in all the locations. A large number of researchers analyzed the various applications of simulation optimization in manufacturing field (Pierreval 1997). The literature review has also identified Just In Time (JIT) and procurement in order to avoid lack
of productivity (Inman 1992). This concept also has been discussed in manufacturing sector with customer’s requirements and expectations in formulating the objectives, plans, strategies and actions for productivity (Stalk et al 1992).

3.2.2.7 Labor and Work Force mix (LWF)

Whitley (1989) and Stewart (1980) defined the characteristics of the organization in connection with labor management along some categorical level. Mohd and Aspinwall (2000) noted that training and education of employees are vital for the implementation of total quality management. The high level of satisfaction of employees can be achieved by giving the empowerment via training. The results of empowerment practices of employees include better productivity, performance and service quality (Michelle and Mile 2003).

The relationship between people and technological issues could be correlated to employees’ training (Pfau 1989). Hackman and Wageman (1995) have given three ideas about employee related learning. The three learning methods are among employees by means of cross functional terms, problem solving and the ways to enhance performance and work process and finally the learning about the management of collective objectives and interests.

3.2.2.8 Technical Instruments and Technology (TIT)

In the design stage itself, Montes et al (2003) proposed the prevention strategy to find shortfalls with respect to quality and productivity. TIT stressed on the fund allocation for quality and quantity improvement for procurement of instruments.

3.2.2.9 Benchmarking (BM)

Fedor et al (1996) endorsed the importance of benchmarking for organizational comparison. Inimitable compatible advantages can be gained through a deeply embedded productivity ideology (Fedor et al 1996). Saravanan and Rao (2006) emphasized the need for benchmarking the level of services such as aesthetics, comforts and the equipment in service stations. Srilakshmankumar and Raju (2008) explained the concept of benchmarking with respect to customer satisfaction, employee satisfaction and commitment in manufacturing and service stations. Hutton and Zairi (1995) appraised the organization’s competitiveness by benchmarking processes. Arnaboldi and Azzone (2004) studied the research methodology of benchmark, the use of benchmarking as a management tool and analyzed the significant change. Coleman and Ingram (2004) created a new benchmark model by learning form restaurant development schemes. Dennis et al (2004) developed a methodology for identifying, classifying, and implementing dimensions such as quality, reliability and timeliness in order to improve productivity and quality.

3.2.2.10 Maintenance of Assets (MA)

Tonnesen (2005) addressed the maintenance of assets while the failure existed in machines. Choi and Valikangas (2001) delved into the degree of importance in forecasting maintenance requirements and advocated
the reliable systems in various operations of machinery. But the effective maintenance of information management systems with optimization was enumerated by Manev and Stevenson (2001). Gronroos (1982) attributed to the maintenance types and s for improving the equipment or system availability. Brady and MacGarveVoly (1998) reported the maintenance procedure by adopting simulation techniques and optimized the staff levels in a pharmaceutical laboratory.

### 3.2.3 Refinement of Research Instrument

Saravanan and Rao (2006) classified the various steps in research regarding instrument refinement as follows.

i) To identify the critical risk priority dimensions through literature survey.

ii) To develop items or operating elements for measuring each dimension.

iii) To validate the proposed instruments given by experts (academicians, researchers, practitioners) in the field.

iv) To modify and fine-tune the instruments by incorporating the comments and suggestions of experts in the field.

v) To make and analysis of the data.

Three types of survey methodology have been described by Malhotra and Grover (1998). One is concerned with information collection from the people through a structured format. The second is simple quantitative method and thirdly the collection of information is done by way of samples. This refinement is used to modify and eliminate a number of variables, until the final questionnaire was designed. Experts on the subject were consulted, to ensure that the questions were properly arranged, ordered
and phased. These experts and academicians also confirmed the suitability of these queries.

Quality consultants and field specialists have reviewed the questionnaire. The instruments have been enhanced, rectified and improved based on the comments and feedback received from the specialists. Ambiguous questions were eliminated and also few new elements were added. The received comments were analyzed and checked to ensure suitability. As far as possible, these comments were merged into the questionnaire before launching the full survey.

3.3 DATA COLLECTION

Chang (2001) explained the data analysis with regard to survey as a means of questioning the respondents. The process of data collection got started after the development of research instruments. Rossi et al (1983) have also emphasized the collection of information from a large group of people or a population through several ways such as personal interview, third person interview, postal questionnaires, telephone calls, television polls, etc.

In order to assess the opinion of practitioners in the field, a survey has been conducted using questionnaires in the textile sector. The textile service sector has been chosen since it is a vibrant field in the Indian Economy. The textile sector has drawn huge amount of money as investment but it has failed to increase or maintain the level of productivity. Cooper et al (1997) clearly identified and represented the relevance of TQM dimensions encompassing larger sections of Indian sector.

The data were collected from the various people such as industry executives, field specialists, industry engineers and senior level managers in chemical and allied textile industry, especially in dyeing and calendering
processing textile industry in Erode and Tirupur District of Tamil Nadu in India. The executives were requested to ask the rate of level practices in regard to of the Productivity and Quality Dimensions (PQD) in textile processing industries on a seven point ‘Likert’ scale (from 1 indicating very low to 7 indicating very high) for all ten dimensions comprising the 90 items. The middle item represents the neutral position in the scale. The seven-point ‘Likert’ provides greater sensitivity of measurements. It delivers the various shades of opinion.

Saravanan and Rao (2006) and Sureshchandar et al (2001) also conducted a study on this scale in an automobile sector. Questionnaires were given to around 120 executives and field specialists in sixty textile processing industries. One hundred and nine executives from sixty textile processing industries showed an interest in participating in this study. Finally, 105 usable questionnaires were received and used for validation. In Appendix, the measuring instruments with 91 items spanning the 10 dimensions on productivity and quality have been presented in detail. The research instruments are of a general nature even though it can be used in other sectors by modifying the phrases.

3.4 REFINEMENT OF RESEARCH INSTRUMENT

Saravanan and Rao (2006) refined the various steps of research instrument. At last, different tests were carried out and the productivity and quality dimensions or instruments were validated. In this study, confirmatory analyses (CFA) have been done for PQ dimensions by Statistical Package for Social Sciences (SPSS).
3.4.1 **Definitions of various tests in research instrument**

The research instruments developed are tested and validated to ensure the methods. The tests involve reliability and validity analysis. The results of all validity tests are discussed in the chapter 4. A brief definitions follows the following sections.

3.4.2 **Reliability**

Rahman (2002) stated that reliability refers to the instrument’s ability to provide consistent results in repeated uses. Reliability is the extent to which a variable or a set of variables is consistent in what it is intended to measure. Reliability can be measured by test-retest method, equivalent form, split-halve method and internal consistency method.

3.4.3 **Validity Analysis**

Flynn et al (1990) noted that validity refers the degree at which the instrument measures the concept. Carmines and Zeller (1990) also measured the survey instrument’s accuracy. The validity analyses in this research work are content validity, convergent validity and criterion related validity.

3.4.3.1 **Content Validity**

Content validity is the extent to which the instrument covers the depth of concept to be measured. It is also called face validity. Litwin (1995) examined in detail the documentation and evaluation of validity.

3.4.3.2 **Convergent validity**

Convergent validity assesses the degree to which two measures of the same concept are correlated. In this regard, high correlations indicate that the scale is capable of measuring its intended concept.
3.4.3.3 Criterion Related Validity

Hair et al (2005) expressed the criterion related validity. It refers to the method of a test that measures the relationship between the outcome dimensions and the other implementation dimensions in the research instrument.

3.6 CASE STUDY METHODOLOGY

Hilma and Yusof (2005) defined research strategy which focuses on understanding the dynamics present within settings, industrial environment and government decision and industry problems etc. Eisenhardt (1989) suggested that one could build theories using the case study approach and provide a roadmap to achieve the objective.

In this research work, one or more combination of research tools is applied in the same kind of product in different textile processing industries. A few case studies in the research is a detailed study in a selected textile processing industry that reviews the results after implementing the fuzzy FMEA risky dimensions.

3.7 CONCLUSION

A detailed research methodology has been explained in this chapter. A structured research instrument is developed after analyzing extensive literature review. A survey instrument comprising 91 items spanning ten critical dimensions with respect to productivity and quality basis has been developed as a research instrument.

Questionnaire was prepared with regard to different literature review. Some of the data were collected in run down time from an industry.