

# **Developing an assessment tool for measuring total quality management in SASOL's Steam Station Plant**

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degree of *Masters of Engineering* at the Potchefstroom Campus of the  
North-West University, South Africa.**

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## DEDICATION

This research work is dedicated to my loving parents, Mr. & Mrs. R. G. A. Amorighoye, whose love, support and motivation was the driving force that geared me towards accomplishing this work.

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## **ABSTRACT**

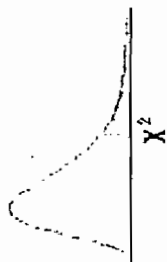
Many attempts were made in the past to measure the success or failure of total quality management (TQM) in organizations. Although there are many quality management theories and models in existence, all are imperfect, i.e. each has its own advantages and disadvantages. This research aims at developing an assessment tool for measuring total quality management in SASOL's Steam Station Plant.

Based on thorough review of some of the existing literatures in the field of TQM, the research has identified nine TQM principles. A tool for measuring TQM in SASOL's Steam Station Plant has also been proposed, illustrating the relationship between the various identified TQM principles. Data was collected from managers, employees and customers of SASOL's Steam Station Plant. The hypotheses stated have been tested using the Chi-square statistical tool.

The findings of the research revealed that employee involvement and empowerment coupled with teamwork is necessary in order for organizations to achieve their goals and quality programs, which includes customer focus and satisfaction. It is suggested that a formal TQM programme be established in SSSP and more principles of TQM that affects a steam station plant be identified and further research work be done on the application of the proposed tool for other process industries.

**Keywords:** Total quality management; SASOL's Steam Station Plant; process industry; holistic tool; Chi-square statistical tool

Right tail areas for the *Chi-square* Distribution



| d.f. | Area    | .995    | .990    | .975    | .950    | .900     | .750     | .500     | .250     | .100            | .050     | .025     | .010     | .005 |
|------|---------|---------|---------|---------|---------|----------|----------|----------|----------|-----------------|----------|----------|----------|------|
| 1    | 0.00004 | 0.00016 | 0.00098 | 0.00393 | 0.01579 | 0.10153  | 0.45494  | 1.32330  | 2.70554  | 3.84146         | 5.02389  | 6.63490  | 7.87944  |      |
| 2    | 0.01003 | 0.02010 | 0.05064 | 0.10259 | 0.21072 | 0.57536  | 1.38629  | 2.77259  | 4.60517  | 5.99146         | 7.37776  | 9.21034  | 10.59663 |      |
| 3    | 0.07172 | 0.11483 | 0.21580 | 0.35185 | 0.58437 | 1.21253  | 2.36597  | 4.10834  | 6.25139  | 7.81473         | 9.34840  | 11.34487 | 12.83816 |      |
| 4    | 0.20699 | 0.29711 | 0.48442 | 0.71072 | 1.06362 | 1.92256  | 3.35669  | 5.38527  | 7.77944  | 9.48773         | 11.14329 | 13.27670 | 14.86026 |      |
| 5    | 0.41174 | 0.55430 | 0.83121 | 1.14548 | 1.61031 | 2.67460  | 4.35146  | 6.62568  | 9.23636  | 11.07050        | 12.83250 | 15.08627 | 16.74960 |      |
| 6    | 0.67573 | 0.87209 | 1.23734 | 1.63538 | 2.20413 | 3.45460  | 5.34812  | 7.84080  | 10.64464 | <b>12.59159</b> | 14.44938 | 16.81189 | 18.54758 |      |
| 7    | 0.98926 | 1.23904 | 1.68987 | 2.16735 | 2.83311 | 4.25485  | 6.34581  | 9.03715  | 12.01704 | 14.06714        | 16.01276 | 18.47531 | 20.27774 |      |
| 8    | 1.34441 | 1.64650 | 2.17973 | 2.73264 | 3.48954 | 5.07064  | 7.34412  | 10.21885 | 13.36157 | 15.50731        | 17.53455 | 20.09024 | 21.95495 |      |
| 9    | 1.73493 | 2.08790 | 2.70039 | 3.32511 | 4.16816 | 5.89883  | 8.34283  | 11.38875 | 14.68366 | 16.91898        | 19.02277 | 21.66599 | 23.58935 |      |
| 10   | 2.15586 | 2.55821 | 3.24697 | 3.94030 | 4.86518 | 6.73720  | 9.34182  | 12.54886 | 15.98718 | 18.30704        | 20.48318 | 23.20925 | 25.18818 |      |
| 11   | 2.60322 | 3.05348 | 3.81575 | 4.57481 | 5.57778 | 7.58414  | 10.34100 | 13.70069 | 17.27501 | 19.67514        | 21.92005 | 24.72497 | 26.75685 |      |
| 12   | 3.07382 | 3.57057 | 4.40379 | 5.22603 | 6.30380 | 8.43842  | 11.34032 | 14.84540 | 18.54935 | 21.02607        | 23.33666 | 26.21697 | 28.29952 |      |
| 13   | 3.56503 | 4.10692 | 5.00875 | 5.89186 | 7.04150 | 9.29907  | 12.33976 | 15.98391 | 19.81193 | 22.36203        | 24.73560 | 27.68825 | 29.81947 |      |
| 14   | 4.07467 | 4.66043 | 5.62873 | 6.57063 | 7.78953 | 10.16531 | 13.33927 | 17.11693 | 21.06414 | 23.68479        | 26.11895 | 29.14124 | 31.31935 |      |

|    |          |          |          |          |          |          |          |          |          |          |          |          |          |
|----|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 15 | 4.60092  | 5.22935  | 6.26214  | 7.26094  | 8.54676  | 11.03654 | 14.33886 | 18.24509 | 22.30713 | 24.99579 | 27.48839 | 30.57791 | 32.80132 |
| 16 | 5.14221  | 5.81221  | 6.90766  | 7.96165  | 9.31224  | 11.91222 | 15.33850 | 19.36886 | 23.54183 | 26.29623 | 28.84535 | 31.99993 | 34.26719 |
| 17 | 5.69722  | 6.40776  | 7.56419  | 8.67176  | 10.08519 | 12.79193 | 16.33818 | 20.48868 | 24.76904 | 27.58711 | 30.19101 | 33.40866 | 35.71847 |
| 18 | 6.26480  | 7.01491  | 8.23075  | 9.39046  | 10.86494 | 13.67529 | 17.33790 | 21.60489 | 25.98942 | 28.86930 | 31.52638 | 34.80531 | 37.15645 |
| 19 | 6.84397  | 7.63273  | 8.90652  | 10.11701 | 11.65091 | 14.56200 | 18.33765 | 22.71781 | 27.20357 | 30.14353 | 32.85233 | 36.19087 | 38.58226 |
| 20 | 7.43384  | 8.26040  | 9.59078  | 10.85081 | 12.44261 | 15.45177 | 19.33743 | 23.82769 | 28.41198 | 31.41043 | 34.16961 | 37.56623 | 39.99685 |
| 21 | 8.03365  | 8.89720  | 10.28290 | 11.59131 | 13.23960 | 16.34438 | 20.33723 | 24.93478 | 29.61509 | 32.67057 | 35.47888 | 38.93217 | 41.40106 |
| 22 | 8.64272  | 9.54249  | 10.98232 | 12.33801 | 14.04149 | 17.23962 | 21.33704 | 26.03927 | 30.81328 | 33.92444 | 36.78071 | 40.28936 | 42.79565 |
| 23 | 9.26042  | 10.19572 | 11.68855 | 13.09051 | 14.84796 | 18.13730 | 22.33688 | 27.14134 | 32.00690 | 35.17246 | 38.07563 | 41.63840 | 44.18128 |
| 24 | 9.88623  | 10.85636 | 12.40115 | 13.84843 | 15.65868 | 19.03725 | 23.33673 | 28.24115 | 33.19624 | 36.41503 | 39.36408 | 42.97982 | 45.55851 |
| 25 | 10.51965 | 11.52398 | 13.11972 | 14.61141 | 16.47341 | 19.93934 | 24.33659 | 29.33885 | 34.38159 | 37.65248 | 40.64647 | 44.31410 | 46.92789 |
| 26 | 11.16024 | 12.19815 | 13.84390 | 15.37916 | 17.29188 | 20.84343 | 25.33646 | 30.43457 | 35.56317 | 38.88514 | 41.92317 | 45.64168 | 48.28988 |
| 27 | 11.80759 | 12.87850 | 14.57338 | 16.15140 | 18.11390 | 21.74940 | 26.33634 | 31.52841 | 36.74122 | 40.11327 | 43.19451 | 46.96294 | 49.64492 |
| 28 | 12.46134 | 13.56471 | 15.30786 | 16.92788 | 18.93924 | 22.65716 | 27.33623 | 32.62049 | 37.91592 | 41.33714 | 44.46079 | 48.27824 | 50.99338 |
| 29 | 13.12115 | 14.25645 | 16.04707 | 17.70837 | 19.76774 | 23.56659 | 28.33613 | 33.71091 | 39.08747 | 42.55697 | 45.72229 | 49.58788 | 52.33562 |
| 30 | 13.78672 | 14.95346 | 16.79077 | 18.49266 | 20.59923 | 24.47761 | 29.33603 | 34.79974 | 40.25602 | 43.77297 | 46.97924 | 50.89218 | 53.67196 |

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## LIST OF ACRONYMS

|       |   |                                                           |
|-------|---|-----------------------------------------------------------|
| AC    | - | Appraisal Costs                                           |
| ANSI  | - | American National Standards Institute                     |
| ASQC  | - | American Society for Quality Control                      |
| CFA   | - | Confirmatory Factor Analysis                              |
| CIRCA | - | Continuous Improvement Research for Competitive Advantage |
| DCC   | - | Defect Control Costs                                      |
| EFA   | - | Exploratory Factor Analysis                               |
| EFC   | - | External Failure Costs                                    |
| EVF   | - | Employee Value Factor                                     |
| EQA   | - | European Quality Award                                    |
| FIDIC | - | Fédération Internationale des Ingénieurs-Conseils         |
| FUTO  | - | Federal University of Technology, Owerri                  |
| IFC   | - | Internal Failure Costs                                    |
| ISO   | - | International Standards Organization                      |
| KAIE  | - | King Abdullah II Award for Excellence                     |
| KPA   | - | Key Performance Area                                      |
| KPI   | - | Key Performance Index                                     |
| MBNQA | - | Malcolm Baldrige National Quality Award                   |
| NYSAN | - | New York State Afterschool Network                        |
| PC    | - | Prevention Costs                                          |
| PQAT  | - | Program Quality Assessment Tool                           |

|        |   |                                  |
|--------|---|----------------------------------|
| SCI    | - | SASOL Chemical Industries        |
| SME    | - | Small to Medium-sized Enterprise |
| SSSP   | - | SASOL's Steam Station Plant      |
| SQA    | - | Singapore Quality Award          |
| TCQ    | - | Total Cost of Quality            |
| TQM    | - | Total Quality Management         |
| TQS    | - | Total Quality Service            |
| UNIBEN | - | University of Benin              |

## CHAPTER ONE

### 1.1 INTRODUCTION

There is a positive drive for greater efficiencies, reduced costs and increased productivity in today's business world (Zairi, 1991: vii). If an organization is to stay in operation in any competitive economy, continuous cost reduction and continuous quality improvement are essential. (Oakland, 2000: ix, Carpinetti *et al.*, 2003: 543). In order to fulfil today's business goals and objectives, many enlightened organisations are urgently promoting strategies that will result in a more responsive and effective service to customers (Ezeoguzie, 2005: 1).

The term "*Total Quality Management*" (TQM) was coined in 1985 by Nancy Warren, a psychologist with the United States Navy (FIDIC, 2001: 2). TQM has no universally accepted definition (Pheng, 1996: 7). Vouzas & Psychogios (2007: 64) gave the American Federal Office of Management Budget Circular baseline technical definition of TQM as "a total organizational approach for meeting customer needs and expectations that involves all managers and employees in using quantitative methods to improve continuously, the organization's processes, products and services".

TQM simply refers to the act of using everyone's commitment and involvement to achieve quality (Mitchell, 1994: 7). However, for the purpose of this research, the researcher has defined TQM as follows:

*"TQM is a senior management led company-wide initiative that involves all managers and employees commitment to satisfy or meet customer needs and expectations through continuous improvement."*

Over the past few decades, the level of awareness of TQM has considerably increased while discussions on the subject of TQM have been popularized (Zhang & Wijngaard, 2000: 730). According to Vouzas and Psychogios (2007: 63) through customer satisfaction, TQM aims to provide organizations with a model for success.

TQM is like a culture, that is, a total way of life. It is an enhancing culture that drives an entire organization. It is a total movement, or a way of life and a never-ending journey, which involves being quality driven in all aspects by continuous improvement.

Operationally, TQM is process focused and places emphasis on prevention rather than inspection and crisis management. It involves reducing errors, wastes and scraps, aiming at achieving zero defects in product and services and removal of long cycle time and delays in operations.

#### 1.1.1 Why TQM?

The importance of TQM has significantly increased over the last years, both practically and theoretically (Tari & Sabater, 2003: 267).

The primary purpose of TQM is to competitively provide excellence in customer satisfaction. It is driven by the need to meet the expectation and requirement of a customer. It acts as a means of change involving all staff. However, the full involvement of the entire workforce is the key factor for the success of TQM. The key factors for the success of TQM in organizations are (Huang & Lin, 2002: 173; Vouzas & Psychogios, 2007: 65);

1. Top management commitment
2. All level employee involvement
3. Continuous improvement

Implementing TQM has been an important feature for improving organisational efficiency (Yusof & Aspinwall, 2000: 31). There are various forms of TQM and irrespective of the form that is organizations adopt, there is positive effect on the bottom line performance of organizations (Kelemen, 2003). TQM is the license to be in the market. It helps organizations to achieve competitive advantage.

## 1.2 PROBLEM STATEMENT AND SUBSTANTIATION

Interest in TQM as a framework to further raise quality and improve the competitiveness of organizations has increased rapidly since the early 1980s (Woon, 2000: 314). TQM implementation has been considerably successful in terms of its implementation in business organizations and has been the subject of many studies in recent years (Forza & Filippini, 1998: 1).

The SASOL's Steam Station Plant (SSSP) customer care statement states that: "*we, at the Steam Stations value our customers and associates and strive to build lasting relations, mutually beneficial to all: in order to comply to our customer needs, we obtained ISO 9001 and ISO 14001 registration and is committed to quality and environment*" (Sasol Infrachem, s.a.).

With the growing interest in the implementation of TQM, the question is: how do organizations demonstrate the return on quality investment? **The answer lies in measurement** (Weller, 1996: 30; Sinclair & Zairi, 1995: 53).

Although, assessment of TQM has not been the subject of much empirical work, attempts have been made to measure its success or failure (Davidson *et al.*, 2001: 12); that is, how to assess and account for the return on the quality investments made by those stakeholders involved in the quality venture: Many organizations who are engaged in quality efforts have become obsessed with measurement techniques and are making every effort to measuring quality gains and performance through accruing amount of quantifiable data and then refining these gains (Weller, 1996: 31).

Chen *et al.* (2007: 162) maintains that, many quality measurement theories and models exist, but all of these are imperfect; that is each with its own advantages or disadvantages.

This research dissertation critically compared the advantages, disadvantages and limitations of the existing TQM assessment tools and techniques and developed an effective TQM assessment tool. The assessment tool developed will be proposed for

adoption in measuring TQM in SSSP. The scope of the research dissertation is limited on the identified TQM principles.

### **1.3 RESEARCH OBJECTIVES**

This research dissertation is carried out with a view to:

- 1) Critically study the advantages of the existing TQM assessment tools, including but not limited to the program quality assessment tool, inventory performance and multifactor model, service quality performance model, total quality index, continuous improvement self-assessment model, holistic model for total quality service and quality award programmes.
- 2) Critically study the disadvantages of the existing TQM assessment tools.
- 3) Critically study the limitations of the existing TQM assessment tools.
- 4) Develop an assessment tool for measuring TQM in SSSP.
- 5) Create a better employee awareness of TQM and thus improving the level of TQM implementation in SSSP.

### **1.4 BENEFICIARIES**

Developing an assessment tool for measuring Total Quality Management in SASOL's Steam Station Plant could serve as a means of increasing plant productivity and cost reduction.

For years, the lower cadre of employees had argued that it was management that had it wrong. Through greater involvement, teamwork and responsibility, employees become not only more motivated but also more productive and effective. Nobody wishes to be connected with awful quality! (Mitchell, 2000: 13).

SSSP customers are becoming more demanding. Complaints are seen as an opportunity to improve productivity and meet customers' satisfaction. Quality value is an increasingly important consideration as customers struggle to balance the relative price and quality levels offered between suppliers.

The research analysis and recommendations stand to benefit:

- + SSSP
- + Employees of SSSP
- + Customers/stakeholders of SSSP
- + Engineering body of knowledge
- + The researcher

## **1.5 LIMITATIONS OF THE STUDY**

Some limitations were encountered in the course of this research. These limitations include:

- ❖ Reluctance of some of SSSP workers to give information to the researcher. Some of the respondent believes that giving information might expose the company to the danger of their competitors.
- ❖ Although some of the elements of TQM is being implemented in SSSP, there was still the lack of full knowledge of the concept of TQM in SSSP. Some employees have low level of TQM awareness.

## **1.6 DISSERTATION OUTLINE**

### **Chapter One**

Chapter one is an introduction into the concept of Total Quality Management. It dealt with the importance of TQM and highlighted who the beneficiaries of this research work are. Some of the limitations encountered during the course of this research work are also highlighted here.

### **Chapter Two**

Chapter two deals with a thorough literature review of the concept of quality and total quality management. The work of different researchers, authors and experts in quality and TQM is extensively studied. The literatures, journals, textbooks and other related works explained the important terms, precepts and concepts with respect to TQM and the principles of TQM.

### **Chapter Three**

Chapter three gives an overview of the existing TQM assessment tools, their advantages, disadvantages and limitations. The tool adapted for measuring TQM in the process industry is also discussed, and a tool for measuring TQM in SSSP is proposed and discussed.

### **Chapter Four**

The research design is presented in chapter four. In order to achieve the stated objectives, the SSSP was investigated on TQM. It explains the design and methodology in gathering information using questionnaires, unstructured interviews, observations and internet sources, etc. as they relate to the research dissertation.

### **Chapter Five**

In chapter five, analysis and discussions on the findings in chapter four is done. The data from the questionnaire response is extensively analyzed.

### **Chapter Six**

In chapter six, the research dissertation is concluded by summarizing what has been done so far. Conclusions and recommendations are made.

## **CHAPTER TWO**

### **2.0 LITERATURE REVIEW**

This chapter will deal extensively with the concept of quality, and will include the definitions of quality and the evolution of quality. The quality terms, as they relate to TQM will be discussed. The nine key TQM principles will also be thoroughly explained in this chapter.

### **2.1 WHAT IS QUALITY?**

Quality is the conformance of a product or service to requirements or specifications and its fitness to satisfy or exceed its intended use or given need. Over time, the concept of quality has been carefully looked at and it has continued to be of much concern till date.

Quality, according to Kelemen, is by no means a modern invention: quality has always been important to human survival and progress. The quality of crops, the quality of houses and roads, of medical care were as important to our ancestors as they are to us. Quality has become a scientific discipline in the last century that is safeguarded by professional elite of managers, designers, engineers and marketers (Kelemen, 2003).

There is no doubt that quality is the number-one requirement for any product or service. It is rightly said that once an organization is out of quality in its product or service, the organization is out of business.

As a scientific discipline, quality has its own vocabulary, techniques and rules that must be endorsed by those interested in pursuing its cause. As the quality profession grows and matures, the meaning of quality continues to evolve (Evans & Lindsay, 2005: 12). There are three features usually associated with the definition of quality (Mitra, 1998: 7) and these are:

1. Quality of design;
2. Quality of conformance; and

### 3. Quality of performance.

#### **Quality of Design:**

This simply refers to the minimum conditions that products or services must meet in order to satisfy the requirements of the customer. According to Mitra (1998: 7), *"it implies that the product or service must be designed to meet at least minimally the needs of the consumer."*

#### **Quality of Conformance:**

This refers to the fact that the products or services must meet the standards that have been selected in the design (Talha, 2004: 17). Quality of design has an impact on quality of conformance, as an organization must be able to produce what was designed (Mitra, 1998: 7).

#### **Quality of Performance:**

This is the third aspect of quality and measures the degree to which the products or services satisfy the customers (Mitra, 1998: 7). It refers to how well the product functions or how the service performs when put to use. Shown in figure 2.1 is a diagrammatic representation of the three aspects of quality and their inter-relationships.



**Figure 2.1 Three aspects of quality (Mitra, 1998: 9)**

### 2.1.1 Definitions of Quality

There is no universally agreed definition of quality; different definitions highlight different aspects of quality. We can liken quality to beauty and say quality is in the eye of the beholder or the mind of the consumer just like the old saying "beauty is in the eye of the beholder" (Peters, 1999: 6).

According to Soanes and Stevenson (2004: 1174), quality is defined as "*the standard of something measured against other things of a similar kind.*" It refers to *general excellence*. However, for the purpose of this research dissertation, given below are brief definitions of quality by renowned authors who have contributed immensely to the development of quality management as we have it today.

#### 1. Customer-Based:

According to the ANSI/ASQC A3 1978, "*quality is the totality of features and characteristics of a product or service that bears on its ability to satisfy given need.*"

Quality thus refers to meeting or exceeding customer expectations. The customer is the most vital component in the production (Deming, 1982).

#### 2. Product-Based:

"Differences in quality reflect differences in quantity of some desired ingredient or attribute" (Evans & Lindsay, 2005: 13)

#### 3. Value-Based:

The term *value* refers to the usefulness or satisfaction to price. Quality in a value-based perspective is defined as "a product or services nature or feature that reflects capacity to satisfy expressed or implied statements of need" (Deming, 1982).

#### 4. Manufacturing-Based:

Quality is refers to the conformance to requirements or specifications (Zairi, 1991: 34; Crosby, 1984).

## 5. User-Based:

In terms of user-based, quality is defined as “fitness for intended use”. It consists of the capacity to satisfy needs of requirements (Zairi, 1991: 34).

## 6. Transcendent-Based:

Evans and Lindsay (2005: 12) refers to transcendent-based quality as “both absolute and universally recognizable, a mark of uncompromising standards and high achievement.” This means that quality cannot be defined precisely – you just know it when you see it.

The above definitions show how broadly quality can be applied in business and also that quality is present or missing from every aspect of an organization's operation depending on how quality is defined and measured. Figure 2.2 shows quality perspective in the value chain.

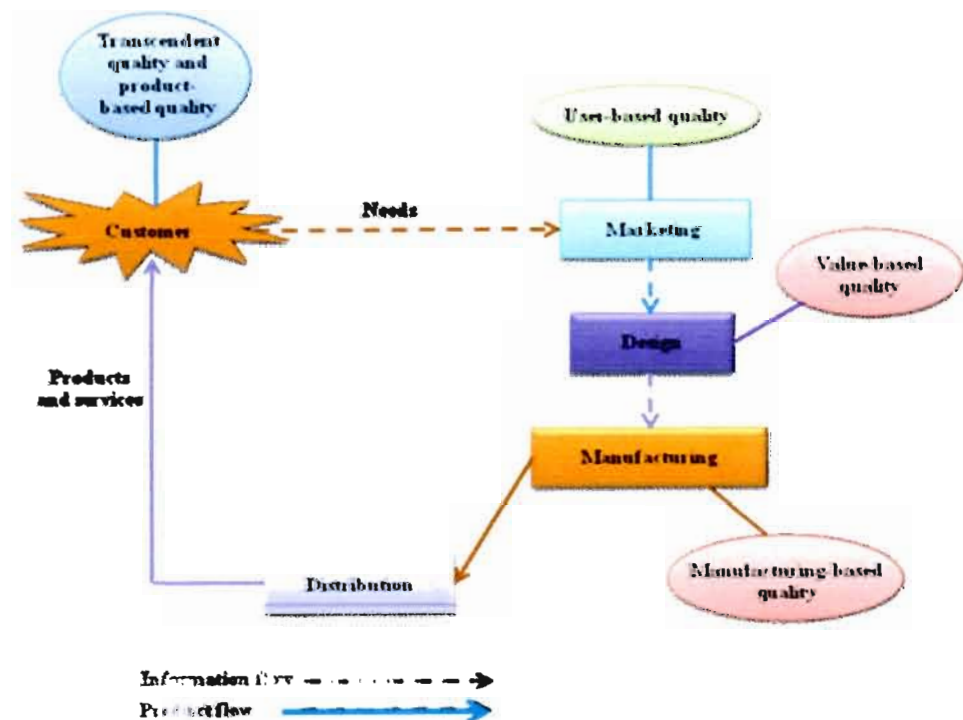


**Figure 2.2** Quality perspective in the value chain (Evans & Lindsay, 2005: 15)

It is important that every organization make the effort to define quality in its unique business, managerial and competitive requirements (Okoye, 2005: 9). This is a very key factor in quality management. It is only after an organization has defined what quality means to it that a quality management system can be developed to achieve its aim and objectives (Okolie, 2002: 11).

## **2.2 EVOLUTION OF QUALITY**

The concept of quality has been in existence for a long time and has developed from the stages of playing a purely reactive role (inspection) to its present prominence in shaping the competitive strategy of business (Zairi, 1991: 15). Concerns for quality are a general thread of both ancient and modern societies; approaches associated with the control and management of quality have developed constantly due to changing economic, social and political conditions and this has been really influenced by cultural and historical factors (Kelemen, 2003).

The First and Second world Wars for example, have given a drive to quality control as a result of the strategic importance and the fast growth of the defense industry. It stirred the development of mass production. Standardization, inspection and interchangeable parts became prevalent in America. The Second World War offered another drive to the development of quality control with a clear stress on preventive activities rather than the detection of low quality (Kelemen, 2003).

Japan was a relatively obscured player at the time when the American imprint on quality was very obvious throughout and between the two wars (Goetsch & Davis, 2006: 10; Petersen, 1999: 477). However, after the Second World War, Japan transformed itself from a country that manufactured mainly shoddy goods into a quality leader in most fields, ranging from car manufacturing to electronics and home appliances. As a result of an extraordinary ability to rapidly and efficiently import and adopt foreign knowledge and know-how, Japan was the first nation to identify and capitalize on the fundamental nature of quality and its strategic role in the global market (Kelemen, 2003).

Across centuries, China and the West have represented major basis for the import of cultural and technological know-how, for the Japanese. In disparity to Japan and America, the British advance to quality in the twentieth century seemed to be highly sectionalized and erratic; the overall approach was to give lip service to quality and favour fire-fighting techniques rather than chase long-term commitments to quality (Kelemen, 2003).

The expansion of quality as a scientific discipline and practice of management has been comprehensive (Kelemen, 2003). Quality as a discipline has become more and more complex and its consequences have become more and more important. If quality used to mean mere conformance to standards, or fitness for use, it now accounts for the expectation and perceptions of the end-user - the customer (Goetsch & Davis, 2006: 5).

Quality has extended from the fields of manufacturing and engineering to integrate the entire production chain, from design to marketing to after-sale services. If initially quality was only the concern of a few specialized professionals from the quality assurance department, it has now become everybody's responsibility in the organization, from the front line people to the highest echelon of management.

Quality is a total culture that includes many sub-disciplines. It has spread to the service, public and voluntary sectors and its focus have shifted away from inspection and detection to preventive and corrective actions, maintenance management, continuous improvement, quality assurance, etc (Ezeoguzie, 2005: 16).

The common concern with quality as a scientific discipline and as a practice of management was driven by a number of 'quality gurus' whose models and theories are presented below (Kelemen, 2003; Huggins, 1998: 60).

1. The early American writers give to mainly a managerial approach to quality: Deming E. W. (1900-1993) and Juran J. M. are characteristically related with the manufacturing-based view on quality, while Feigenbaum A.V. is the

advocate of the value-based approach to quality. To some degree however, Juran and Feigenbaum also embrace a user-based view on quality (Mitchell, 2000: 104). The message of quality was taken to Japan by the early gurus.

2. The Japanese writers developed new concepts in response to the American messages from the late 1990s onwards: K. Ishikawa could be said to have embraced a social constructivist approach to quality, while G. Taguchi and S. Shingo subscribed to manufacturing-based views of quality (Kelemen, 2003).
3. The new Western wave writers, following the Japanese industrial success, have given rise to increased awareness of quality in the West: Phil Crosby (1926-2001) embraces a slogan approach to quality, while Tom Peters's approach is more in line with the transcendental and discursive approaches. Nevertheless, both gurus argue that quality is a manageable and controllable occurrence: in this vein, they could also be classified as managerialists (Ezeoguzie, 2005: 16).

## **2.3 QUALITY TERMS**

In order to understand the term TQM, the following quality terminologies such as quality control, quality assurance, quality planning, quality costs, quality improvement and quality management are explained.

### **2.3.1 Quality Control**

Quality control simply refers to the system of ensuring that the standard of a product or service is kept. According to Soanes and Stevenson (2004: 1174) quality control is a system of maintaining standards in manufactured products by testing a sample of the output against the specification. Mitra's (1998: 9) view of quality control is that quality control is a system that is used to maintain a desired level of quality in a product or service.

The term is usually applied in the context of manufacturing operations. The manufacturer makes one or more items, each having a set of requirements for various attributes, which must be achieved to satisfy the needs of the customer (Ezeoguzie,

2005: 23). Quality control involves a monitoring activity as well as finding and eliminating those factors that cause quality problems, in order to meet continuously the customers' requirements (Oakland, 2000: 13).

The following processes are involved in quality control (Evans & Lindsay, 2005: 25):

1. Assess actual quality performance
2. Compare performance with goal
3. Act on differences between performance and goals

The work of quality control is incorporated into the overall organization in several ways. The quality control department should be organized according to accepted management principles. The roles of a quality control division directly connected with getting out a product can be seen as a continuous sequence. The duty of a quality control division does not end with the shipment of the product. It follows product performance in the field and by making definite suggestions, encourages the engineering department to redesign the product to improve its quality and performance.

### 2.3.2 Quality Assurance

The term *quality assurance* is used to describe activities taken to prevent non-conformance and to remove doubt about meeting customers' requirements. It is a system of activities designed to ensure production that meets pre-established requirements (Talha, 2004: 17).

Quality assurance incorporates procedures for planning, establishing, monitoring, auditing and evaluating management systems. According to Oakland (2000: 13), *quality assurance involves the prevention of quality problems through planned and systematic activities (including documentation).*

A standard definition for quality assurance is given by the ANSI/ASQC Standard A3 1987 which defines quality assurance as follows:

*"All those planned or systematic actions necessary to provide confidence that a product or service will satisfy given needs"*

Providing consistent quality service and removing any possibilities of failure to meet customer expectations is the basic objective of quality assurance. It gives a guarantee of quality to the customer by measuring product conformance with processes and performance specifications. It ensures that there is a formal system in place that continually surveys the effectiveness of the quality philosophy of an organization (Mitra, 1998: 11).

### **2.3.3 Quality Planning**

The bedrock on which total quality is built is a quality management system (Ezeoguzie, 2005: 19). Quality planning is a documented system that ensures that the requirements of customers are satisfied. It aims to remove causes of error and non-conformance and provide for corrective action to be taken if necessary. It requires that a quality plan be written for the provision. *It involves the development of products, systems and processes needed to meet or exceed customer expectations* (Evans & Lindsay, 2006: 24).

According to Walkin (1993), where a large-scale operation with differing inputs and resources is concerned, each department will need a plan that can be integrated into an overall quality plan. This requires everyone in the operation to work systematically to document procedures and to generate specified records while operating the procedures. Planning involves:

1. Analyzing service requirements.
2. Developing performance criteria and action plans to enable standards to be achieved.
3. Documenting systems and control procedures and defining responsibilities.
4. Resourcing and delivering the service.

5. Monitoring, auditing and reviewing the effectiveness of implementation and operating a quality improvement programme where non-compliance is revealed by audit.

#### **2.3.4 Quality Costs**

According to Mitra (1998: 21), one measure of the performance of the total quality system is the cost associated with it. There are numerous classifications of quality costs. General Electric was the first American company, in 1946, to introduce a quality cost management system. The most extensively used taxonomy of quality costs follows intimately the General Electric model and is reflected in both ISO 900 series and the British Standards BS 5750. Usually, quality costs are allocated under four major headings as follows (Kelemen, 2003):

##### **(1) Prevention Costs**

Prevention costs are costs that aim to reduce the possibility of failure (either internal or external) costs occurring. They are incurred in planning, implementing and maintaining a quality system (Mitra, 1998: 21). Typical examples of preventive costs include quality planning, training, supplier assurance, design verification and quality engineering.

##### **(2) Appraisal Costs**

Appraisal costs are costs that are associated with activities that aim to ensure the conformance of products and processes to pre-set requirements. They are associated with measuring, evaluating or auditing products, components or purchased materials to determine their degree of conformance to the specific standards (Mitra, 1998: 21). Typical examples include stock evaluation, inspection, machines testing, calibration, maintenance, inspection and process control.

##### **(3) Internal Failure Costs**

Internal failure costs occur when a product fails to meet the requirements, such failure being identified before delivery to the customer. They are incurred when products, components, materials and services fail to meet quality requirements prior to the

transfer of ownership to the customer (Mitra, 1998: 21). Typical examples of internal failure costs include scrap, repair, troubleshooting, failure analysis, lost productive time and rework.

#### (4) External Failure Costs

External failure costs occur when a product fails to meet the requirements after delivery to the customer. They are incurred when the product does not perform satisfactorily after ownership is transferred to the customer (Mitra, 1998: 21). Distinctive examples are loss of sales, warranty claims, complaints, returned materials repairs and recall costs (Kelemen, 2003).

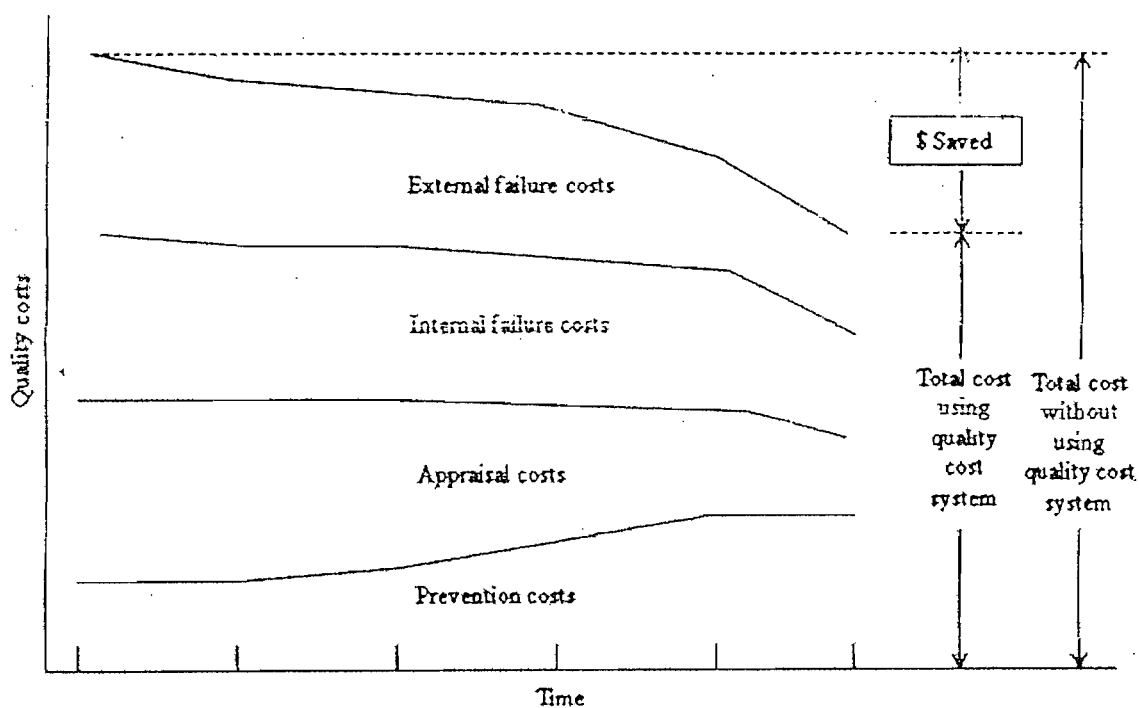


Figure 2.3 Quality cost trend prediction as a function of time (Mitra, 1998: 22).

According to Juran (1988), the total cost of quality (TCQ) is the sum of failure costs (IFC and EFC) and defect control costs (DCC) composed of prevention costs (PC) and appraisal costs (AC). Thus,

$$TCQ = PC + AC + IFC + EFC$$

PC and AC are costs relating to ensuring that the product conforms to specifications (conformance costs), while IFC and EFC are costs of non-conformance.

### 2.3.5 QUALITY IMPROVEMENT

Simply put, quality improvement is anything which causes a beneficial change in quality performance. This is a systematic and continuous way of improving all processes and systems in an organization in order to achieve optimal level of performance. It is a continuous and never-ending process for changing standards.

Mitra (1998: 19) states that quality improvement relates to the detection and elimination of common causes. In every organization, quality improvement should be the objective of the entire organization and individuals. Two basic ways of bringing about improvement in quality performance are;

- (a) **Better Control:** This is a process for changing standards. Standards are altered through a process, education and training. The standards that emerge from this process are an improvement from those used previously.
- (b) **Raising Standards or Innovation:** This is a process for creating new standards, but not for maintaining or improving existing standards. Standards are formed through a process that starts at a feasibility phase and evolves through research and development to result in a new standard established for recurring applications. Such standards are consequences of innovations in technology, marketing and management.

The level has been set in the transition between where quality improvement stops and quality control begins and the mechanisms are in place to keep quality on or above this set level. In simple terms, if quality improvement reduces quality costs from 25% of turnover to 10% of turnover, the objective of quality control is to prevent the quality costs rising above 10% of turnover. Quality improvement through increased productivity and cost reduction, improves the rate of return or profitability.

### **2.3.6 TOTAL QUALITY**

The term '*total*' refers to something that involves the entire organization, supply chain, and/or product life cycle. The New Webster's Dictionary of the English Language (2000: 1043) defines total as entire; constituting the whole.

Total quality can therefore be referred to as the conformance of a product or service to requirements or specifications and its fitness to satisfy or exceed its intended use or given need in the entire organization. Thus, total quality has to do with quality in the entire organization.

### **2.3.7 THE ROLE OF QUALITY MANAGEMENT**

The services and products of a successful firm have to meet three sets of requirements (FIDIC, 2001: 3):

- (a) The requirements of the clients;
- (b) The requirements of the society; and
- (c) The requirements of supplying organizations.

Quality management system is achieved through the functions of planning, organizing, staffing, directing and controlling (Mitra, 1998: 25). The management of quality aims to integrate all processes and functional units to meet the goals of the organization. Management is geared towards the prevention of nonconformities, and their aim is to design, manufacture and maintain the product or the service at the least possible cost while still meeting all customer requirements.

According to Mitra (1998: 25), companies are presently finding out that meeting customer requirements is not always enough to remain competitive. He stated that companies have to satisfy their customers to such a degree that they continually repurchase the product. Mitra further maintained that this feat can be achieved only through thorough evaluation and analysis of performance data integrated into the design phase.

The concept of quality management is concerned with the processes leading to the service or the product, recognising that if those processes are correct, then the service or product will be correct. An integral part of quality management is an involvement of all employees in an organization in the continuous improvement process of the organization. Quality management is a strategy for efficient and effective improvement in organizations (Ivanović & Majstorvić, 2006: 410).

## 2.4 TOTAL QUALITY MANAGEMENT (TQM)

In this age of technological explosion, managers are faced with the challenge of how to uphold technological leadership and present the best possible technology for the customer (Chiou *et al.*, 1999: 69). As earlier defined, TQM is a senior management led company-wide initiative that involves all managers and employees commitment to satisfy or meet customer needs and expectations through continuous improvement.

According to Kelemen, TQM is a philosophy and practice of management which aims to satisfy the customers by means of employee involvement, consistent leadership and continuous improvement.

When all TQM elements are implemented properly, TQM is like a well-built home, which is solid, strong and cohesive.

Looking at TQM critically;

**Total** – involves everyone and all activities in the organization

**Quality** – conformance to requirements (meeting customer requirements)

**Management** – quality can and must be managed

There are two broad approaches to TQM, these are:

- (1) **The hard approach:** this emphasizes continuous improvement by the use of statistical methods. This approach is related with early experts' work, its intent being to improve productivity and profits.

- (2) **The soft approach:** this approach focuses on leadership, employee involvement and cultural change. The approach was popularized by the late wave of American experts and its purpose is to create a strong organizational culture aligned to the needs of the customer.

According to Mitra (1998: 89), TQM revolves around three main themes: the customer, the process and the people. It is a comprehensive approach to improving competitiveness, effectiveness and flexibility through planning, organizing and understanding each activity and involving each individual at each level.

TQM is a business discipline and idea of management which establishes company-wide planned and continuous business improvement through employee participation and involvement with the aim of satisfying the customers in the market place (Kelemen, 2003). From most TQM approaches, the three fundamental pillars of TQM are top management commitment, continuous improvement through scientific knowledge and employee involvement.

TQM has been seen as a source of competitive advantage for the last two decades (Martins & Toledo, 2000: 145). Pheng (1996: 7) maintains that TQM refers to the organization's culture defined and supported by the constant attainment of customer satisfaction through an integrated system of tools, techniques and training. This involves the continuous improvement of organizational activities and results in an increase in quality products and services.

Zairi (1991: 41) maintains that TQM is not just a question of achieving standards, but one of survival and being strong all the time. TQM is the management of quality in totality. The focus of TQM is on the customer (Reavill, 1998: 55). Every organization tends to generate their products or services in order to satisfy or even "delight" the customer. The customer defines the purpose of the products or services and the organizations generate their products or services to "fit the purpose" defined by the customer.

## 2.5 TQM PRINCIPLES

The principles of TQM create the foundation for developing an organizations system for planning, controlling and improving quality (Waldman, 1994: 31). Research has shown that there are many TQM principles commonly found in TQM literatures (Vouzas & Psychogios, 2007: 62). However, for the purpose of this research, nine key TQM principles have been identified. These principles are:

- Total employee involvement
- Continuous improvement
- Continuous training
- Teamwork
- Employee empowerment
- Top-management commitment
- Participative management style
- Customer satisfaction
- Culture change

### 2.5.1 Total Employee Involvement

At the core of TQM lies the idea that all employees play a substantial role in quality improvement. The total involvement of all employees is critical to the successful implementation of TQM in any organization (FIDIC, 2001: 7). It is general belief that when employees participate more in the overall quality strategy program, there is an increase flow of information and knowledge. (Vouzas & Psychogios, 2007: 65).

TQM stresses open communication between individuals and sections as well as teamwork. It claims to offer individuals the opportunity to fulfil personal goals and aspirations while pursuing the objectives of the corporation. The assumptions behind such arguments are that individuals search for meaning in work (rather than outside work) and their sense of achievement in life is closely linked to the act of production (rather than the act of consumption).

This may be a far cry from what is in fact the case. Some employees may be quite excited to execute mindless tasks without having to think about ways for improving their work. For others, work may be only a way to an end: the means for survival or well being through consumption practices.

There are two basic functions of total employee involvement. Firstly, total employee involvement makes use of all individuals' competencies, knowledge and experience for a better decision or plan, and a more effective improvement. This is achieved by bringing more minds to bear on the situation – not just any mind (Goetsch & Davis, 2006: 17). Secondly, total employee involvement, by involving the people who will have to implement decisions, promotes ownership of decision.

### **2.5.2 Continuous Improvement**

Continuous improvement is the nucleus of TQM (Temponi, 2005: 17). In recent years, the term “continuous improvement” has become more popular and is associated with the adoption of a variety of organisational developments including employee involvement programmes and customer service (Caffyn, 1999: 1138).

According to Khan (2003: 374) and Nilsson-Witell *et al.* (2005: 753), continually improving performance will help to improve organizational output. Improving the productivity of existing capacity through continuous improvement will help to increase output. Continuous improvement usually relies on the collection of objective data (i.e., facts that are apparently true) that can be used systematically to improve work processes and products. Continuous improvement sits at the heart of Juran's ‘quality spiral’ which sees quality as a never-ending process unfolding systematically and continuously throughout the organization (Bhuiyan & Baghel, 2005: 761).

In order for an organization to continually improve their services or products, such organization needs to continually improve their systems (Longenecker, 1996: 55). Continuous improvement of organizations' quality of products or services is one of the fundamental goals in a total quality setting (Goetsch & Davis, 2006: 14). Shown below is a strategic framework for developing continuous improvement capabilities.

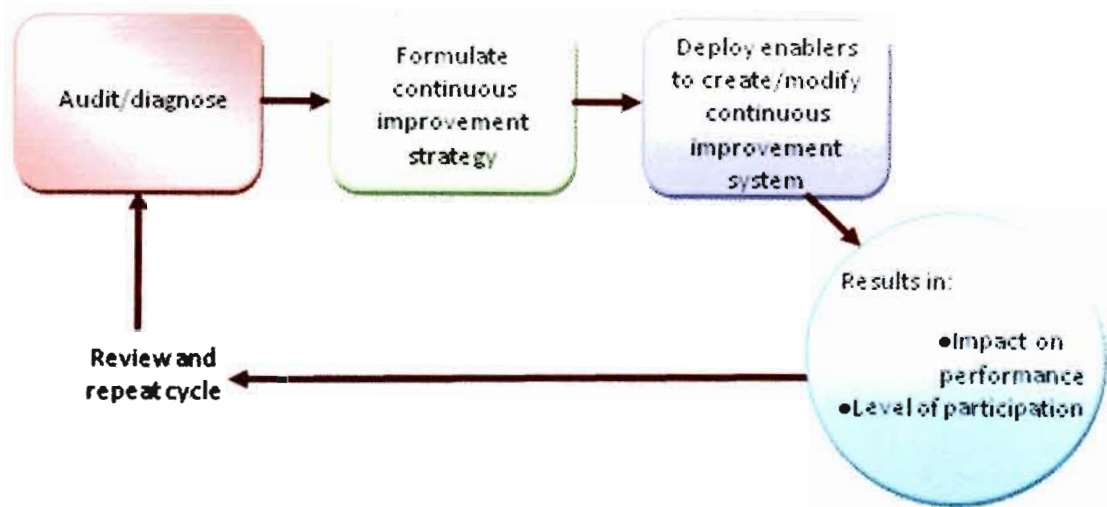


**Figure 2.4 Generic strategic framework for developing continuous improvement capabilities (Caffyn, 1999: 1139)**

If an organization builds up a management philosophy of continuous improvement and supplies the necessary supporting organizational practices, quality improvement can be achieved (Vouzas & Psychogios, 2007: 65). Planning, prevention and anticipation are the focus of continuous improvement. Prevention (as opposed to detection) plays a significant role in any process of continuous improvement. Prevention presupposes predictability; thus, detailed figures are needed at all stages in order to ensure the removal of special causes of failure.

An important means by which processes could be understood, controlled and continuously improved by both managers and employees is by the use of statistical tools and techniques. Continuous improvement does not simply have to be mechanistic act of pursuing statistical routines: it can also be about pursuing enhanced learning.

Evans and Lindsay (2005: 21) refer to continuous improvement as “both incremental changes, which are small and gradual, and breakthrough, or large and rapid, improvements.”

### 2.5.3 Continuous Training

Just like continuous improvement, continuous training plays a vital role in total quality management in any organization (Zhang, *et al.*, 2000: 735). According to Oakland (2000: 234), training is the single most significant component in trying to improve quality. In order for an organization to effectively implement TQM, there should be a training policy in place. This training policy should be geared towards improving the necessary skills for continuous quality improvement and should be part of the overall quality improvement strategy.

People, who know how to work hard, learn how to work smart through effective and continuous training. Continuous training of individuals in an organization is the best way of improving the skill level of individuals in an organization and the correct application of these skills in a motivational climate with objectives and targets will result in organizational improvement. Evans and Lindsay (2006: 14) assert that: "in a quality organization, everyone is constantly learning. Management encourages employees to constantly promote their level of technical skill and professional proficiency. People gain an ever-greater mastery of their jobs and learn to broaden their capabilities."

### 2.5.4 Teamwork

Another principle of TQM is teamwork. This is an important outcome and a condition for continuous improvement (Vouzas & Psychogios, 2007: 65). Rapid quality can be achieved in an organization through the full use of the knowledge, experiences, competencies and creativity of the entire workforce.

According to Goetsch and Davis (2006: 14), the best competitive efforts are often among departments within the organization. When employees are allowed to participate in teams in decisions that affect their jobs and the customer, they make very substantial contributions to quality.

Evans and Lindsay (2005: 20) maintain that "partnerships with unions, customers, suppliers and education organization promotes teamwork and permit the blending of

an organization's core competencies and capabilities with the complementary strengths of partners, creating mutual benefits. In every organization, teamwork is needed to make employees work more effectively and more flexibly and to develop mutual trust among members of staff. It is important for the whole organization to care about quality improvement if TQM must be fully implemented in an organization.

### **2.5.5 Employee Empowerment**

A cornerstone of TQM is increased control over the work process of the organization and another important principle of TQM is empowering of the employee. Organizations show high level of trust for employees by empowering them to make decisions that satisfy customers, without constraining them to rules that are not within their ability and competence (Evans & Lindsay, 2005: 20).

As a result of well-planned and well-carried out control, freedom is enjoyed in a total quality setting. Employee empowerment not only brings more minds to bear on decision-making process, but also increases the ownership employees feel about decisions that are made in the organization (Goetsch & Davis, 2006: 14). This is fundamental to TQM.

The value of decision-making as an empowerment tool lies in the employee being able to make decision within his own role if:

- he/she has the knowledge to make the decision;
- he/she has the understanding of the consequence of the decision; and
- he/she takes responsibility and accountability for his/her decisions.

In process environments, decision matrixes are good tools that help the employees in decision-making. One must be aware that the outcome of decisions influences everybody. Thus it is a big responsibility. Employees that are empowered can incorporate their skills in their day-to-day tasks and such employees can exercise better judgement and sense of responsibility. The employees perceptions of their organization's TQM programmes are related to their affective reactions and this will

determine their level of participation, thus, leading to their empowerment. TQM thus, results in employee empowerment and supporting an organization's efforts towards quality improvement.

#### **2.5.6 Top Management Commitment**

In a typical TQM organizational setting, top management commitment and support have to be genuine and evident. Commitment at the topmost level is important in order to build quality throughout the organization.

According to Oakland (2000: 20), *"TQM must be truly organization-wide, and it must start at the top with the Chief Executive or equivalent."* He further stated that it is the duty of the senior directors and management to demonstrate a serious attitude towards quality and the duty of the middle management to explain the principles of TQM to the people for whom they are responsible, and ensure that their commitment is communicated.

Top managers of organizations need to take charge personally, lead the processes, provide directions, exercise forceful leadership, including dealing with employees who deter improvement and maintain the impetus (Kasul & Motwani, 1995: 60). Senior managers should accept responsibility for a policy they believe in, so as to create responsibilities for a chain of quality interactions between the different departments of such organizations. It should be noted that leading quality improvement is the responsibility of every member of the organization, including managers and employees of all level.

#### **2.5.7 Participative Management Style**

In a proper TQM organizational setting, a participative management style is identified. The basic difference between TQM and other management approaches is that TQM is more participative.

In order for an organization to successfully implement TQM, employees should be engaged in extra-role behaviours. Soliciting ideas and input from employees make

them more participative in the organizational affairs. A TQM plan in which employees are more participative and given freedom to air their views in a participative way is the most appropriate style of management.

#### 2.5.8 Customer Satisfaction

Another basic TQM principle is customer satisfaction. It is the primary focus and key objective of TQM. Khan (2003: 376) states that when customers are delighted, organizations are able to compete in an environment of stiff competition. Customer satisfaction is the objective to improving organizational performance. (Vouzas & Psychogios, 2007: 66). It is imperative to know what customers want and provide products and services that satisfy their requirements (Chiou, 1999: 69).

According to FIDIC (2001: 6), “management and each employee must learn the concept of internal and external customer – the client- to be satisfied, but along the way as each person passes work to the next, the concept of the ‘next person as a customer to be satisfied’ must be cultivated.” Goetsch and Davis (2006: 12) define internal customers as those customers that help to define the quality of the people, processes and environments associated with the products or services, while external customers are those customers that define the quality of the products or services delivered.

In order to entice new customers and retain old customers, an organization must focus on providing value to the customer in a manner that is more effective than those of its competitors. A close relationship with the customer should be maintained in order to fully determine the customers’ needs. Feedbacks should be received and the extent to which the customers’ needs are met should be determined. An effective TQM plan should include the following questions (Oakland, 2000: 8):

1. Who are the customers?
2. What are their true requirements?
3. How does the organization find out what the requirements are?
4. How can the organization measure its ability to meet the requirements?

5. Does the organization have necessary capability to meet the requirements?
6. Does the organization continually meet the requirements?
7. How does the organization monitor changes in the requirements if requirements change?

Oakland (2000: 5) argues that when customer requirements are consistently met, organizations can move to a higher level of satisfaction, which is, *delighting the customer*. According to Khan (2003: 376), when products or services exceed customer's expectations, customer satisfaction changes into customer delight.

From Vouzas and Psychogios (2007: 66) view, for customer satisfaction to be realized, all employees and managers of an organization must consider continuous improvement as something that is normal. Organizations should make an inventory of customer's data, customer's complaints and benchmarking. This is done to improve the customer orientation.

When organizations meet customers' requirements and needs, it leads to higher competitive advantage in the market. According to Oakland (2005: 5), focusing on customer loyalty can provide several commercial advantages, which include:

- Customers cost less to retain than to acquire.
- The longer the relationship with the customer, the higher the profitability.
- A loyal customer will commit more spend to its chosen supplier.
- Some of the new customers will come through referrals from existing customers.

Satisfying customers is the primary benefit of a TQM system (FIDIC, 2001: 12). Customer satisfaction is thus, the relevant objective for ensuring a stable and continuously increasing business (Goetsch & Davis, 2006: 13). Customers require assurance that organizations will provide products and services that will meet their needs and organizations should provide such assurance.

### 2.5.9 Culture Change

According to Oakland (2005: 32), *"the culture of an organization is formed by the beliefs, behaviours, norms, dominant values, rules and climate in the organization"*. A critical determinant of an organization's culture is the business environment in which the organization must operate. Goetsch and Davis (2006: 174) argue that "organizations that operate in a stable market in which competition is limited may develop a *don't-rock-the-boat* culture".

Goetsch and Davis (2006: 174) define a quality culture as *"an organizational value system that results in an environment that is conducive to the establishment and continual improvement of quality. It consists of values, traditions, procedures and expectations that promote quality."*

The common denominator of all the soft aspects of TQM is a supportive organizational culture. Cultural barrier is one of the major obstacles that organizations face when they try to implement TQM. It is imperative for organizations to make every possible effort to change the organization's culture. From Vouzas and Psychogios (2007: 67) view, organizational culture controls people's actions and reference points. This changes their perceptions of all aspect of their work.

Vouzas and Psychogios (2007: 67) also argue that "quality culture nurtures high-trust social relationships and develops a shared sense of membership as well as a belief that continuous improvement is for the good of everyone within the organization."

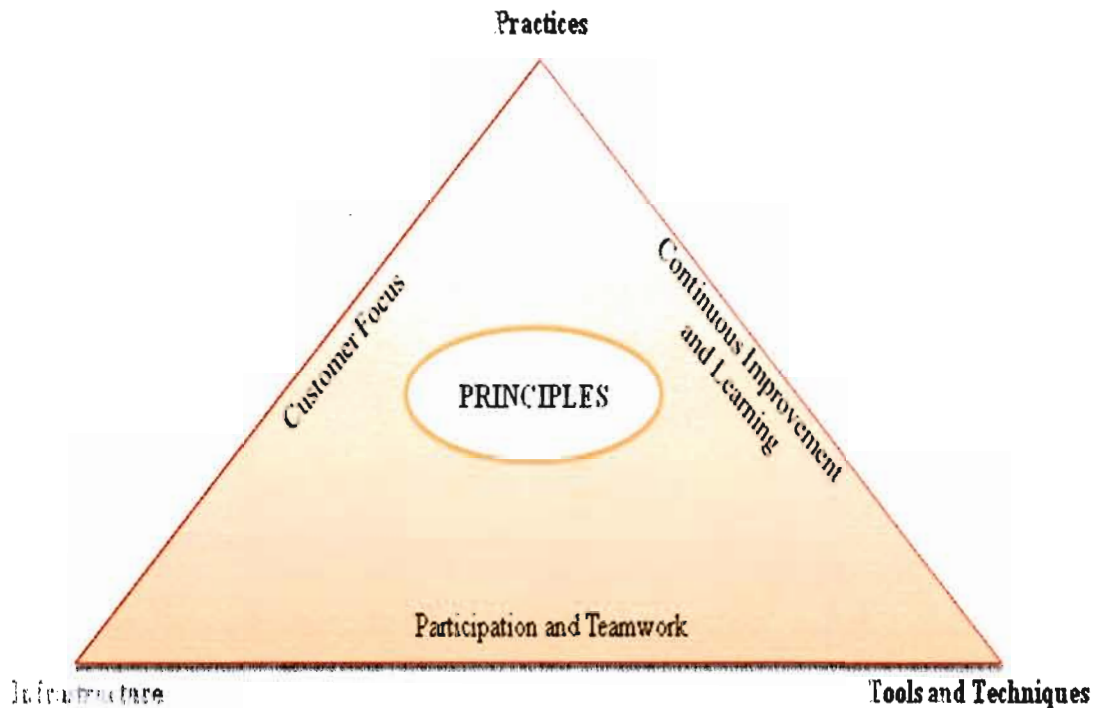


**Figure 2.5 Scope of total quality (Evans & Lindsay, 2005: 23)**

TQM cannot exist without a complete acceptance of the above nine principles by top management of an organization. Figure 2.6 shows some of the TQM principles and their inter-relationships by Khan (2003: 375). One of the major objectives of the TQM principle is to ensure “effective efficiency” (Khan, 2003: 376). This is achieved through encouraging organizations to plan products and develop systems that deliver products only according to customer expectations.

Research has been proven that organizations that adopt TQM achieve greater effective productivity, profitability and market share for most kinds of products and market situations (Khan, 2003: 376).

According to FIDIC (2001: 4), *“the Quality Management System that a consulting firm must develop and put into everyday practice may require an important cultural shift in thinking throughout the firm. A vital prerequisite to success is the total support of senior management in thought, word and deed. It must become ‘the way we do things around here’. The achievement of this mindset and ‘way of working’*

*may require continuous training throughout the firm, with all employees focusing on 'customer satisfaction'.*”

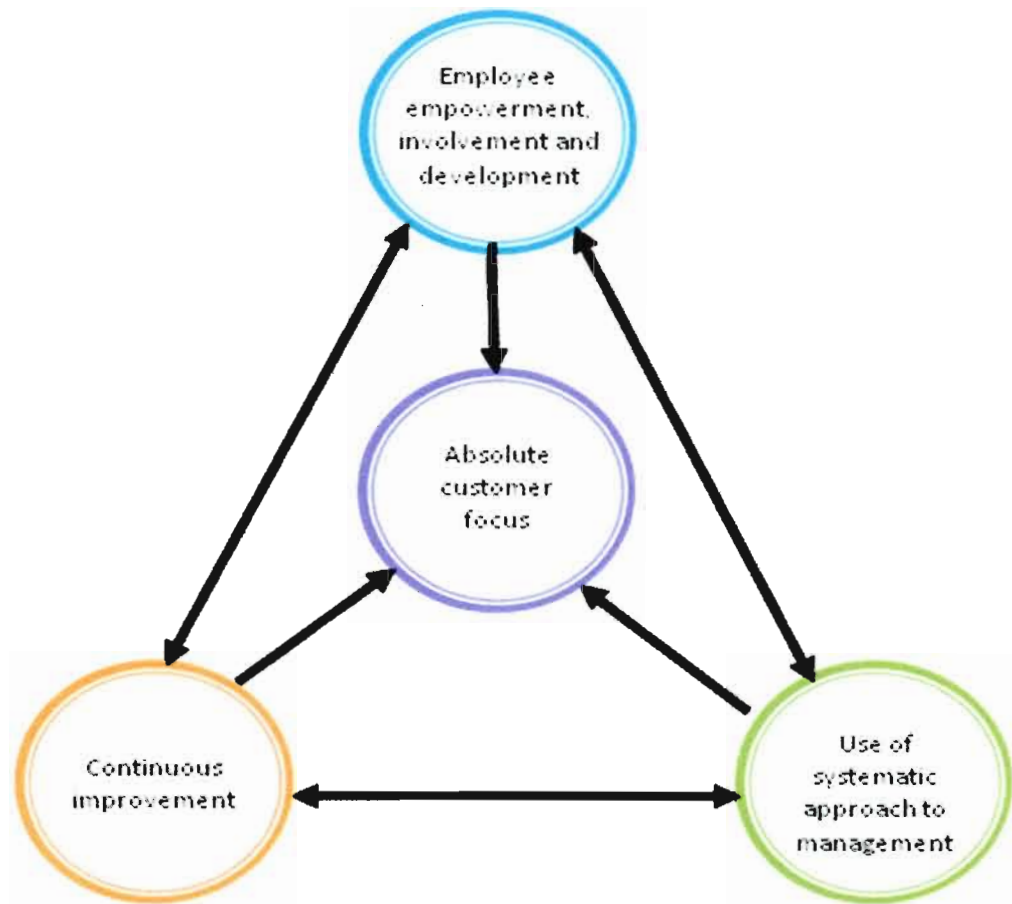


**Figure 2.6 Components of TQM principles and their inter-relationships**  
(Khan, 2003: 375)

## **2.6 BENEFITS OF IMPLEMENTING TQM**

Organizations implement TQM because of its immense benefits. Some of these benefits are highlighted below:

1. Organizational performance is improved through TQM.
2. TQM helps in ensuring customer satisfaction is met.
3. Profitability of organizations is improved through TQM.
4. Revenue increases when TQM is implemented in organizations.

5. It reduces costs in the long run.
6. Risk management is also improved.
7. An organization's reputation is enhanced with the implementation of TQM.
8. It increases the organization's competitive advantage.
9. TQM ensures clients' performance criteria are met.
10. Through TQM, a higher efficiency ratio of output to input can be obtained by improving the quality of resources, training inputs and learning outputs without increasing capital, volume or effort.
11. As a result of staff motivation, TQM encourages staff to set their own quality goals.
12. TQM improves productivity, which is a goal for every organization.

Figure 2.7 is a simplified diagram by Evans and Lindsay (2005: 26) showing the relationships between quality and profitability, while figure 2.8 is a more complex version by Mitra (1998: 31).

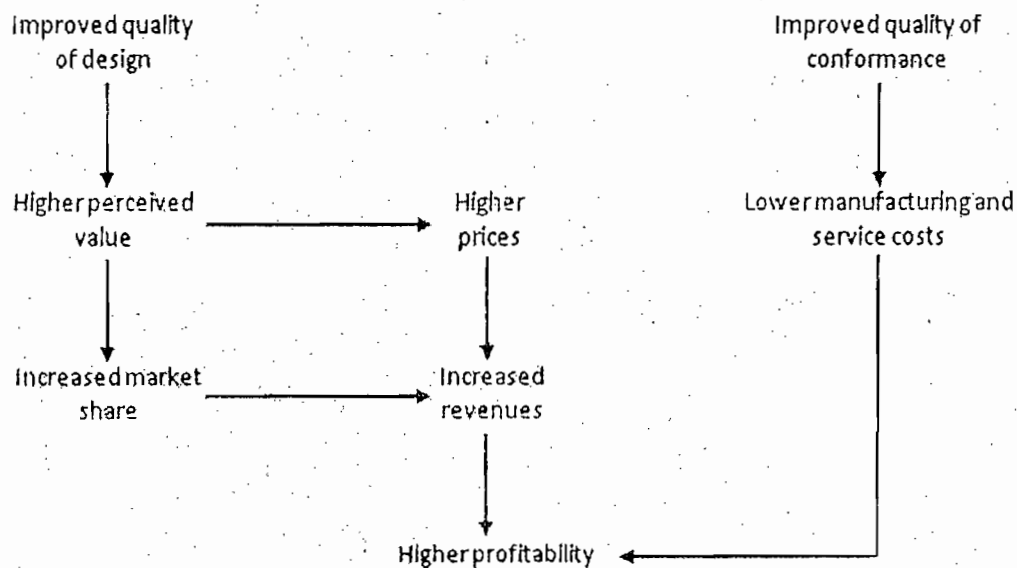


Fig. 2.7 Quality and profitability (Evans & Lindsay, 2005: 26)

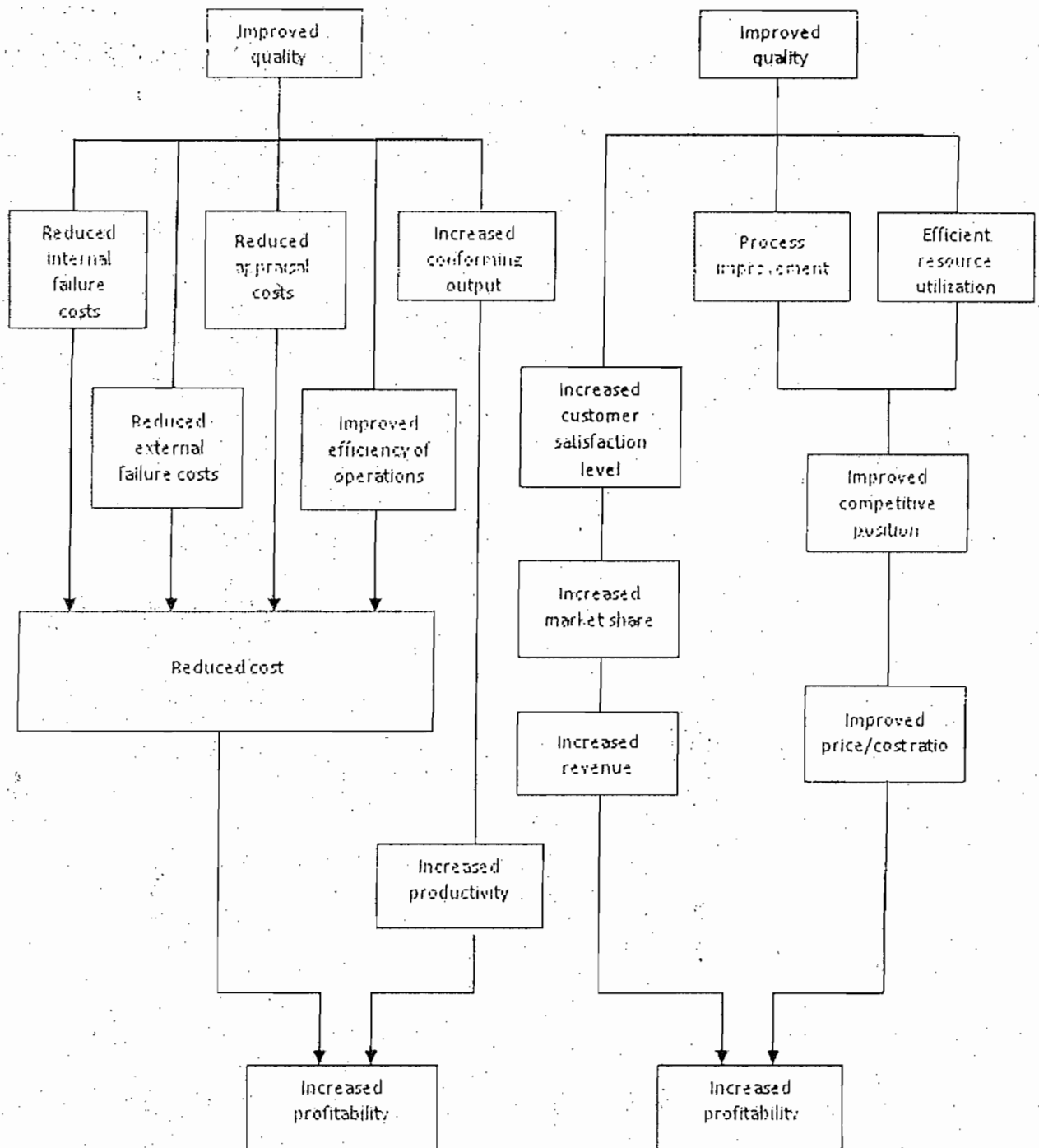


Fig. 2.8 Effect of quality on productivity and profitability (Mitra, 1998: 31)

### **CHAPTER THREE**

#### **3.0 INTRODUCTION TO TQM ASSESSMENT TOOLS**

There are many quality management theories, models and tools. Each of these tools is used in assessing TQM in different fields and industries. However, critics are of the opinion that all of these tools are imperfect (Chen *et al.*, 2007: 162; Curkovic & Sroufe, 2007: 560). Each of them has its own advantages, disadvantages and limitations; the limitation of one is the advantage of the other. Some of these tools can indicate accurately some of the TQM principles, but some other principles are inaccurately indicated.

Assessing TQM in industries involves assessing the needs and expectations of customers, producing quality outputs which meet or exceed customer satisfaction and then filing these returns (Weller, 1996: 30). It also involves assessing the other principles of TQM discussed in chapter two of this research, which are; employee involvement, continuous improvement, teamwork, employee empowerment, top-management commitment, employee satisfaction and culture change.

Also, research has shown that some of the TQM assessment tools in existence are used in assessing TQM in just certain industries and cannot be used in assessing TQM in other industries. For example, certain TQM assessment tools are used in assessing TQM in the service industry and others are used to assess TQM in manufacturing industries. These tools have not been justified to work in the process industry.

This chapter will give an overview of the existing TQM assessment tools, with a view to furnish a brief critique of the existing literature on TQM assessment tools.

#### **3.1 OVERVIEW OF SOME OF THE EXISTING TQM ASSESSMENT TOOLS**

There are several TQM assessment tools in existence, both in the manufacturing and service industries. These tools include, but not limited to the program quality assessment tool (NYSAN, 2005: 2), inventory performance and multifactor model,

service quality performance model, total quality index (Tavana *et al.*, 2003: 507), continuous improvement self-assessment model, quality award programmes and the holistic model for total quality service.

### **3.1.1 The Program Quality Assessment Tool (PQAT)**

This is a management tool that is practical in nature. It is proposed to create information about program quality that middle managers can use directly to affect program performance, or indirectly to influence program policy makers (Raghavan-Gilbert *et al.*, 1998: 802).

However, PQAT is still in a formative phase and training of assessors is essential if PQAT must be applied successfully. The tool was developed for application in the service industry, but it was never empirically validated as a research evaluation tool (Raghavan-Gilbert *et al.*, 1998: 804).

### **3.1.2 The Inventory Performance and Multifactor Model**

This is an innovative, quantitative tool that objectively assesses the presence of TQM in an organization and for determining the effectiveness of a company's TQM initiatives. It is an objective and numerical measurement of total quality in manufacturing firms that depicts Deming's systemic concept of quality (Davidson *et al.*, 2001: 12).

Although this tool is very effective, efficient, impartial and practical in assessing TQM in manufacturing firms (Davidson *et al.*, 2001: 23), however, it needs a lot of expertise to understand its use and does not fully encompass the principles of TQM.

### **3.1.3 Service Quality Performance Model**

One of the most important performance factors in an organization is service quality (Sinclair & Zairi, 1995: 59). The most important problem facing the contemporary service industry is the provision of excellent service quality and high customer satisfaction (Chen *et al.*, 2007: 162). The Service Quality Performance Model combines service quality with importance and satisfaction.

However, the limitation of this tool is that importance-level and satisfaction-level must be performed simultaneously when using this tool. Also, it is applicable only in the service industry, thus it cannot be applied in process industry. It is also based on a disconfirmation pattern rather than an attitudinal pattern; and service quality fails to draw an ascertained economic, statistical and psychological theory (Buttle, 1996: 10).

#### **3.1.4 The Continuous Improvement Self-Assessment Tool**

This tool was developed by the Continuous Improvement Research for Competitive Advantage (CIRCA) team. It uses the continuous improvement capability model in assessing TQM in organizations.

However, it is too narrow in its assessment as it dwells only on continuous improvement and tends to neglect the other factors of TQM, which include employee empowerment, customer satisfaction, etc.

#### **3.1.5 Quality Award Programmes**

Another way of assessing TQM in organizations is by quality award programmes. These award programmes include; British Quality Award, The Malcolm Baldrige National Quality Award (MBNQA), Canadian Awards for Business Excellence, Australian Business Excellence Award, Singapore Quality Award (SQA), European Quality Award (EQA), King Abdullah II Award for Excellence (KAIE) and The Deming Prize (Evans & Lindsay, 2005: 123; Chow-Chua & Goh, 2002: 56; Rawabdeh, 2008: 5; Dale, 1996: 28).

Critics have shown that, despite the credibility of these award programmes, it still have its limitations. Davidson *et al.*, (2001: 24) maintains that, if a company is striving to improve its TQM practice and in so doing happens to win an award, then the company will continue to pursue higher levels of quality. However, if a company is striving to win an award and in so doing happens to improve its TQM practice, then improvement efforts may cease once the award has been won.

### 3.1.6 The Holistic Model for Total Quality Service (TQS)

This deals with the critical dimensions of total quality service that portrays a holistic TQM concept in service organizations (Sureshchandar *et al.*, 2001: 378). Research shows that this tool almost completely assesses TQM in service industries.

## 3.2 AN INTRODUCTION TO THE HOLISTIC MODEL FOR TQS

In order to address the critical dimensions of total quality service that will depict a holistic TQM philosophy in service industry, the holistic model was developed by Sureshchandar *et al.* The holistic model serves as an instrument for measuring TQM in the service industry with specific reference to the banking sector (Sureshchandar *et al.*, 2001: 378).

Sureshchandar *et al.* (2001: 381) identified twelve dimensions of TQM for the institution of a TQM environment in service organizations. These twelve constructs are: top management commitment and visionary leadership, human resources management, technical system, information and analysis system, benchmarking, continuous improvement, customer focus, employee satisfaction, union intervention, social responsibility, servicescapes and service culture.

The holistic model portrays the relationship between the twelve dimensions and uses this concept in assessing TQM in the service industry. Top management commitment and visionary leadership will lead to human resources management, social responsibility, servicescapes, technical system, information and analysis system and service culture, which are all embedded in the organizational system. This will lead to the goals of the organization being achieved with employee satisfaction and customer focus.

While human resources management, social responsibility and servicescapes are affected by union involvement through industrial relations; technical system, information and analysis and service culture are benchmarked through a comparison standard.

According to Sureshchandar *et al.* (2001: 400), the key of the holistic model is “strong management commitment that creates an entire change of the organizational culture and way of operating, so as to make all members of the organization strive all the time for customer focus and a never ending improvement.” The model shows TQM as an integrated approach where there is lot of interaction among the different principles or factors.

### 3.2.1 Shortcomings of the Model in Process Industries

Although these principles seem to be very reliable consideration principles in assessing TQM in the service and manufacturing industries, keeping them as complete yardstick for process industry lacks sound logic.

A thorough review of the conceptual, prescriptive and empirical literature on TQM in the process industry identifies nine factors or principles that are critical in the process industry (Vouzas & Psychogios, 2007: 62). These principles include total employee involvement, continuous improvement, continuous training, teamwork, employee empowerment, top management commitment, participative management style, customer satisfaction and culture change.

Almost all of the above factors have been incorporated in the holistic model for service industries. However, the concept of teamwork has not been incorporated in this model.

The only effective way to tackle process improvement or complex problems as applicable in the process industry is through teamwork (Oakland, 2000: 222). Teamwork makes individual and organizations to grow.

The holistic tool has been developed for implementation in the banking industry (service industry), where there is in most cases, one-on-one contact between customers and employees. Its implementation in the process industry will not be fully effective as the process industry does not necessarily need that contact between customers and employees. The necessary factor for achieving organizational goals in the process industry is teamwork.

The principle of teamwork will thus, be considered in developing the assessment tool that will be used in measuring TQM in a process industry, using SSSP as a case study.

### **3.3 ADAPTATION OF THE HOLISTIC MODEL FOR MEASURING TQM IN PROCESS INDUSTRIES**

The holistic model for total service quality will be adapted for measuring TQM in process industries. SSSP will serve as a case study for the process industry, which is discussed in the chapter that follows. The nine TQM principles will be considered with emphasis on teamwork as it affects the process industry.

### **3.4 THE SSSP-TQM ASSESSMENT TOOL**

From the holistic model for TQS, a tool has been developed and proposed for use in measuring TQM in SSSP. This tool is the SSSP-TQM assessment tool. Figure 3.1 below reflects the SSSP-TQM assessment tool.

The SSSP-TQM assessment tool proposed will use the nine TQM principles identified in section 3.2.1 above in achieving its objective, with greater focus on the principle of teamwork.

The change that has been made from the adapted holistic model for TQS is the incorporation of the concept of teamwork and a modification of the flow diagram to suit the process industry.

A fundamental element of TQM in the process industry is teamwork (Goetsch & Davis, 2006: 300) as seen in the following quote: "someone may be great at his or her job, maybe even the best there ever was. But what counts at work is the organization's success, not personal success. After all, if your organization fails, it does not matter how great you were: you are just as unemployed as everyone else" (Goetsch & Davis, 2006: 300).

Foster (2004: 314) defines a team as a finite number of individuals who are united in a common purpose. The only effective way to tackle process improvement or complex problems as applicable in the process industry is through teamwork (Oakland, 2000: 222). Teamwork makes individual and organizations to grow.

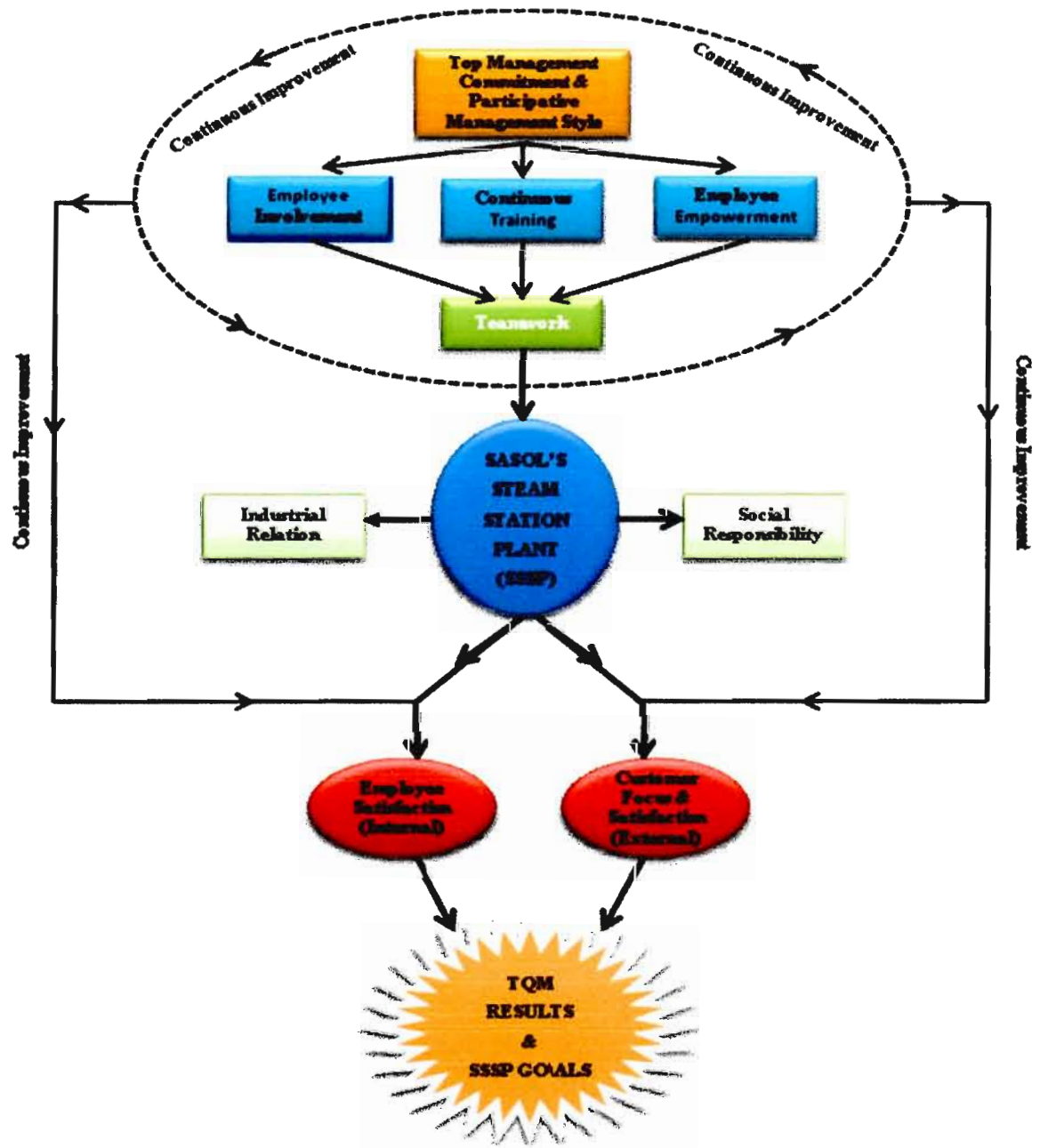


Figure 3.1 SSSP-TQM assessment tool (ADAPTED FROM Sureshchandar, 2001: 400)

The above tool reflects TQM as an integrated approach where there is much synergy between the various principles. From the above tool, top management must show a high sense of commitment and democratic style by giving employees' continuous training and empowering them to make them highly involved in organizational affairs. All these coupled with teamwork in an ambience of continuous improvement will help SSSP to ensure both employees and customers are satisfied, thus achieving the SSSP TQM results and goals.

It is evident from the tool that top management commitment provides the impetus for TQM in SSSP. Top management interest in quality should not be a mere intellectual exercise, but should be characterized by intense personal commitment evinced through democratic management style. This commitment and management style drives SSSP and consists of such sub-systems as employee involvement, continuous training, employee empowerment and teamwork. It also involves industrial relation and SSSP social responsibilities.

Every organization has a purpose, a mission or a goal. SSSP serves its customers with its product and this is done only through its employees. Customer focus and employee satisfaction is thus, the two main goals of SSSP.

The principles that have been discussed earlier (see section 2.5) are all vital components for quality improvement in a process industry like SSSP. But TQM in SSSP can only be effective if these principles operate in an environment that embraces continuous improvement as a philosophy of quality management. The success of TQM in SSSP will largely depend on how interactive the various principles are supported in an environment of continuous improvement.

The journey towards TQM is a long, steady, sustained and demanding one (Sureshchandar, 2001: 400). The whole idea is strong management commitment that will enhance a change of the organizational culture, in order to make all members of SSSP strive all the time for customer focus and a never ending improvement.

Furthermore, in process industries, where the focus is on product, process and technology, industries always strive for superiority and a proper TQM system and measurement will help in this vein. The SSSP-TQM assessment tool has been developed to meet this objective.

## **CHAPTER FOUR**

### **4.0 RESEARCH METHODOLOGY AND DESIGN**

TQM has been an extensively applied process for improving competitiveness around the world (Samson & Terziovski, 1999: 393). In chapter three, a review of the existing TQM assessment tools was presented and an assessment tool for measuring TQM in SSSP was also presented. Research methodology is concerned with the presentation of the techniques, procedures and tools that are used for the collection of data and subsequent analysis.

This chapter discusses the research method and design with a view to achieving the stated objectives of the research work. A thorough examination of the source of data, the method used in data collection and data analysis is carried out. It further presents an overview of the case study (SSSP).

### **4.1 STUDY APPROACH AND DESIGN**

Exploratory and descriptive research design has been adopted to minimize difficulties that may arise in the course of this research work. The research design was adopted as a result of the peculiar nature of research problems which borders around measurement of TQM practice.

Questionnaire survey has been widely accepted as an efficient tool for assessing the perceptions of individuals/organizations on a particular subject. Therefore, the tool used in the research design is basically questionnaires. Observations and existing models are also used. While some data were gathered through having personal contacts with the employees of the case study organization through unstructured interviews, some data were collected through indirect means. Observation, reading and asking questions are part of the techniques used in the data gathering.

The questionnaires were distributed to some of SSSP managers and employees and also customers of SSSP through a third party known as SurveyMonkey. A follow up

was done by the researcher through involved visits to the managers, employees and customers at their place of work for the purpose of reminder.

The investigation process involved the following major activities:

- a. Examination and analysis of existing TQM assessment tools with a view to establishing a tool for assessing TQM in SSSP.
- b. The determination of TQM principles to measure and monitor in order to establish consistency in the assessment tools.
- c. Comparison of the advantages, disadvantages and limitations of the existing TQM tools in order to establish a tool for assessing TQM in SSSP.
- d. Use of questionnaire to appraise the TQM tool.
- e. Collection of data through the third party (SurveyMonkey).

#### 4.2 POPULATION OF THE STUDY

The target population is a finite population, with fixed boundaries, described by time, geography and the characteristics of the individual members composing it, as well as the nature of the variables being studied (Ezeoguzie, 2005: 47). For the purpose of this research work, the target population has been identified as the SASOL's Steam Station Plant. This will serve as the case study.

TQM involves managers, employees and customers. For this reason and also for the fact that sampling the whole SSSP managers, employees and customers will be cumbersome, the sampled population will be some of SSSP managers and employees and some of SSSP customers randomly selected to represent the general characteristic of the case study site. Table 4.1 below shows the sampled population under survey.

Table 4.1 Population survey

| CATEGORY   | Managers | Employees | Customers | Total |
|------------|----------|-----------|-----------|-------|
| POPULATION | 13       | 13        | 13        | 39    |

#### **4.3 THE CASE STUDY: SASOL'S STEAM STATION PLANT (SSSP)**

##### **4.3.1 SSSP Overview**

The SASOL's Steam Station Plant (SSSP) is a unit of SASOL Chemical Industries (SCI) located in Sasolburg in Free State province of the Republic of South Africa. The SSSP controls the energy conversion process that takes place when chemical energy (coal) is converted to mechanical energy (steam turbines) and then to electrical energy (turbo alternators) (Barnard, 1997).

The greatest asset of SSSP is its people. They are in general a group of dedicated individuals focused on achievement and continuous improvement. The stations are well operated and maintained. It needs this type of focus on a continuous basis due to its age, interconnectivity and the nature of steam production which follows a "Chase Demand Strategy" in which capacity is adjusted continuously to meet demand.

SSSP's people therefore have a rich history of achievements in:

- ✦ Safety compliance
- ✦ Environmental improvement
- ✦ Engineering innovation
- ✦ Managing with out-of-specification coal quality
- ✦ Maintaining high yields
- ✦ Being pioneers in the ISO systems approach

##### **4.3.2 SSSP Vision**

SSSP maintains SASOL's worldwide vision. According to the SASOL internet ([www.sasol.com](http://www.sasol.com)), Sasol is a company that is driven to excel. Included in the Sasol's vision are the following statements:

"Sasol creates an environment where teams of dedicated people who are characterized by their diversity of skills and background can grow to their full potential through development, empowerment, recognition, respect and involvement in a safe and healthy working environment" ([www.sasol.com](http://www.sasol.com))

“We respect the communities where we operate and participate in their growth. We conduct our business activities with integrity and in compliance with internationally accepted principles and practices” ([www.sasol.com](http://www.sasol.com))

“Finally, we mould the shared values of our diversity into one formidable brand, founded on customer focus, winning with people, safety, excellence in all we do, continuous improvement and integrity” ([www.sasol.com](http://www.sasol.com))

#### 4.3.3 SSSP Resources

SSSP has 212 permanent employees and a contingent of service providers, subdivided and performing in the following functional structure ([www.sasol.com](http://www.sasol.com)):



**Figure 4.1** SSSP organogram (*Sasol Infonet*)

#### 4.3.4 SSSP Process

The SSSP comprises two steam station plants (steam station 1 & 2). There are 8 boilers and 5 generators at steam station 1 and 7 boilers and 3 generators at steam

station 2, with the boiler evaporation capacities on an average of 145 ton of steam per hour per boiler (t/h).

There are presently two 13.5MW and three 25MW condensing turbo alternators at steam station 1. At steam station 2, there are three 12.5MW back pressure turbo generators in operation. The exhaust steam from these turbines is used as process steam for the Lime Softeners at the *Water Softening Plant*. The SSSP is basically divided into two interdependent main systems, namely;

- Steam generation system
- Power generation system

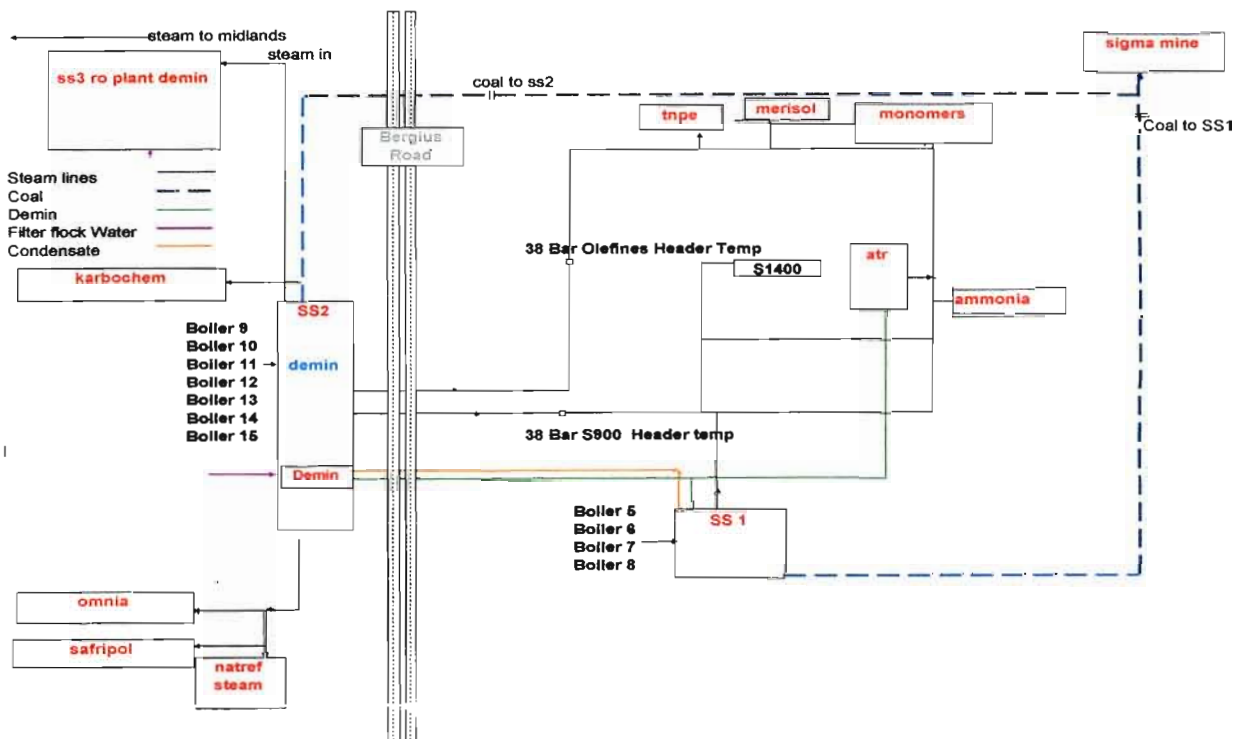


**Figure 4.2 SSSP coal, steam and water flow diagram (Meyer, 2007: 6)**

Figure 4.2 represents the SSSP coal, steam and water flow diagram, while figure 4.3 represents the steam generation process showing all the inputs and outputs

graphically. Steam is generated by coal fired boilers using coal mined by SASOL's Sigma Coal Mine. Coal mined is split into two streams.

Coal is fed from the bunkers to the Coal Mills, where it is pulverized to a powder. This is then mixed with air through combustion to generate steam. This steam then passes through a superheater with a temperature of about  $438^{\circ}\text{C}$  to drive the turbines of the generators (see figure 4.4). SSSP, however, is not self sufficient as far as electrical power generation is concerned and therefore have to import power from Eskom. This import is approximately 8% of the total power consumption.

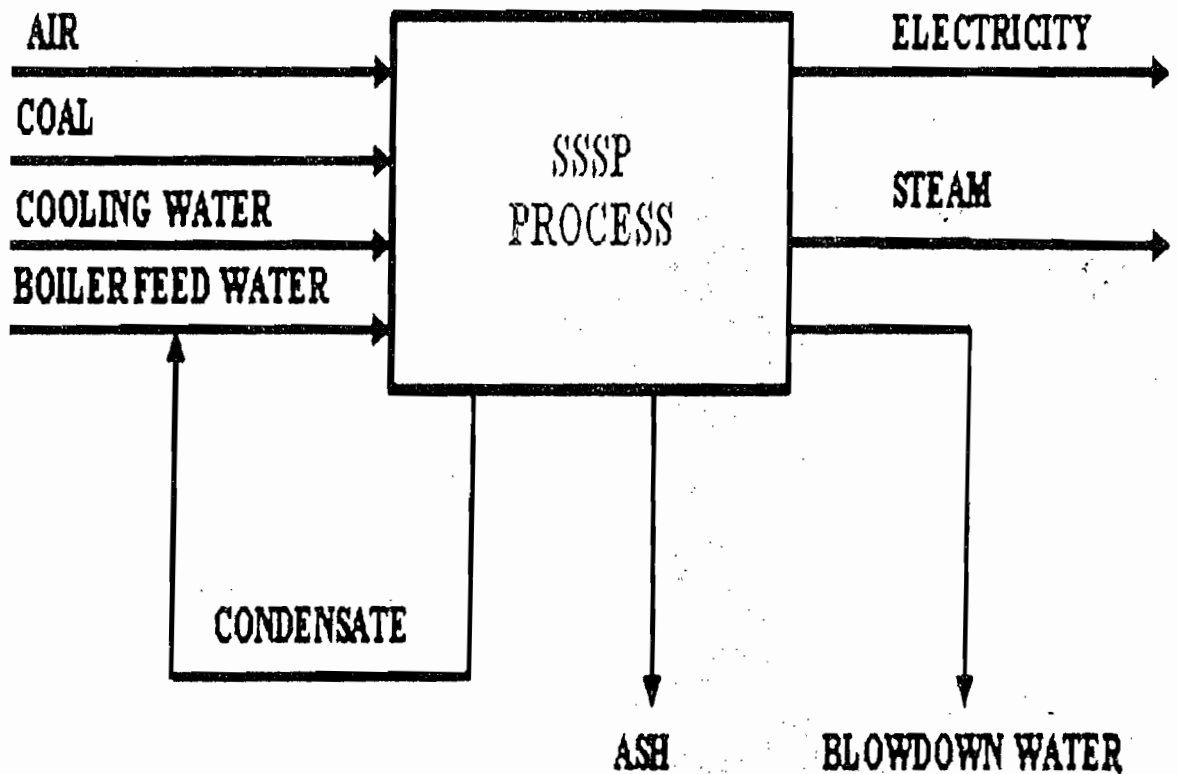


Figure 4.3 Process overview of SSSP (Barnard, 1997)

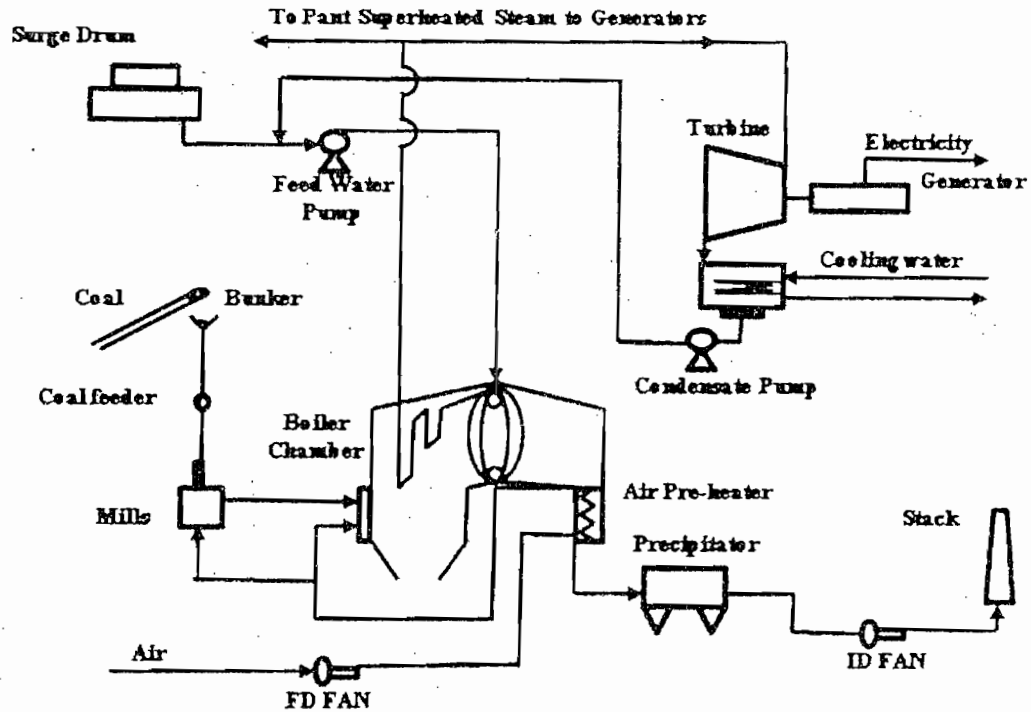


Figure 4.4 Process flow diagram of SASOL's Steam Station 1 Plant (Barnard, 1997)

#### 4.3.5 SSSP Team Focus

This function provides support by monitoring, investigation and reporting/advising on deviations and trends.

- Optimisation of raw material consumption (electricity, oil, coal, water, etc.)
- Boiler performance and efficiency monitoring
- Dust emissions monitoring and ESP (electro-static precipitator) control
- Coal supply quality and monitoring
- Tracking and support of projects and modifications
- Facilitate technical knowledge sharing
- Incident investigations, RCA (root cause analysis)
- Early detection (leading indicators) of faulty/failing equipment
- Initiation of projects that improve the facilities business viability
- Development of new and young engineers and technicians

- Provide technical support to customers and suppliers when required

#### 4.3.6 SSSP Optimisation Model and Approach

The function uses the model in figure 4.5, which is based on the principle of “You cannot manage what you do not measure.”

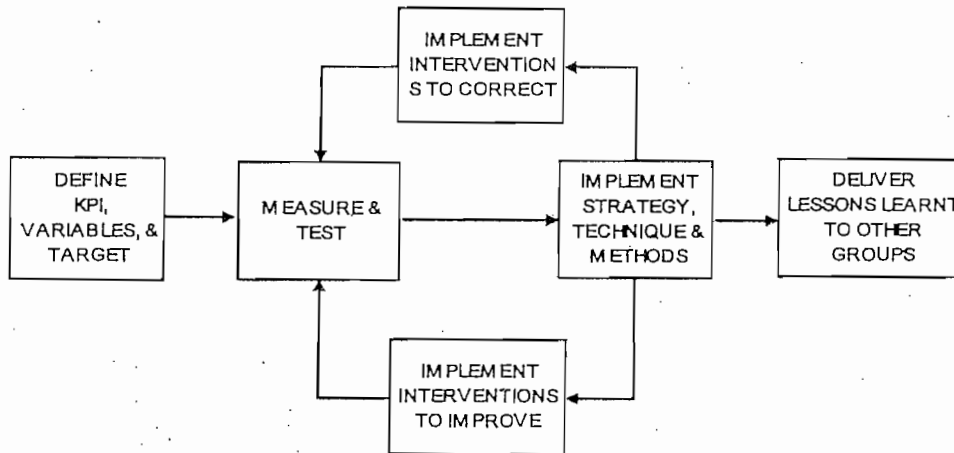


**Figure 4.5 SSSP optimization model and approach (SASOL Infonet)**

The process starts by defining what is important to the station, key suppliers and customers and how it is measured. The function is therefore mostly occupied with monitoring, measuring and testing of these key indicators. The results are continuously scrutinised for correction or improvement opportunities with the use of different strategies and techniques.

#### 4.3.7 Continuous Improvement

This entails the frequent analysis of the operational status of the plant, with the following methods being used:

- ✦ Boiler performance is monitored by trending vital and related variables e.g. air flow, temperatures, etc.
- ✦ Precipitator behaviour is analysed using trends regularly throughout the day.

- ✦ Inspections on boilers and precipitators are done during outages and general overhauls.
- ✦ On line and off line tests are performed on equipment that has been identified as being sub optimal in some way.

#### **4.4 TQM Practice and Assessment in SSSP**

It was discovered by the researcher from observation and unstructured interviews that the term "TQM" is not widely known in SSSP, but the principles of TQM are being implemented. Thus, SSSP practice TQM without knowing. As earlier discussed, SSSP is geared towards the SASOL's vision and shared values and this incorporates the TQM principles. The vision entails TQM principles like teamwork, employee involvement, culture change, leadership, employee empowerment, customer satisfaction, etc. The assessment of these however, is being done manually at SSSP. Research shows that there is no actual tool that is being used in SSSP to assess these TQM principles. They are just being assessed by what people feel and their intuition, which actually is not a right means of measurement.

#### **4.5 THE RESEARCH INSTRUMENT**

Both primary and secondary instruments were used in the course of this research. To develop an assessment tool for measuring TQM in SASOL's Steam Station Plant, an exhaustive review of the literature on the existing TQM assessment tools was carried out. The structured questionnaire developed from the literature survey was used as the secondary instrument for data collection.

##### **4.5.1 QUESTIONNAIRE DESIGN**

TQM programs are implemented in diverse ways and because of the quality and improvement-based nature of TQM programs; they are implemented with the desire to achieve the best practice so as to target improvement areas. Employee empowerment, teamwork, and employee involvement have a significant and positive impact on employee satisfaction (Jun *et al.*, 2006: 791). This research uses a questionnaire survey that dwells more on the principle of teamwork to verify this tool.

The following identified TQM principles are also incorporated into the questionnaire design:

- ✓ Top-management commitment
- ✓ Total employee involvement
- ✓ Continuous training
- ✓ Employee empowerment
- ✓ Culture change
- ✓ Team work
- ✓ Continuous improvement
- ✓ Participative management style
- ✓ Customer satisfaction

#### **4.5.2 DEVELOPMENT OF THE QUESTIONNAIRE PARAMETERS**

The questionnaire design started in August 2006 and went through phases of development. The questionnaire survey has been developed on the basis of an exhaustive review of the literature (prescriptive, conceptual, empirical and practitioner).

A pre-test was done by professionals in quality management and academicians to help determine the strengths and weaknesses of the survey concerning the format of the questions, the flow and wordings. Also, a pilot survey was done. The questionnaire survey has been refined several times based on the pilot survey findings and on the comments and suggestions of the pre-test.

The questionnaire has been so developed in order to maximally capture all the principles of TQM. Though the survey could be made generic to the process industry as a whole, it has been so designed as to specifically address the issues of TQM in SSSP. The SSSP has been chosen in order to have a high level of internal validity and because the SSSP tends to play a significant role in teamwork. Moreover, SSSP is large enough to have managers, employees and customers.

#### **4.6 TYPES OF DATA AND SOURCES**

The data used in this research work can be classified into primary and secondary data. Primary data are data that were collected in the fieldwork and survey at the unit of enquiry. This primary data are otherwise called raw data and are processed during data presentation and analysis stage. Secondary data are statistical data or information, which were not initiated during the research work, but were collected from other published records such as gazettes, books, journals, seminars, workshops, etc.

The sources of data used in this research work can be classified into two broad categories according to the distinction of primary and secondary data.

#### **4.7 METHOD OF DATA COLLECTION**

The method of data collection is divided into collection of primary data and collection of secondary data.

##### **4.7.1 Primary Data Collection**

The methods of collection of primary data in this research work are:

- (a) **Questionnaire:** In this research, questionnaires were distributed and collected through a third party known as SurveyMonkey. This is the main source of data used in the analysis. The questionnaires were distributed to managers, technicians and artisans and apprentices and customers of SSSP. For each statement, the respondents were requested to select only one position among a scale that has four categories (1 = not satisfactory, 2 = somewhat satisfactory, 3 = satisfactory, 4 = very satisfactory). A copy of the questionnaire is attached in annexure 1.
- (b) **Observations and Unstructured Interviews:** Unstructured interviews and one-on-one interviews were conducted on the issue of TQM in SSSP with members of staff and other stakeholders on the subject. This is a vital source of the perceptions of managers and employees.

(c) **Internet:** the internet was consulted for information.

#### 4.7.2 Secondary Data Collection

For the purpose of this research work, the researcher consulted some textbooks, journals, seminar papers, dictionary, publications and some unpublished materials.

### 4.8 VALIDITY AND RELIABILITY OF THE SURVEY INSTRUMENT

Unless reliability and validity are established, it is difficult to standardize the measurement scales, without which it is difficult to know whether the scales actually measure what they are supposed to measure. The reliability of the survey instrument (i.e. capability to yield constant results for repeated administrations) was ascertained in multiple ways.

In order to understand what TQM is all about, the first step was to expound the theory and concepts that underlie TQM concept. This was done through an extensive review of the literature and subsequent identification of the critical factor that it is intended to measure.

The next step was careful selection of the representative items to measure each factor. The third step was pre-testing and carrying out of a pilot survey of by professionals; thus, carrying out content validity checking.

Another step was by the use of the third party, SurveyMonkey, which is a registered, well known and valid questionnaire design site. According to SurveyMonkey team expert (surveymonkey.com), "there are ways of ensuring respondents only respond once. One is to set a web collector so that a link to the survey clicked on a respondent's computer will only go to the survey once. The other is to create an email collector where the link only works once in the email it was sent."

For the data derived from the administered questionnaire, the contingency table and chi-square were used. The chi-square distribution is applied in different fields for carrying out test like the goodness of fit test, test of independence or the contingency

test, normality test and other tests based on frequency data. The data gathered would be summarized in a frequency table. Chi-square was used to test the hypothesis.

#### 4.8.1 Contingency Table

The contingency table helps in data evaluation in which responses and explanatory variables are classified into categories, that is they are measured on ordinal scale. The observation consists of frequencies in the cells of contingency table formed by cross-classification of response and explanatory variables.

Chi-square test is then applied to determine where there is relationship between two ordinal variables. A random sample of n-population would give random frequencies to the cells. A contingency table can be defined as an array of natural numbers in matrix form where those natural numbers represent counts or frequencies (Ezeoguzie, 2005: 51). The frequency table is presented below:

**Table 4.2 Cell frequencies**

| Row   | 1        | 2        | column j |          | Total     |
|-------|----------|----------|----------|----------|-----------|
| 1     | $X_{11}$ | $X_{12}$ | $X_{1j}$ | $X_{1c}$ | $X_{1.}$  |
| 2     | $X_{21}$ | $X_{22}$ | $X_{2j}$ | $X_{2c}$ | $X_{2.}$  |
| :     | :        | :        | :        | :        | :         |
| i     | $X_{i1}$ | $X_{i2}$ | $X_{ij}$ | $X_{ic}$ | $X_{i.}$  |
| :     | :        | :        | :        | :        | :         |
| R     | $X_{r1}$ | $X_{r2}$ | $X_{rj}$ | $X_{rc}$ | $X_{r.}$  |
| Total | $X_{.1}$ | $X_{.2}$ | $X_{.j}$ | $X_{.c}$ | $X_{n.n}$ |

Where  $X_i$  = frequency total from  $i^{\text{th}}$  row

$X_j$  = frequency total from  $j^{\text{th}}$  column

The expected frequency is calculated from the formula:

$$X_{ij} = \frac{n\{x_i\}\{x_j\}}{\{n\}\{n\}} = \frac{x_i x_j}{n}$$

#### 4.8.2 Chi-Square Test

The chi-square devoted by the Greek letter  $X^2$  is frequently used in testing a hypothesis concerning the difference between a set of observed frequencies of a sample and corresponding set of expected or theoretical frequencies. A value is calculated from the data using chi-square procedure (this value is called the calculated chi-square denoted by  $X^2_{cal}$ ) and then compared to a critical value from a chi-square table (this value is called the tabulated chi-square denoted as  $X^2_{tab}$ ) at the chosen level of significance and degree of freedom. The formula used in evaluation of data using chi-square method is given as:

$$X^2_{cal} = \sum_{i=1}^n \frac{(x - \bar{x})^2}{\bar{x}}$$

Where,  $X^2$  = calculated chi-square

$n$  = total number of observation

$x$  = observed value

$\bar{x}$  = expected value

The chi-square distribution table from which the value of  $X^2_{tab}$  is determined is given in annexure 2.

#### 4.8.3 Calculation of the Expected Value

From the frequency table given above (table 4.2), the value of the expected value ( $\bar{x}$ ) is calculated as follows:

$$\bar{x}_{ij} = \frac{X_{i.} \times X_{.j}}{X_{n.n}}$$

Where  $\bar{x}_{ij}$  = expected value for  $i^{\text{th}}$  row and  $j^{\text{th}}$  column.

$X_i$  = frequency total from  $i^{\text{th}}$  row

$X_j$  = frequency total from  $j^{\text{th}}$  column

For example, to determine the value of  $\bar{x}$  for row 1 column 1, we have;

$$\bar{x}_{11} = \frac{X_{1.} \times X_{.1}}{X_{n.n}}$$

While for row 1 column 2, we have;

$$\bar{x}_{12} = \frac{X_{1.} \times X_{.2}}{X_{n.n}}$$

#### 4.8.4 Degree of freedom

The degree of freedom (d.f) is used to get the expected frequency and is given by the formula;

$$\text{d.f} = \text{degree of freedom} = (r-1)(c-1)$$

Where,  $r$  = number of rows

$c$  = number of columns

#### 4.8.5 Decision Rule or Test of Hypothesis

Test for hypothesis is the test performed in order to verify whether a hypothesis is true or false. The Null hypothesis is the hypothesis that is being tested and it is denoted as  $H_0$ . The hypothesis that we are willing to accept if we reject the null hypothesis is the Alternative hypothesis denoted as  $H_A$ .

The decision rule states that  $H_0$  is accepted if  $X^2_{\text{cal}}$  is less than  $X^2_{\text{tab}}$ . Otherwise,  $H_A$  is accepted mathematically.

$$\begin{array}{ll}
 X^2_{\text{cal}} < X^2_{\text{tab}} & \text{----- accept } H_0 \\
 X^2_{\text{cal}} > X^2_{\text{tab}} & \text{----- reject } H_0
 \end{array}$$

#### 4.9 DATA GATHERING AND ANALYSIS

The final questionnaires were made up of forty-five (45) questions. Six (6) questions for top management commitment, three (3) questions for employee involvement, five (5) questions for continuous training, four (4) questions for employee empowerment, seven (7) questions for teamwork, four (4) questions for culture change, four (4) questions for continuous improvement, six (6) questions for employee satisfaction and six (6) questions for customer focus and satisfaction.

The questionnaires were hosted on the web. The service of SurveyMonkey was engaged for the online hosting of the surveys. The online survey software is accessible via the company's URL address – [www.surveymonkey.com](http://www.surveymonkey.com). A URL link was generated for the survey and this link was mailed to the sampled population. Reminder emails were also sent and verbal reminder was done.

In order to encourage high response rate, anonymous filling of the surveys was made the rule. Also, emails or the IP addresses of the respondents were not tracked. As the surveys were being completed, the online software received completed questionnaires and made a database for the responses.

A preliminary statistical analysis of the gathered data was done by the Survey Monkey software. Further analysis of the investigation was carried out with chi-square and decision rule.

## CHAPTER FIVE

### 5.0 RESULTS, FINDINGS, ANALYSIS AND DISCUSSION

In this chapter, the data generated from the questionnaire responses are presented. The survey was conducted between the months of August and September, 2008. Data have been collected from managers, employees and customers of SSSP. The respondents have been asked to indicate their perception on the level of TQM practice in SSSP with respect to each item on a four-point Likert scale (from 1 indicating not satisfied to 4 indicating very satisfied).

A total of 13 managers, 13 employees and 13 customers have been approached from whom 12 managers, 13 employees and 10 customers correctly completed questionnaires have been received, yielding a response rate of 89.74%. Table 5.1 shows the number of managers, employees and customers and the corresponding number of respondents who have participated in the study.

The high response rate is due to the third party known as SurveyMonkey and the email approach used followed by periodic follow-ups over telephone and personal visits.

**Table 5.1      Distribution of respondents**

| Number of Respondents | Managers | Employees | Customers | Total |
|-----------------------|----------|-----------|-----------|-------|
| Number of People      | 13       | 13        | 13        | 39    |
| Number of Respondents | 12       | 13        | 10        | 35    |

In this analysis, five hypotheses are drawn based on the TQM principles incorporated in the SASOL's vision statement given in section 4.3.2 which includes employee involvement, employee empowerment, teamwork, continuous improvement and customer focus and satisfaction. The hypotheses are:

### **Hypothesis One**

H<sub>0</sub>: Employees should be involved in SSSP quality programmes.

### **Hypothesis Two**

H<sub>0</sub>: Employees should be fully empowered in SSSP.

### **Hypothesis Three**

H<sub>0</sub>: Teamwork is necessary for achieving SSSP organizational goals.

### **Hypothesis Four**

H<sub>0</sub>: Continuous improvement is promoted at all levels of SSSP.

### **Hypothesis Five**

H<sub>0</sub>: Customer focus is a driving force behind day-to-day operations in SSSP.

## **5.1 RESPONSE ANALYSIS**

This section gives a summary of the responses to the questions in the survey. For each section, i.e. the nine TQM principles, the number of respondents and the percentage of responses to each question are given. The percentage of response is calculated from the formula:

$$\text{Percentage Rating} = \frac{\text{No. of Response}}{\text{Response Count}} \times 100 \%$$

The rating average is calculated by dividing the summation of the number of responses multiplied by the ranking in each likert scale by the response count.

The full response summary for the 35 correct responses is also attached as annexure 3 of this research work.

### 5.1.1 Top Management Commitment

**Table 5.2** Tabulation of response to questions on top management commitment

|                                                                                       | Not Satisfactory<br>(1) | Somewhat Satisfactory<br>(2) | Satisfactory<br>(3) | Very Satisfactory<br>(4) | Rating Average | Response Count |
|---------------------------------------------------------------------------------------|-------------------------|------------------------------|---------------------|--------------------------|----------------|----------------|
| 1. How would you rate SSSP top management commitment to quality?                      | 3 (8.6%)                | 5 (14.3%)                    | 23 (65.7%)          | 4 (11.4%)                | 2.80           | 35             |
| 2. What is your perception about top management's quality vision?                     | 1 (2.9%)                | 10 (28.6%)                   | 18 (51.4%)          | 6 (17.1%)                | 2.83           | 35             |
| 3. What is your view on top management rating quality more than cost?                 | 2 (5.7%)                | 11 (31.4%)                   | 18 (51.4%)          | 4 (11.4%)                | 2.69           | 35             |
| 4. How would you rate top management efforts to improve quality?                      | 2 (5.7%)                | 6 (17.1%)                    | 20 (57.1%)          | 7 (20.0%)                | 2.91           | 35             |
| 5. What is your view on the way management eliminates the causes of problems in SSSP? | 6 (17.1%)               | 8 (22.9%)                    | 16 (45.7%)          | 5 (14.3%)                | 2.57           | 35             |
| 6. What is your view on the way top management value employees?                       | 6 (17.1%)               | 13 (37.1%)                   | 11 (31.4%)          | 5 (14.3%)                | 2.43           | 35             |

Table 5.2 above shows the summary of the 35 responses to questions 1 to 6 on top management commitment. The number of responses to each question and their percentages with reference to the four likert scale are tabulated above.

### 5.1.2 Employee Involvement

**Table 5.3** Tabulation of response to questions on employee involvement

|                                                                                  | Not<br>Satisfactory<br>(1) | Somewhat<br>Satisfactory<br>(2) | Satisfactory<br>(3) | Very<br>Satisfactory<br>(4) | Rating<br>Average | Response<br>Count |
|----------------------------------------------------------------------------------|----------------------------|---------------------------------|---------------------|-----------------------------|-------------------|-------------------|
| 1. What is your view on the involvement of employees in SSSP quality programmes? | 4 (11.4%)                  | 13 (37.1%)                      | 14 (40.0%)          | 4 (11.4%)                   | 2.51              | 35                |
| 2. What is your view on the way employees put in extra effort to their work?     | 1 (2.9%)                   | 13 (37.1%)                      | 16 (45.7%)          | 5 (14.3%)                   | 2.71              | 35                |
| 3. How would you rate the way management motivates employees?                    | 4 (11.4%)                  | 15 (42.9%)                      | 14 (40.0%)          | 2 (5.7%)                    | 2.40              | 35                |

Table 5.3: above shows the summary of the 35 responses to questions 1 to 4 on employee involvement. The number of responses to each question and their percentages with reference to the four likert scale are tabulated above.

### 5.1.3 Continuous Training

**Table 5.4** Tabulation of response to questions on continuous training

|                                                                                                   | Not<br>Satisfactory<br>(1) | Somewhat<br>Satisfactory<br>(2) | Satisfactory<br>(3) | Very<br>Satisfactory<br>(4) | Rating<br>Average | Response<br>Count |
|---------------------------------------------------------------------------------------------------|----------------------------|---------------------------------|---------------------|-----------------------------|-------------------|-------------------|
| 1. How would you rate the extent to which employees receive training in SSSP?                     | 3 (8.6%)                   | 11 (31.4%)                      | 12 (34.3%)          | 9 (25.7%)                   | 2.77              | 35                |
| 2. What is your view on employees' training on SSSP quality programmes?                           | 0 (0.0%)                   | 21 (60.0%)                      | 12 (34.3%)          | 2 (5.7%)                    | 2.46              | 35                |
| 3. How would you rate the frequency at which quality programmes are being conducted for employees | 3 (8.6%)                   | 14 (40.0%)                      | 17 (48.6%)          | 1 (2.9%)                    | 2.46              | 35                |
| 4. How would you rate employees' training on team building?                                       | 2 (5.7%)                   | 15 (42.9%)                      | 15 (42.9%)          | 3 (8.6%)                    | 2.54              | 35                |
| 5. How would you rate employee's training on quality?                                             | 3 (8.6%)                   | 19 (54.3%)                      | 12 (34.3%)          | 1 (2.9%)                    | 2.31              | 35                |

Table 5.4 above shows the summary of the 35 responses to questions 1 to 5 on training. The number of responses to each question and their percentages with reference to the four likert scale are tabulated above.

### 5.1.4 Employee Empowerment

**Table 5.5**      **Tabulation of response to questions on employee empowerment**

|                                                                                                                  | Not<br>Satisfactory<br>(1) | Somewhat<br>Satisfactory<br>(2) | Satisfactory<br>(3) | Very<br>Satisfactory<br>(4) | Rating<br>Average | Response<br>Count |
|------------------------------------------------------------------------------------------------------------------|----------------------------|---------------------------------|---------------------|-----------------------------|-------------------|-------------------|
| 1. How would you rate the extent to which employees are allowed to work without supervision?                     | 2 (5.7%)                   | 12 (34.3%)                      | 15 (42.9%)          | 6 (17.1%)                   | 2.71              | 35                |
| 2. What is your view on the way employees are motivated towards being innovative?                                | 2 (5.7%)                   | 16 (45.7%)                      | 13 (37.1%)          | 4 (11.4%)                   | 2.54              | 35                |
| 3. What is your perception on the way employees are allowed to learn from their mistakes instead of being fired? | 5 (14.3%)                  | 13 (37.1%)                      | 16 (45.7%)          | 1 (2.9%)                    | 2.37              | 35                |
| 4. How would you rate employees' relationship with SSSP customers?                                               | 2 (5.7%)                   | 12 (34.3%)                      | 19 (54.3%)          | 2 (5.7%)                    | 2.60              | 35                |

Table 5.5 above shows the summary of the 35 responses to questions 1 to 4 on employee empowerment. The number of responses to each question and their percentages with reference to the four likert scale are tabulated above.

### 5.1.5 Teamwork

**Table 5.6** Tabulation of response to questions on teamwork

|                                                                                    | Not<br>Satisfactory<br>(1) | Somewhat<br>Satisfactory<br>(2) | Satisfactory<br>(3) | Very<br>Satisfactory<br>(4) | Rating<br>Average | Response<br>Count |
|------------------------------------------------------------------------------------|----------------------------|---------------------------------|---------------------|-----------------------------|-------------------|-------------------|
| 1. How would you rate trust, openness and good relationships among SSSP employees? | 5 (14.3%)                  | 17 (48.6%)                      | 11 (31.4%)          | 2 (5.7%)                    | 2.29              | 35                |
| 2. What is your view on the extent to which teams are used in SSSP?                | 1 (2.9%)                   | 15 (42.9%)                      | 18 (51.4%)          | 1 (2.9%)                    | 2.54              | 35                |
| 3. What is your view on the effectiveness of teams in solving problems?            | 3 (8.6%)                   | 9 (25.7%)                       | 20 (57.1%)          | 3 (8.6%)                    | 2.66              | 35                |
| 4. How would you rate the co-ordination of teams in the plant?                     | 2 (5.7%)                   | 13 (37.1%)                      | 16 (45.7%)          | 4 (11.4%)                   | 2.63              | 35                |
| 5. How effective are the teams towards achieving organizational goals?             | 1 (2.9%)                   | 12 (34.3%)                      | 18 (51.4%)          | 4 (11.4%)                   | 2.71              | 35                |
| 6. How would you rate the way team spirit superceeds individual goals?             | 3 (8.6%)                   | 14 (40.0%)                      | 17 (48.6%)          | 1 (2.9%)                    | 2.46              | 35                |
| 7. What is your view on the necessity of teamwork in SSSP?                         | 1 (2.9%)                   | 10 (28.6%)                      | 19 (54.3%)          | 5 (14.3%)                   | 2.80              | 35                |

Table 5.6 above shows the summary of the 35 responses to questions 1 to 7 on teamwork. The number of responses to each question and their percentages with reference to the four likert scale are tabulated above.

### 5.1.6 Culture Change

**Table 5.7** Tabulation of response to questions on culture change

|                                                                                                           | Not<br>Satisfactory<br>(1) | Somewhat<br>Satisfactory<br>(2) | Satisfactory<br>(3) | Very<br>Satisfactory<br>(4) | Rating<br>Average | Response<br>Count |
|-----------------------------------------------------------------------------------------------------------|----------------------------|---------------------------------|---------------------|-----------------------------|-------------------|-------------------|
| 1. How would you rate the way employees resist changes?                                                   | 9 (25.7%)                  | 15 (42.9%)                      | 10 (28.6%)          | 1 (2.9%)                    | 2.09              | 35                |
| 2. What is your view on the way employees see customer satisfaction as an important goal?                 | 1 (2.9%)                   | 13 (37.1%)                      | 16 (45.7%)          | 5 (14.3%)                   | 2.71              | 35                |
| 3. What is your view on the way employees see the plant as their own plant?                               | 6 (17.1%)                  | 11 (31.4%)                      | 16 (45.7%)          | 2 (5.7%)                    | 2.40              | 35                |
| 4. What is your view on the way employees see quality as an important factor for the growth of the plant? | 0 (0.0%)                   | 15 (42.9%)                      | 17 (48.6%)          | 3 (8.6%)                    | 2.66              | 35                |

Table 5.7 above shows the summary of the 35 responses to questions 1 to 4 on culture change. The number of responses to each question and their percentages with reference to the four likert scale are tabulated above.

### 5.1.7 Continuous Improvement

**Table 5.8**      **Tabulation of response to questions on continuous improvement**

|                                                                                                                                           | <b>Not<br/>Satisfactory<br/>(1)</b> | <b>Somewhat<br/>Satisfactory<br/>(2)</b> | <b>Satisfactory<br/>(3)</b> | <b>Very<br/>Satisfactory<br/>(4)</b> | <b>Rating<br/>Average</b> | <b>Response<br/>Count</b> |
|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------------------------|-----------------------------|--------------------------------------|---------------------------|---------------------------|
| 1. How would you rate the way management promotes continuous improvement at all levels in SSSP?                                           | 2 (5.7%)                            | 13 (37.1%)                               | 17 (48.6%)                  | 3 (8.6%)                             | 2.60                      | 35                        |
| 2. What is your view on the way employees consider getting immediate results rather than work towards quality and continuous improvement? | 2 (5.7%)                            | 15 (42.9%)                               | 15 (42.9%)                  | 3 (8.6%)                             | 2.54                      | 35                        |
| 3. How would you rate the plant's continuous improvement strategies?                                                                      | 3 (8.6%)                            | 7 (20.0%)                                | 24 (68.6%)                  | 1 (2.9%)                             | 2.66                      | 35                        |
| 4. What is your view on the need for continuous improvement?                                                                              | 0 (0.0%)                            | 5 (14.3%)                                | 20 (57.1%)                  | 10 (28.6%)                           | 3.14                      | 35                        |

Table 5.8 above shows the summary of the 35 responses to questions 1 to 4 on continuous improvement. The number of responses to each question and their percentages with reference to the four likert scale are tabulated above.

### 5.1.8 Participative Management Style

**Table 5.9**      **Tabulation of response to questions on participative management style**

|                                                                                                         | <b>Not<br/>Satisfactory<br/>(1)</b> | <b>Somewhat<br/>Satisfactory<br/>(2)</b> | <b>Satisfactory<br/>(3)</b> | <b>Very<br/>Satisfactory<br/>(4)</b> | <b>Rating<br/>Average</b> | <b>Response<br/>Count</b> |
|---------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------------------------|-----------------------------|--------------------------------------|---------------------------|---------------------------|
| 1. How would you rate the way management involve employees in decision-making?                          | 1 (2.9%)                            | 18 (51.4%)                               | 14 (40.0%)                  | 2 (5.7%)                             | 2.49                      | 35                        |
| 2. How would you rate the way employees are satisfied in carrying out their job?                        | 1 (2.9%)                            | 13 (37.1%)                               | 20 (57.1%)                  | 1 (2.9%)                             | 2.60                      | 35                        |
| 3. What is your view on recommending SSSP to a friend if he/she were looking for a job?                 | 4 (11.4%)                           | 9 (25.7%)                                | 18 (51.4%)                  | 4 (11.4%)                            | 2.63                      | 35                        |
| 4. How would you rate the extent to which employees are proud of telling people they work in SSSP?      | 3 (8.6%)                            | 10 (28.6%)                               | 20 (57.1%)                  | 2 (5.7%)                             | 2.60                      | 35                        |
| 5. How would you rate the extent to which employees see SSSP as the best organization to work?          | 3 (8.6%)                            | 15 (42.9%)                               | 15 (42.9%)                  | 2 (5.7%)                             | 2.46                      | 35                        |
| 6. What is your view on the extent to which employees participate in the day-to-day activities of SSSP? | 6 (17.1%)                           | 19 (54.3%)                               | 10 (28.6%)                  | 0 (0.0%)                             | 2.11                      | 35                        |

Table 5.9 above shows the summary of the 35 responses to questions 1 to 6 on participative management style. The number of responses to each question and their percentages with reference to the four likert scale are tabulated above.

### 5.1.9 Customer Focus and Satisfaction

**Table 5.10** Tabulation of response to questions on customer focus and satisfaction

|                                                                                                                           | Not Satisfactory | Somewhat Satisfactory | Satisfactory | Very Satisfactory | Rating Average | Response Count |
|---------------------------------------------------------------------------------------------------------------------------|------------------|-----------------------|--------------|-------------------|----------------|----------------|
| 1. What is your view on the extent to which customer and quality are driving forces behind day-to-day operations in SSSP? | 1 (2.9%)         | 11 (31.4%)            | 20 (57.1%)   | 3 (8.6%)          | 2.71           | 35             |
| 2. How would you rate the way SSSP provide products to the customers as promised?                                         | 0 (0.0%)         | 11 (31.4%)            | 17 (48.6%)   | 7 (20.0%)         | 2.89           | 35             |
| 3. What is your view on the readiness of SSSP to respond to customers' requests?                                          | 2 (5.7%)         | 4 (11.4%)             | 24 (68.6%)   | 5 (14.3%)         | 2.91           | 35             |
| 4. How would you rate the use of customer feedback to improve SSSP standards?                                             | 0 (0.0%)         | 9 (25.7%)             | 19 (54.3%)   | 7 (20.0%)         | 2.94           | 35             |
| 5. How do you rate the extent to which SSSP keep their customers abreast with their quality efforts?                      | 1 (2.9%)         | 13 (37.1%)            | 19 (54.3%)   | 2 (5.7%)          | 2.63           | 35             |
| 6. How do you rate management's gratitude to their customers?                                                             | 2 (5.7%)         | 7 (20.0%)             | 23 (65.7%)   | 3 (8.6%)          | 2.77           | 35             |

Table 5.10 above shows the summary of the 35 responses to questions 1 to 6 on customer focus and satisfaction. The number of responses to each question and their percentages with reference to the four likert scale are tabulated above.

## 5.2 CHI-SQUARE ANALYSIS OF DATA AND TEST OF HYPOTHESIS

In line with the data presented above from response received, the evaluation and analysis of data and test of significance begins. The chi-square model will be used.

### 5.2.1 Test of Hypothesis One

To test this hypothesis, question 1 on employee involvement is used. The response from managers, employees and customers to question 1 of employee involvement is summarized in table 5.11 and this is used to analyze the hypothesis.

$H_0$ : Employees should be involved in SSSP quality programmes.

$H_A$ : Employees should not be involved in SSSP quality programmes.

**Table 5.11 Evaluation of hypothesis one**

| Choice<br>Category | Not<br>Satisfactory<br>(1)  | Somewhat<br>Satisfactory<br>(2) | Satisfactory<br>(3)         | Very<br>Satisfactory<br>(4) | Total |
|--------------------|-----------------------------|---------------------------------|-----------------------------|-----------------------------|-------|
| Managers           | $x = 0$<br>$\bar{x} = 1.37$ | $x = 5$<br>$\bar{x} = 4.46$     | $x = 5$<br>$\bar{x} = 4.80$ | $x = 2$<br>$\bar{x} = 1.37$ | 12    |
| Employees          | $x = 2$<br>$\bar{x} = 1.49$ | $x = 3$<br>$\bar{x} = 4.83$     | $x = 6$<br>$\bar{x} = 5.20$ | $x = 2$<br>$\bar{x} = 1.49$ | 13    |
| Customers          | $x = 2$<br>$\bar{x} = 1.14$ | $x = 5$<br>$\bar{x} = 3.71$     | $x = 3$<br>$\bar{x} = 4.00$ | $x = 0$<br>$\bar{x} = 1.14$ | 10    |
| <b>Total</b>       | 4                           | 13                              | 14                          | 4                           | 35    |

$$X^2_{cal} = \sum_{i=1}^n \frac{(x - \bar{x})^2}{\bar{x}}$$

$$X^2_{cal} = 1.37 + 0.07 + 0.01 + 0.29 + 0.17 + 0.69 + 0.12 + 0.17 + 0.65 + 0.45 + 0.25 + 1.14$$

$$X^2_{cal} = 5.38$$

$$\text{Degree of freedom} = (c-1)(r-1) = (3-1)(4-1) = 6$$

$$X^2_{tab}(0.05) \text{ at } 95\% \text{ limit of significance} = 12.592 \text{ (refer to annexure 2)}$$

#### Conclusion:

Since  $X^2_{tab}$  is higher than  $X^2_{cal}$ , i.e.  $12.592 > 5.38$ , we accept the null hypothesis ( $H_0$ ) and conclude that employees should be involved in SSSP quality programs.

### 5.2.2 Test of Hypothesis Two

To test this hypothesis, question 1 on employee empowerment is used. The response from managers, employees and customers to question 1 of employee empowerment is summarized in table 5.12 and this is used to analyze the hypothesis.

$H_0$ : Employees should be fully empowered in SSSP.

$H_A$ : Employees should not be empowered in SSSP.

**Table 5.12 Evaluation of hypothesis two**

| Choice<br>Category | Not<br>Satisfactory<br>(1)  | Somewhat<br>Satisfactory<br>(2) | Satisfactory<br>(3)         | Very<br>Satisfactory<br>(4) | Total |
|--------------------|-----------------------------|---------------------------------|-----------------------------|-----------------------------|-------|
| Managers           | $x = 0$<br>$\bar{x} = 0.69$ | $x = 3$<br>$\bar{x} = 4.11$     | $x = 5$<br>$\bar{x} = 5.14$ | $x = 4$<br>$\bar{x} = 2.06$ | 12    |
| Employees          | $x = 2$<br>$\bar{x} = 0.74$ | $x = 3$<br>$\bar{x} = 4.46$     | $x = 7$<br>$\bar{x} = 5.57$ | $x = 1$<br>$\bar{x} = 2.23$ | 13    |
| Customers          | $x = 0$<br>$\bar{x} = 0.57$ | $x = 6$<br>$\bar{x} = 3.43$     | $x = 3$<br>$\bar{x} = 4.29$ | $x = 1$<br>$\bar{x} = 1.71$ | 10    |
| <b>Total</b>       | 2                           | 12                              | 15                          | 6                           | 35    |

$$X^2_{cal} = \sum_{j=1}^n \frac{(x - \bar{x})^2}{\bar{x}}$$

$$X^2_{cal} = 0.69 + 0.30 + 0.00 + 1.83 + 2.15 + 0.48 + 0.37 + 0.68 + 0.57 + 1.93 + 0.39 + 0.29$$

$$X^2_{cal} = 9.68$$

$$\text{Degree of freedom} = (c-1)(r-1) = (3-1)(4-1) = 6$$

$$X^2_{tab}(0.05) \text{ at } 95\% \text{ limit of significance} = 12.592 \text{ (refer to annexure 2)}$$

#### Conclusion:

Since  $X^2_{tab}$  is higher than  $X^2_{cal}$ , i.e.  $12.592 > 9.68$ , we accept the null hypothesis ( $H_0$ ) and conclude that employees should be fully empowered in SSSP.

### 5.2.3 Test of Hypothesis Three

To test this hypothesis, question 5 on teamwork is used. The response from managers, employees and customers to question 5 of teamwork is summarized in table 5.13 and this is used to analyze the hypothesis.

$H_0$ : Teamwork is necessary for achieving SSSP organizational goals.

$H_A$ : Teamwork is not necessary for achieving SSSP organizational goals.

**Table 5.13 Evaluation of hypothesis three**

| Choice<br>Category | Not<br>Satisfactory<br>(1)  | Somewhat<br>Satisfactory<br>(2) | Satisfactory<br>(3)         | Very<br>Satisfactory<br>(4) | Total |
|--------------------|-----------------------------|---------------------------------|-----------------------------|-----------------------------|-------|
| Managers           | $x = 1$<br>$\bar{x} = 0.34$ | $x = 5$<br>$\bar{x} = 4.11$     | $x = 6$<br>$\bar{x} = 6.17$ | $x = 0$<br>$\bar{x} = 1.37$ | 12    |
| Employees          | $x = 0$<br>$\bar{x} = 0.37$ | $x = 5$<br>$\bar{x} = 4.46$     | $x = 5$<br>$\bar{x} = 6.69$ | $x = 3$<br>$\bar{x} = 1.49$ | 13    |
| Customers          | $x = 0$<br>$\bar{x} = 0.29$ | $x = 2$<br>$\bar{x} = 3.43$     | $x = 7$<br>$\bar{x} = 5.14$ | $x = 1$<br>$\bar{x} = 1.14$ | 10    |
| <b>Total</b>       | 1                           | 12                              | 18                          | 4                           | 35    |

$$X^2_{cal} = \sum_{j=1}^n \frac{(x - \bar{x})^2}{\bar{x}}$$

$$X^2_{cal} = 1.28 + 0.19 + 0.00 + 1.37 + 0.37 + 0.07 + 0.43 + 1.53 + 0.29 + 0.60 + 0.67 + 0.02$$

$$X^2_{cal} = 6.82$$

$$\text{Degree of freedom} = (c-1)(r-1) = (3-1)(4-1) = 6$$

$$X^2_{tab}(0.05) \text{ at } 95\% \text{ limit of significance} = 12.592 \text{ (refer to annexure 2)}$$

#### Conclusion:

Since  $X^2_{tab}$  is higher than  $X^2_{cal}$ , i.e.  $12.592 > 6.82$ , we accept the null hypothesis ( $H_0$ ) and conclude that teamwork is necessary for achieving SSSP organizational goals.

### 5.2.4 Test of Hypothesis Four

To test this hypothesis, question 1 on continuous improvement is used. The response from managers, employees and customers to question 1 of continuous improvement is summarized in table 5.14 and this is used to analyze the hypothesis.

$H_0$ : Continuous improvement is promoted at all levels of SSSP.

$H_A$ : Continuous improvement is not promoted at all levels of SSSP.

**Table 5.14** Evaluation of hypothesis four

| Choice<br>Category | Not<br>Satisfactory<br>(1)  | Somewhat<br>Satisfactory<br>(2) | Satisfactory<br>(3)         | Very<br>Satisfactory<br>(4) | Total |
|--------------------|-----------------------------|---------------------------------|-----------------------------|-----------------------------|-------|
| Managers           | $x = 1$<br>$\bar{x} = 0.69$ | $x = 2$<br>$\bar{x} = 4.46$     | $x = 8$<br>$\bar{x} = 5.83$ | $x = 1$<br>$\bar{x} = 1.03$ | 12    |
| Employees          | $x = 1$<br>$\bar{x} = 0.74$ | $x = 5$<br>$\bar{x} = 4.83$     | $x = 5$<br>$\bar{x} = 6.31$ | $x = 2$<br>$\bar{x} = 1.11$ | 13    |
| Customers          | $x = 0$<br>$\bar{x} = 0.57$ | $x = 6$<br>$\bar{x} = 3.71$     | $x = 4$<br>$\bar{x} = 4.86$ | $x = 0$<br>$\bar{x} = 0.86$ | 10    |
| <b>Total</b>       | 2                           | 13                              | 17                          | 3                           | 35    |

$$X^2_{cal} = \sum_{i=1}^n \frac{(x - \bar{x})^2}{\bar{x}}$$

$$X^2_{cal} = 0.14 + 1.36 + 0.81 + 0.00 + 0.09 + 0.01 + 0.27 + 0.71 + 0.57 + 1.41 + 0.15 + 0.86$$

$$X^2_{cal} = 6.38$$

$$\text{Degree of freedom} = (c-1)(r-1) = (3-1)(4-1) = 6$$

$$X^2_{tab}(0.05) \text{ at } 95\% \text{ limit of significance} = 12.592 \text{ (refer to annexure 2)}$$

#### Conclusion:

Since  $X^2_{tab}$  is higher than  $X^2_{cal}$ , i.e.  $12.592 > 6.38$ , we accept the null hypothesis ( $H_0$ ) and conclude that continuous improvement is promoted at all levels of SSSP.

### 5.2.5 Test of Hypothesis Five

To test this hypothesis, question 1 on customer focus and satisfaction is used. The response from managers, employees and customers to question 1 of customer focus and satisfaction is summarized in table 5.15 and this is used to analyze the hypothesis.

$H_0$ : Customer focus is a driving force behind day-to-day operations in SSSP.

$H_A$ : Customer focus is not a driving force behind day-to-day operations in SSSP.

**Table 5.15 Evaluation of hypothesis five**

| Choice<br>Category | Not<br>Satisfactory<br>(1)  | Somewhat<br>Satisfactory<br>(2) | Satisfactory<br>(3)         | Very<br>Satisfactory<br>(4) | Total |
|--------------------|-----------------------------|---------------------------------|-----------------------------|-----------------------------|-------|
| Managers           | $x = 1$<br>$\bar{x} = 0.34$ | $x = 2$<br>$\bar{x} = 3.77$     | $x = 9$<br>$\bar{x} = 6.86$ | $x = 0$<br>$\bar{x} = 1.03$ | 12    |
| Employees          | $x = 0$<br>$\bar{x} = 0.37$ | $x = 4$<br>$\bar{x} = 4.09$     | $x = 7$<br>$\bar{x} = 7.43$ | $x = 2$<br>$\bar{x} = 1.11$ | 13    |
| Customers          | $x = 0$<br>$\bar{x} = 0.29$ | $x = 5$<br>$\bar{x} = 3.14$     | $x = 4$<br>$\bar{x} = 5.71$ | $x = 1$<br>$\bar{x} = 0.86$ | 10    |
| <b>Total</b>       | 1                           | 11                              | 20                          | 3                           | 35    |

$$X^2_{cal} = \sum_{i=1}^n \frac{(x - \bar{x})^2}{\bar{x}}$$

$$X^2_{cal} = 1.28 + 0.83 + 0.67 + 1.03 + 0.37 + 0.00 + 0.02 + 0.71 + 0.29 + 1.10 + 0.51 + 0.02$$

$$X^2_{cal} = 6.83$$

$$\text{Degree of freedom} = (c-1)(r-1) = (3-1)(4-1) = 6$$

$$X^2_{tab}(0.05) \text{ at } 95\% \text{ limit of significance} = 12.592 \text{ (refer to annexure 2)}$$

#### Conclusion:

Since  $X^2_{tab}$  is higher than  $X^2_{cal}$ , i.e.  $12.592 > 6.83$ , we accept the null hypothesis ( $H_0$ ) and conclude that customer focus is a driving force behind day-to-day operations in SSSP.

### 5.3 DISCUSSION OF FINDINGS

In view of identified problems, objectives and the research hypothesis of this study, questionnaires were carefully developed and administered to the sample population to support the investigation. The response scores from the sample population were analyzed with a vision to empirical discoveries.

The five hypotheses linked some of the identified principles of TQM with the case study (SSSP). Hypothesis one looks at employee involvement. There is low level of employee awareness of TQM in SSSP which reduces their involvement in SSSP quality programmes. This is validated by the data analysis, which establishes hypothesis one of this research.

The result of data analysis of hypothesis two indicates that  $X^2_{\text{tab}}$  is greater than  $X^2_{\text{cal}}$  which indicates employees should be fully empowered in SSSP. Wherever TQM operates, staff should be actively involved and empowered in managing quality and playing an important part in management decision-making. Without staff involvement and empowerment, TQM will become ineffective and will grind to a halt (Ezeoguzie, 2005: 68).

Hypothesis three concludes that teamwork is necessary for achieving SSSP organizational goals, while hypothesis four concludes that continuous improvement is promoted at all levels of SSSP. Hypothesis five finally concludes that customer focus and satisfaction is a driving force behind the day-to-day operations in SSSP.

The implications of the findings of this research to SSSP is that with customer satisfaction being the main objective of the organization and the culture of continuous improvement being imbibed, employees should be more involved and better empowered in order for SSSP to gain a competitive advantage over her competitors.

## **CHAPTER SIX**

### **6.0 SUMMARY, CONCLUSION AND RECOMMENDATION**

This chapter summarizes the whole research work from chapter one to chapter five. It also concludes the research work and some recommendations and suggestions for further research are given.

### **6.1 SUMMARY**

TQM is a senior management led company-wide initiative that involves all managers and employees commitment to satisfy or meet customer needs and expectations through continuous improvement. It is a philosophy and practice of management which aims to satisfy the customers and employees by means of employee involvement, empowerment and teamwork and consistent management commitment in an ambience of continuous improvement.

The dissertation is organized in five chapters. Chapter one looked at the background of the research along with the statement of the research problem. The specific objectives of the research were enumerated and limitations encountered during the research exercise were documented (see section 1.5).

A thorough review of relevant literature was conducted in chapter two of this research work. This gave an understanding into the concept of quality and quality management. TQM and the principles of TQM were also discussed and the chapter was concluded by highlighting the benefits of implementing a TQM program in an organization.

In chapter three, some of the existing TQM assessment tools were discussed. A tool was adapted for measuring TQM in SSSP and the proposed tool (SSSP-TQM assessment tool) was discussed in detail.

Chapter four is the research methodology and design. The study approach and design used was discussed and the population of the study was identified. Also discussed in

this chapter are the questionnaire design and the method of validation and reliability of the survey instrument. Light was thrown on the survey target. Sampling procedure and the research instruments were explained in details. An overview of the case study, i.e. SASOL's Steam Station Plant (SSSP) was also done.

Chapter five analyzed the results and findings of the survey instrument. Chi-square analysis was used to analyze the data from questionnaire response. This covered hypothesis one to five. Interpretations were given to the findings and tabulations were used to present the data.

Finally, chapter six embraces summary of the work. Conclusions drawn from the analysis of the surveys are documented in this chapter. Recommendations are made for further study.

## 6.2 CONCLUSIONS

With the current quality revolution in the world, the concept of TQM remains a prospective area of research. The dissertation attempts to present a broad and yet simple methodology for scientifically investigating how the extensive philosophies, concepts, precepts, principles and practices involved in TQM can be structured into a systematic tool for developing an understanding of TQM.

The selected TQM assessment tools have been critically studied. Their advantages, disadvantages and limitations were highlighted. Based on the shortcomings of the adapted model (holistic model for TQS), a comprehensive TQM assessment tool with specific focus on SASOL's Steam Station Plant (SSSP) has been developed and validated based on data collected from managers, employees and customers of SSSP. This assessment tool (with due modifications depending on the specific industry) could effectively be used by researchers and practitioners to measure the level of TQM implementation in other process industries.

The objective of this research was to develop an assessment tool for measuring TQM in SSSP. Generally, this survey revealed that the principles of TQM discussed in

chapter two forms a solid construct for assessing TQM in a process industry. The SSSP-TQM assessment tool has been proposed portraying relationship between the various principles.

The SSSP-TQM assessment tool addresses the vital principle of teamwork in the process industry and the analysis showed that for a process industry to achieve organizational goals, teamwork is necessary.

Employee involvement and awareness is one aspect of TQM that has been lacking in SSSP. There is also lack of employee awareness of the concept of TQM in SSSP and this research has helped in creating a better awareness as more employees now have a better knowledge of what TQM is all about. The research work thus, attempts to add value to the literature by contributing to the establishment of a tool for assessing TQM in SASOL's Steam Station Plant.

### 6.3 RECOMMENDATIONS

From the research and based on the result of the data analyzed and the conclusions drawn, the following recommendations were made:

1. Employees should be more involved in SASOL's Steam Station quality programmes. If employees are involved, their latent talent will liberate boundless improvement in energy in SSSP.
2. Employee empowerment leads to increased participating in the quality improvement efforts of organizations. SSSP should empower its employees in line with their vision statement.
3. Quality improvement teams are necessary in order to achieve organizational goals in a process industry. There is the popular saying that "two heads are better than one." Teamwork and participation is vital for implementing a proper TQM programme.
4. Since TQM is an organization-wide, multi-disciplinary approach that warrants increased participation of employees at all levels and functions, in the form of teamwork and shared vision and objectives, SSSP should

establish a formal TQM awareness program, so as to make all employees aware of the concepts of TQM and its implementation.

5. Based on the comprehensive structure of the SSSP-TQM assessment tool, it is recommended that the tool be implemented in SASOL's Steam Station Plant for assessing its total quality management programmes.
6. Assessment of TQM in SSSP should be done frequently in order to ensure that employees are continually involved in SSSP TQM programmes.

#### **6.4 SUGGESTION FOR FURTHER STUDY**

The focus of this research work was to develop a TQM assessment tool from the concept of the TQM principles. It is suggested that future research efforts should investigate more principles of TQM as it affects a steam station plant. Also, further research work should be done on the application of the SSSP-TQM assessment tool on other process industries.

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# **ANNEXURE 1**

# Amorighoye Lucky Questionnaire Survey for Developing an Assessment Tool for Measuring TQM

| 1. TOP MANAGEMENT COMMITMENT                                                          |                  |                       |              |                   |                   |
|---------------------------------------------------------------------------------------|------------------|-----------------------|--------------|-------------------|-------------------|
|                                                                                       | Not Satisfactory | Somewhat Satisfactory | Satisfactory | Very Satisfactory | Rating<br>Average |
|                                                                                       |                  |                       |              |                   | Response<br>Count |
| 1. How would you rate SSSP top management commitment to quality?                      | 8.6% (3)         | 14.3% (5)             | 65.7% (23)   | 11.4% (4)         | 2.80              |
| 2. What is your perception about top management's quality vision?                     | 2.9% (1)         | 28.6% (10)            | 51.4% (18)   | 17.1% (6)         | 2.83              |
| 3. What is your view on top management rating quality more than cost?                 | 5.7% (2)         | 31.4% (11)            | 51.4% (18)   | 11.4% (4)         | 2.69              |
| 4. How would you rate top management efforts to improve quality?                      | 5.7% (2)         | 17.1% (6)             | 57.1% (20)   | 20.0% (7)         | 2.91              |
| 5. What is your view on the way management eliminates the causes of problems in SSSP? | 17.1% (6)        | 22.9% (8)             | 45.7% (16)   | 14.3% (5)         | 2.57              |
| 6. What is your view on the way top management value employees?                       | 17.1% (6)        | 37.1% (13)            | 31.4% (11)   | 14.3% (5)         | 2.43              |
| answered question                                                                     |                  |                       |              |                   | 35                |
| skipped question                                                                      |                  |                       |              |                   | 0                 |

## 2. EMPLOYEE INVOLVEMENT

|                                                                                  | Not Satisfactory | Somewhat Satisfactory | Satisfactory | Very Satisfactory | Rating<br>Average        | Response<br>Count |
|----------------------------------------------------------------------------------|------------------|-----------------------|--------------|-------------------|--------------------------|-------------------|
| 1. What is your view on the involvement of employees in SSSP quality programmes? | 11.4% (4)        | 37.1% (13)            | 40.0% (14)   | 11.4% (4)         | 2.51                     | 35                |
| 2. What is your view on the way employees put in extra effort to their work?     | 2.9% (1)         | 37.1% (13)            | 45.7% (16)   | 14.3% (5)         | 2.71                     | 35                |
| 3. How would you rate the way management motivates employees?                    | 11.4% (4)        | 42.9% (15)            | 40.0% (14)   | 5.7% (2)          | 2.40                     | 35                |
|                                                                                  |                  |                       |              |                   | <i>answered question</i> | 35                |
|                                                                                  |                  |                       |              |                   | <i>skipped question</i>  | 0                 |

### 3. CONTINUOUS TRAINING

|                                                                                                    | Not Satisfactory | Somewhat Satisfactory | Satisfactory | Very Satisfactory | Rating<br>Average | Response<br>Count |
|----------------------------------------------------------------------------------------------------|------------------|-----------------------|--------------|-------------------|-------------------|-------------------|
| 1. How would you rate the extent to which employees receive training in SSSP?                      | 8.6% (3)         | 31.4% (11)            | 34.3% (12)   | 25.7% (9)         | 2.77              | 35                |
| 2. What is your view on employees' training on SSSP quality programmes?                            | 0.0% (0)         | 60.0% (21)            | 34.3% (12)   | 5.7% (2)          | 2.46              | 35                |
| 3. How would you rate the frequency at which quality programmes are being conducted for employees? | 8.6% (3)         | 40.0% (14)            | 48.6% (17)   | 2.9% (1)          | 2.46              | 35                |
| 4. How would you rate employees' training on team building?                                        | 5.7% (2)         | 42.9% (15)            | 42.9% (15)   | 8.6% (3)          | 2.54              | 35                |
| 5. How would you rate employees' training on quality?                                              | 8.6% (3)         | 54.3% (19)            | 34.3% (12)   | 2.9% (1)          | 2.31              | 35                |
| answered question                                                                                  |                  |                       |              |                   |                   | 35                |
| skipped question                                                                                   |                  |                       |              |                   |                   | 0                 |

#### 4. EMPLOYEE EMPOWERMENT

|                                                                                                                  | Not Satisfactory | Somewhat Satisfactory | Satisfactory | Very Satisfactory | Rating<br>Average | Response<br>Count |
|------------------------------------------------------------------------------------------------------------------|------------------|-----------------------|--------------|-------------------|-------------------|-------------------|
| 1. How would you rate the extent to which employees are allowed to work without supervision?                     | 5.7% (2)         | 34.3% (12)            | 42.9% (15)   | 17.1% (6)         | 2.71              | 35                |
| 2. What is your view on the way employees are motivated towards being innovative?                                | 5.7% (2)         | 45.7% (16)            | 37.1% (13)   | 11.4% (4)         | 2.54              | 35                |
| 3. What is your perception on the way employees are allowed to learn from their mistakes instead of being fired? | 14.3% (5)        | 37.1% (13)            | 45.7% (16)   | 2.9% (1)          | 2.37              | 35                |
| 4. How would you rate employees relationship with SSSP customers?                                                | 5.7% (2)         | 34.3% (12)            | 54.3% (19)   | 5.7% (2)          | 2.60              | 35                |
| answered question                                                                                                |                  |                       |              |                   |                   | 35                |
| skipped question                                                                                                 |                  |                       |              |                   |                   | 0                 |

## 5. TEAMWORK

|                                                                                    | Not Satisfactory | Somewhat Satisfactory | Satisfactory | Very Satisfactory | Rating<br>Average | Response<br>Count |
|------------------------------------------------------------------------------------|------------------|-----------------------|--------------|-------------------|-------------------|-------------------|
| 1. How would you rate trust, openness and good relationships among SSSP employees. | 14.3% (5)        | 48.6% (17)            | 31.4% (11)   | 5.7% (2)          | 2.29              | 35                |
| 2. What is your view on the extent to which teams are used in SSSP?                | 2.9% (1)         | 42.9% (15)            | 51.4% (18)   | 2.9% (1)          | 2.54              | 35                |
| 3. What is your view on the effectiveness of teams in solving problems?            | 8.6% (3)         | 25.7% (9)             | 57.1% (20)   | 8.6% (3)          | 2.66              | 35                |
| 4. How would you rate the coordination of teams in the plant?                      | 5.7% (2)         | 37.1% (13)            | 45.7% (16)   | 11.4% (4)         | 2.63              | 35                |
| 5. How effective are the teams towards achieving organizational goals?             | 2.9% (1)         | 34.3% (12)            | 51.4% (18)   | 11.4% (4)         | 2.71              | 35                |
| 6. How would you rate the way team spirit superceeds individual goals?             | 8.6% (3)         | 40.0% (14)            | 48.6% (17)   | 2.9% (1)          | 2.46              | 35                |
| 7. What is your view on the necessity of teamwork in SSSP?                         | 2.9% (1)         | 28.6% (10)            | 54.3% (19)   | 14.3% (5)         | 2.80              | 35                |
| answered question                                                                  |                  |                       |              |                   |                   | 35                |
| skipped question                                                                   |                  |                       |              |                   |                   | 0                 |

## 6. CULTURE CHANGE

|                                                                                                           | Not Satisfactory | Somewhat Satisfactory | Satisfactory | Very Satisfactory | Rating<br>Average | Response<br>Count |
|-----------------------------------------------------------------------------------------------------------|------------------|-----------------------|--------------|-------------------|-------------------|-------------------|
| 1. How would you rate the way employees resist changes?                                                   | 25.7% (9)        | 42.9% (15)            | 28.6% (10)   | 2.9% (1)          | 2.09              | 35                |
| 2. What is your view on the way employees see customer satisfaction as an important goal?                 | 2.9% (1)         | 37.1% (13)            | 45.7% (16)   | 14.3% (5)         | 2.71              | 35                |
| 3. What is your view on the way employees see the plant as their own plant?                               | 17.1% (6)        | 31.4% (11)            | 45.7% (16)   | 5.7% (2)          | 2.40              | 35                |
| 4. What is your view on the way employees see quality as an important factor for the growth of the plant? | 0.0% (0)         | 42.9% (15)            | 48.6% (17)   | 8.6% (3)          | 2.66              | 35                |

answered question

35

skipped question

0

## 7. CONTINUOUS IMPROVEMENT

|                                                                                                                                           | Not Satisfactory | Somewhat Satisfactory | Satisfactory | Very Satisfactory | Rating<br>Average        | Response<br>Count |
|-------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------------|--------------|-------------------|--------------------------|-------------------|
| 1. How would you rate the way management promotes continuous improvement at all levels in SSSP?                                           | 5.7% (2)         | 37.1% (13)            | 48.6% (17)   | 8.6% (3)          | 2.60                     | 35                |
| 2. What is your view on the way employees consider getting immediate results rather than work towards quality and continuous improvement? | 5.7% (2)         | 42.9% (15)            | 42.9% (15)   | 8.6% (3)          | 2.54                     | 35                |
| 3. How would you rate the plant's continuous improvement strategies?                                                                      | 8.6% (3)         | 20.0% (7)             | 68.6% (24)   | 2.9% (1)          | 2.66                     | 35                |
| 4. What is your view on the need for continuous improvement?                                                                              | 0.0% (0)         | 14.3% (5)             | 57.1% (20)   | 28.6% (10)        | 3.14                     | 35                |
|                                                                                                                                           |                  |                       |              |                   | <i>answered question</i> | 35                |
|                                                                                                                                           |                  |                       |              |                   | <i>skipped question</i>  | 0                 |

## 8. PARTICIPATIVE MANAGEMENT STYLE

|                                                                                                         | Not Satisfactory | Somewhat Satisfactory | Satisfactory | Very Satisfactory | Rating<br>Average | Response<br>Count |
|---------------------------------------------------------------------------------------------------------|------------------|-----------------------|--------------|-------------------|-------------------|-------------------|
| 1. How would you rate the way management involve employees in decision-making?                          | 2.9% (1)         | 51.4% (18)            | 40.0% (14)   | 5.7% (2)          | 2.49              | 35                |
| 2. How would you rate the way employees are satisfied in carrying out their job?                        | 2.9% (1)         | 37.1% (13)            | 57.1% (20)   | 2.9% (1)          | 2.60              | 35                |
| 3. What is your view on recommending SSSP to a friend if he/she were looking for a job?                 | 11.4% (4)        | 25.7% (9)             | 51.4% (18)   | 11.4% (4)         | 2.63              | 35                |
| 4. How would you rate the extent to which employees are proud of telling people they work in SSSP?      | 8.6% (3)         | 28.6% (10)            | 57.1% (20)   | 5.7% (2)          | 2.60              | 35                |
| 5. How would you rate the extent to which employees see SSSP as the best organization to work?          | 8.6% (3)         | 42.9% (15)            | 42.9% (15)   | 5.7% (2)          | 2.46              | 35                |
| 6. What is your view on the extent to which employees participate in the day-to-day activities of SSSP? | 17.1% (6)        | 54.3% (19)            | 28.6% (10)   | 0.0% (0)          | 2.11              | 35                |
| answered question                                                                                       |                  |                       |              |                   |                   | 35                |
| skipped question                                                                                        |                  |                       |              |                   |                   | 0                 |

# 9. CUSTOMER FOCUS AND SATISFACTION

|                                                                                                                           | Not Satisfactory | Somewhat Satisfactory | Satisfactory | Very Satisfactory | Rating<br>Average | Response<br>Count |
|---------------------------------------------------------------------------------------------------------------------------|------------------|-----------------------|--------------|-------------------|-------------------|-------------------|
| 1. What is your view on the extent to which customer and quality are driving forces behind day-to-day operations in SSSP? | 2.9% (1)         | 31.4% (11)            | 57.1% (20)   | 8.6% (3)          | 2.71              | 35                |
| 2. How would you rate the way SSSP provide products to the customers as promised?                                         | 0.0% (0)         | 31.4% (11)            | 48.6% (17)   | 20.0% (7)         | 2.89              | 35                |
| 3. What is your view on the readiness of SSSP to respond to customers' requests?                                          | 5.7% (2)         | 11.4% (4)             | 68.6% (24)   | 14.3% (5)         | 2.91              | 35                |
| 4. How would you rate the use of customer feedback to improve SSSP standards?                                             | 0.0% (0)         | 25.7% (9)             | 54.3% (19)   | 20.0% (7)         | 2.94              | 35                |
| 5. How do you rate the extent to which SSSP keep their customers abreast with their quality efforts?                      | 2.9% (1)         | 37.1% (13)            | 54.3% (19)   | 5.7% (2)          | 2.63              | 35                |
| 6. How do you rate management's gratitude to their customers?                                                             | 5.7% (2)         | 20.0% (7)             | 65.7% (23)   | 8.6% (3)          | 2.77              | 35                |
| answered question                                                                                                         |                  |                       |              |                   |                   | 35                |
| skipped question                                                                                                          |                  |                       |              |                   |                   | 0                 |

# **ANNEXURE 2**

# Amorighoye Lucky Questionnaire Survey for Developing an

## 1. Total Quality Management (TQM) Assessment Tool Survey Instrument

Total Quality Management (TQM) is a senior management led company-wide initiative that involves all managers and employees commitment (e.g. employee involvement, training and teamwork) to satisfy or meet customer needs and expectations through continuous improvement. The objective of the questionnaire is to identify the nine TQM principles as it applies to a process industry, with Sasol's Steam Station Plant (SSSP) as a case study. Please, indicate your experience and perception on each question by clicking either 'not satisfactory', 'somewhat satisfactory', 'satisfactory' or 'very satisfactory'. Please note that the survey is strictly for academic exercise and will be treated with utmost confidentiality. Thank you for your voluntary participation.

### 1. TOP MANAGEMENT COMMITMENT

|                                                                                       | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|---------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. How would you rate SSSP top management commitment to quality?                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. What is your perception about top management's quality vision?                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. What is your view on top management rating quality more than cost?                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. How would you rate top management efforts to improve quality?                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5. What is your view on the way management eliminates the causes of problems in SSSP? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 6. What is your view on the way top management value employees?                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

### 2. EMPLOYEE INVOLVEMENT

|                                                                                  | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|----------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. What is your view on the involvement of employees in SSSP quality programmes? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. What is your view on the way employees put in extra effort to their work?     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. How would you rate the way management motivates employees?                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

# Amorighoye Lucky Questionnaire Survey for Developing an

## 3. CONTINUOUS TRAINING

|                                                                                                    | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|----------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. How would you rate the extent to which employees receive training in SSSP?                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. What is your view on employees' training on SSSP quality programmes?                            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. How would you rate the frequency at which quality programmes are being conducted for employees? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. How would you rate employees' training on team building?                                        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5. How would you rate employee's training on quality?                                              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

## 4. EMPLOYEE EMPOWERMENT

|                                                                                                                  | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. How would you rate the extent to which employees are allowed to work without supervision?                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. What is your view on the way employees are motivated towards being innovative?                                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. What is your perception on the way employees are allowed to learn from their mistakes instead of being fired? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. How would you rate employees relationship with SSSP customers?                                                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

# Amorighoye Lucky Questionnaire Survey for Developing an

## 5. TEAMWORK

|                                                                                    | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. How would you rate trust, openness and good relationships among SSSP employees. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. What is your view on the extent to which teams are used in SSSP?                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. What is your view on the effectiveness of teams in solving problems?            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. How would you rate the co-ordination of teams in the plant?                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5. How effective are the teams towards achieving organizational goals?             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 6. How would you rate the way team spirit superceeds Individual goals?             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 7. What is your view on the necessity of teamwork in SSSP?                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

## 6. CULTURE CHANGE

|                                                                                                           | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|-----------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. How would you rate the way employees resist changes?                                                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. What is your view on the way employees see customer satisfaction as an important goal?                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. What is your view on the way employees see the plant as their own plant?                               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. What is your view on the way employees see quality as an important factor for the growth of the plant? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

# Amorighoye Lucky Questionnaire Survey for Developing an

## 7. CONTINUOUS IMPROVEMENT

|                                                                                                                                           | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. How would you rate the way management promotes continuous improvement at all levels in SSSP?                                           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. What is your view on the way employees consider getting immediate results rather than work towards quality and continuous improvement? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. How would you rate the plant's continuous improvement strategies?                                                                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. What is your view on the need for continuous improvement?                                                                              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

## 8. PARTICIPATIVE MANAGEMENT STYLE

|                                                                                                         | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|---------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. How would you rate the way management involve employees in decision-making?                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. How would you rate the way employees are satisfied in carrying out their job?                        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. What is your view on recommending SSSP to a friend if he/she were looking for a job?                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. How would you rate the extent to which employees are proud of telling people they work in SSSP?      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5. How would you rate the extent to which employees see SSSP as the best organization to work?          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 6. What is your view on the extent to which employees participate in the day-to-day activities of SSSP? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

# Amorighoye Lucky Questionnaire Survey for Developing an

## 9. CUSTOMER FOCUS AND SATISFACTION

|                                                                                                                           | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|---------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. What is your view on the extent to which customer and quality are driving forces behind day-to-day operations in SSSP? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. How would you rate the way SSSP provide products to the customers as promised?                                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. What is your view on the readiness of SSSP to respond to customers' requests?                                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. How would you rate the use of customer feedback to improve SSSP standards?                                             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5. How do you rate the extent to which SSSP keep their customers abreast with their quality efforts?                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 6. How do you rate management's gratitude to their customers?                                                             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

# **ANNEXURE 3**

## TOTAL QUALITY MANAGEMENT (TQM) ASSESSMENT TOOL SURVEY INSTRUMENT

Total Quality Management (TQM) is a senior management led company-wide initiative that involves all managers and employees commitment (e.g. employee involvement, training and teamwork) to satisfy or meet customer needs and expectations through continuous improvement, leadership and decision making. The objective of the questionnaire is to identify the nine TQM principles as it applied to a process industry, with SASOL's Steam Station Plant (SSSP) as a case study. Please, indicate your experience and perception on each question by clicking either 'not satisfactory', 'somewhat satisfactory', 'satisfactory' or 'very satisfactory'. Please note that the survey is strictly for academic exercise and will be treated with utmost confidentiality. Thank you for your voluntary participation.

### 1. TOP MANAGEMENT COMMITMENT

|                                                                       | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|-----------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. How would you rate SSSP top management commitment to quality?      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. What is your perception about top management's quality vision?     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. What is your view on top management rating quality more than cost? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. How would you rate top management efforts to improve quality?      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5. What is your view on the way management eliminates the causes of   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

problems in SSSP?

6. What is your view on the way top management value employees?

☐☐☐☐

## 2. EMPLOYEE INVOLVEMENT

|                                                                                  | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|----------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. What is your view on the involvement of employees in SSSP quality programmes? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. What is your view on the way employees put in extra effort to their work?     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. How would you rate the way management motivates employees?                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. What is your view on the involvement of employees in SSSP quality programmes? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

### 3. CONTINUOUS TRAINING

|                                                                                                    | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|----------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. How would you rate the extent to which employees receive training in SSSP?                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. What is your view on employees' training on SSSP quality programmes?                            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. How would you rate the frequency at which quality programmes are being conducted for employees? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. How would you rate employees' training on team building?                                        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5. How would you rate employee's training on quality?                                              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

### 4. EMPLOYEE EMPOWERMENT

|                                                                         | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|-------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. How would you rate the extent to which employees are allowed to work | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

|                                                                                                                  |                       |                       |                       |                       |
|------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| without supervision?                                                                                             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. What is your view on the way employees are motivated towards being innovative?                                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. What is your perception on the way employees are allowed to learn from their mistakes instead of being fired? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. How would you rate employees' relationship with SSSP customers?                                               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

5. TEAMWORK

|                                                                                    | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. How would you rate trust, openness and good relationships among SSSP employees? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. What is your view on the extent to which teams are used in SSSP?                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. What is your view on the effectiveness of teams in solving problems?            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

|                                                                        |                       |                       |                       |                       |
|------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 4. How would you rate the co-ordination of teams in the plant?         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5. How effective are the teams towards achieving organizational goals? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 6. How would you rate the way team spirit supersedes individual goals? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 7. What is your view on the necessity of teamwork in SSSP?             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

## 6. CULTURE CHANGE

|                                                                                           | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|-------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. How would you rate the way employees resist changes?                                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. What is your view on the way employees see customer satisfaction as an important goal? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. What is your view on the way employees see the plant as their own plant?               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. What is your view on the way employees see                                             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

quality as an important factor for the growth of the plant?

## 7. CONTINUOUS IMPROVEMENT

|                                                                                                                                           | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. How would you rate the way management promotes continuous improvement at all levels in SSSP?                                           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. What is your view on the way employees consider getting immediate results rather than work towards quality and continuous improvement? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. How would you rate the plant's continuous improvement strategies?                                                                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. What is your view on the need for continuous improvement?                                                                              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

## 8. PARTICIPATIVE MANAGEMENT STYLE

|                                                                                                         | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|---------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. How would you rate the way management involve employees in decision-making?                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. How would you rate the way employees are satisfied in carrying out their job?                        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. What is your view on recommending SSSP to a friend if he/she were looking for a job?                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. How would you rate the extent to which employees are proud of telling people they work in SSSP?      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5. How would you rate the extent to which employees see SSSP as the best organization to work?          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 6. What is your view on the extent to which employees participate in the day-to-day activities of SSSP? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

9. CUSTOMER FOCUS AND SATISFACTION

|                                                                                                                           | Not Satisfactory      | Somewhat Satisfactory | Satisfactory          | Very Satisfactory     |
|---------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. What is your view on the extent to which customer and quality are driving forces behind day-to-day operations in SSSP? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. How would you rate the way SSSP provide products to the customers as promised?                                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. What is your view on the readiness of SSSP to respond to customers' requests?                                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. How would you rate the use of customer feedback to improve SSSP standards?                                             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5. How do you rate the extent to which SSSP keep their customers abreast with their quality efforts?                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 6. How do you rate management's gratitude to their customers?                                                             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |