

**MANAGING THE QUALITY OF COLOUR TELEVISION RECEIVERS IN THE
REPUBLIC OF SOUTH AFRICA**

by

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SUMMARY

This study investigates whether quality management has developed to such an extent that retailers, service repair organisations and consumers are satisfied with product and repair service quality provided by South African manufacturing companies. To investigate these aspects, the colour television industry has been selected because it contains various manufacturing companies of varying sizes and characters, employing different quality policies and performances. It offers relatively standardised products and services, which facilitates intercompany comparisons and employs a simple flow type assembly line process that is representative of other mass production industries.

The hypotheses are tested by interviewing four selected populations by means of carefully constructed questionnaires, namely a retail population, a repair service population, a consumer population and a manufacturing population. The empirical results are statistically evaluated in terms of the various manufacturers ability to provide satisfactory product and repair service quality. Consumers and repair service organisations are selected because they represent a broad spectrum of the population with varying, but important opinions on product and repair service quality. Retailers selling colour television receivers are also selected as they play an important role in the management of quality and vary from small independent retailers to large chain stores and discounters. The results obtained from this study show that:

- there is a need from the retailers, service repair organisations and consumers for the South African manufacturers to improve the quality of colour television receivers
- there is a need by the consumers and the retailers for the manufacturers to improve their repair service quality
- there is a need to improve the quality control procedures employed by the colour television manufacturers.

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CHAPTER 1

THE SCOPE AND OBJECTIVES OF THE STUDY

1.1 INTRODUCTION

The television industry commenced in 1974 with the granting of licences to certain manufacturers. Initially it was the government's intention that manufacturers set up in decentralised areas as this was an important economic criteria at that time. Incentives were provided for industrialists, in decentralised areas, by way of a facility to import 200 000 semi knocked down (SKD) kits. Only two manufacturers availed themselves of this facility, one of whom set up in East London (TVMAND), and the other in Belleville (TVMANC). The industry was very controlled. Licensing required commitments as regards investment, setting up of service and adherence to South African Bureau of Standards specifications. (Bosworth 1996).

The colour television market was initially serviced by international brands, including Telefunken, Philips, Sony and Blaupunkt. Barlows marketed sets under 'Barlowvision' but later changed to National Panasonic.

After a period of four years there was some rationalisation within the industry which resulted in the establishment of four major manufacturers (TVMANA, TVMANB, TVMANC and TVMAND). Initial demand had been met and competition between the manufacturers increased. TVMAND had the strongest brand having gained leadership through the initial supply of SKD kits. After 1987 the government started deregulating the industry. This covered the removal of certain SABS requirements, elimination of import control and the

announced intention to reduce import duties. (Bosworth 1996).

In the late 1980's, the industry destabilised further with the emergence of low cost operators, which, in most cases were breaching import regulations. These were established mainly in neighbouring states. SKD kits were imported under the guise of completely knocked down (CKD) kits, thereby allowing very low assembly cost. This development encouraged the introduction of private brands, mainly based on low cost Chinese kits. Price points were destabilised by these low cost operators and the major brands continued to lose market share particularly at the bottom end of the colour television market. During this period South African and Far Eastern industrialists established additional colour television manufacturing facilities in South Africa bringing the total number of local manufacturers to eight. (Bosworth 1996).

Prior to 1990 the policies of the South African government isolated the local manufacturing industry from international competition. Duties on imported products have since been reduced and are being phased down to levels provided for in the General Agreement on Trade and Tariffs (GATT) negotiations which are presently 40% compared with 100% that applied up to 1990 for colour television receivers (Bosworth 1996). As a result, the quality and therefore the cost of locally manufactured products may now be in serious trouble in competing against imported products and overseas markets. The major reason is the immediate threat posed by the revolution in quality that has taken place in the East during South Africa's economic isolation.

The international competitive pressure has not only increased by an order of magnitude, it has also changed dimensions. There is more pressure on enterprises to market products with the appropriate quality and at the same time to meet the expectations of customers whilst keeping in view the products and services of competing enterprises. Enterprises can no longer adopt reactive responses to the management of quality, or delegate the responsibility about product and service quality to operational level functions. A proactive and aggressive top management approach about quality will be required.

To investigate these aspects the colour television industry has been selected because it contains eight manufacturing companies, at present, of varying sizes and characters employing different quality policies and performances. It offers relatively standardised products and services, which facilitates intercompany comparisons and employs a simple flow type assembly line process that is representative of other mass production industries. Consumers and service repair organisations represent a broad spectrum of the population with varying, but important opinions on product and service quality. Retailers selling colour television receivers also play an important role in the management of quality and vary from small independent retailers to large chain stores and discounters who represent a large sector of the retail industry.

According to Juran (1978:10) the colour television receiver is a good case to base comparisons on because of its technological complexity and because its price makes it one of the most expensive products bought by consumers. Juran (1978:10) also points out that the colour television receiver is produced and sold in such large numbers that it constitutes an important industry and therefore an important element in the economy of many nations.

Leonard and Sasser (1982:164) indicate that many consumers regard the quality of products and services to be an important variable in so far as there is now an increased demand for high quality. Factors contributing to this increased demand are:

- rates of inflation have increased with the result that consumers are more attracted to durable products with long useful lives; in South Africa the exchange rates of major international currencies have appreciated against the Rand thereby inflating the prices of colour television receivers (the majority of television components are imported)
- energy costs have increased dramatically and consumers are shifting to energy-efficient products and services

- with rising repair and maintenance costs, consumers are increasingly concerned about warranties and frequency of repairs.

1.2 THE RESURGENCE OF QUALITY

In 1980 the National Broadcasting Corporation of the United States of America transmitted a two hour, prime time television program entitled "If Japan can ... why can't we?". Although the principal emphasis was on productivity, a major aspect of the program was on quality. The Japanese took on the world in their own home markets and performed this for a variety of products. They had established a primary position for consumer television products in the United States of America and only artificial restrictions had prevented a similar takeover in Western Europe. The program pointed out that the quality of the Japanese products was the key element and that an American, Dr. William Edwards Deming, was responsible for the improvement in the quality of Japanese products. The Japanese had taken his advice as early as 1950, but thirty years passed before United States companies began to respond and take Deming seriously. By 1990 a significant number of United States companies achieved stunning results in meeting their customer's quality needs (Juran 1991a:6). It is suggested by Juran (1991a:8) that the 1990's will witness the first serious Western challenge to Japanese quality leadership by a significant number of United States companies.

With the lifting of economic sanctions against South Africa during the 1990's a normalising of international competition can be expected. It can therefore be argued that the quality of colour television receivers presents both a problem and an opportunity for the South African colour television industry - a problem, because foreign competitors are far ahead in offering superior quality; an opportunity, because South African and overseas markets are increasingly concerned about quality.

The challenge confronting industry in South Africa today is the attitude and direction from management to improve quality on an ongoing basis.

The management of quality entails the interaction of four participants: (1) the **product** which is a function of design and manufacture; (2) the **retailer** and how he sells the product, demonstrates it and installs it for the consumer; (3) the **consumer** and how he uses the product, how he takes care of it, what he was led to expect; (4) the **service** provided for repairs and availability of parts. Deming (1986:176) uses the three corners of a triangle to describe the interaction of the participants of quality (consumer, manufacturer and service) and does not make a distinction between the retailer and consumer which the researcher feels is important as each participant impacts on the management of quality in a unique way. This research investigates the effectiveness of the colour television industry to manage quality in respect of the four participants.

1.3 PROBLEM DEFINITION

International competition in the 1990's and thereafter will require South African companies to take an aggressive approach towards managing quality. The impact on product and service quality requirements in the buying decision of many consumers is therefore expected to escalate in accordance with international pressure. Most South African companies, however, have been adopting the following approach to quality:

- the top priority is on meeting schedules and cost budgets, not on quality
- field performance is compatible with that of competitors but not with the needs of consumers
- cost of poor quality is high and is hidden in the cost standards
- emphasis is on meeting standards, not on improvement
- quality is a function of manufacturing processes

- top management has no direct hand in the leadership of the quality function -- it is delegated to the quality department or to no one.

The main problem facing the South African manufacturing industry is the failure of management to plan for the future and to foresee that quality problems have brought about a waste of manpower, of materials, and of machine time, all of which raise the manufacturer's cost and price that the consumer must pay. Governments are not always willing to subsidise this waste which has been evidenced by the reduction in import duties as provided for in GATT. The inevitable result is loss of market. Loss of market begets unemployment. It is no longer socially acceptable to dump employees on the to the heap of the unemployed. Performance of management should be measured by the potential to stay in business, to protect investment, to ensure future dividends and jobs through the improvement in product and service.

The fundamental problem is the failure of South African managers to manage quality effectively in an ever increasingly competitive environment.

1.4 STATEMENT OF THE RESEARCH HYPOTHESES

The hypotheses to be addressed in this study are:

- there is a need from the **retailers, service repair organisations and consumers** for the South African manufacturers to improve the quality of colour television receivers
- there is a need by the **consumers** and the **retailers** for the manufacturers to improve their repair service quality
- there is a need to improve the quality control procedures employed by the colour television **manufacturers**.

1.5 OBJECTIVES OF THE RESEARCH

This research proposes to explore, identify, compare and evaluate those management practices and attitudes concerning colour television receiver quality in the manufacturing and repair service sectors of the economy. The dimensions and characteristics of product and service quality are investigated to establish the meaning of quality in the colour television receiver industry so that the precise connection between consumer satisfaction and the various dimensions of quality may be determined. The results of this research provides the causes of quality problems and contributors to quality performance so that the local colour television industry may be sustained.

1.6 LIMITATIONS OF THE STUDY

This study is subject to the following limitations:

- the study will not attempt to explain the underlying technical reasons for product failures or non conformances
- the study will be limited to the South African colour television industry during 1994
- the study will be limited to consumers, retailers and service repairers living and working in the Guateng province of the Republic of South Africa
- the study will be limited by the South African government's policies which, if significantly changed, will impact on the competitiveness of the local colour television manufacturers.

1.7 EXPECTED CONTRIBUTION TO KNOWLEDGE

This research identifies, ranks and measures those specific dimensions and associated

characteristics that are impacting on the quality of locally manufactured colour television receivers. From these results it may be assumed that similarly mass produced products will require comparable solutions to improving the quality of local manufacture and repair service.

Few studies have recognised the multiple dimensions of quality, and still fewer, the possibility that quality may have different meanings in different industries. Contributions from consumers, sales staff, service technicians and production supervisors provide a broad perception of requirements and new dimensions for the South African television industry. The dimensions of colour television receiver quality have never been defined to the extent that other industries have identified conformance, reliability and low cost as their objectives.

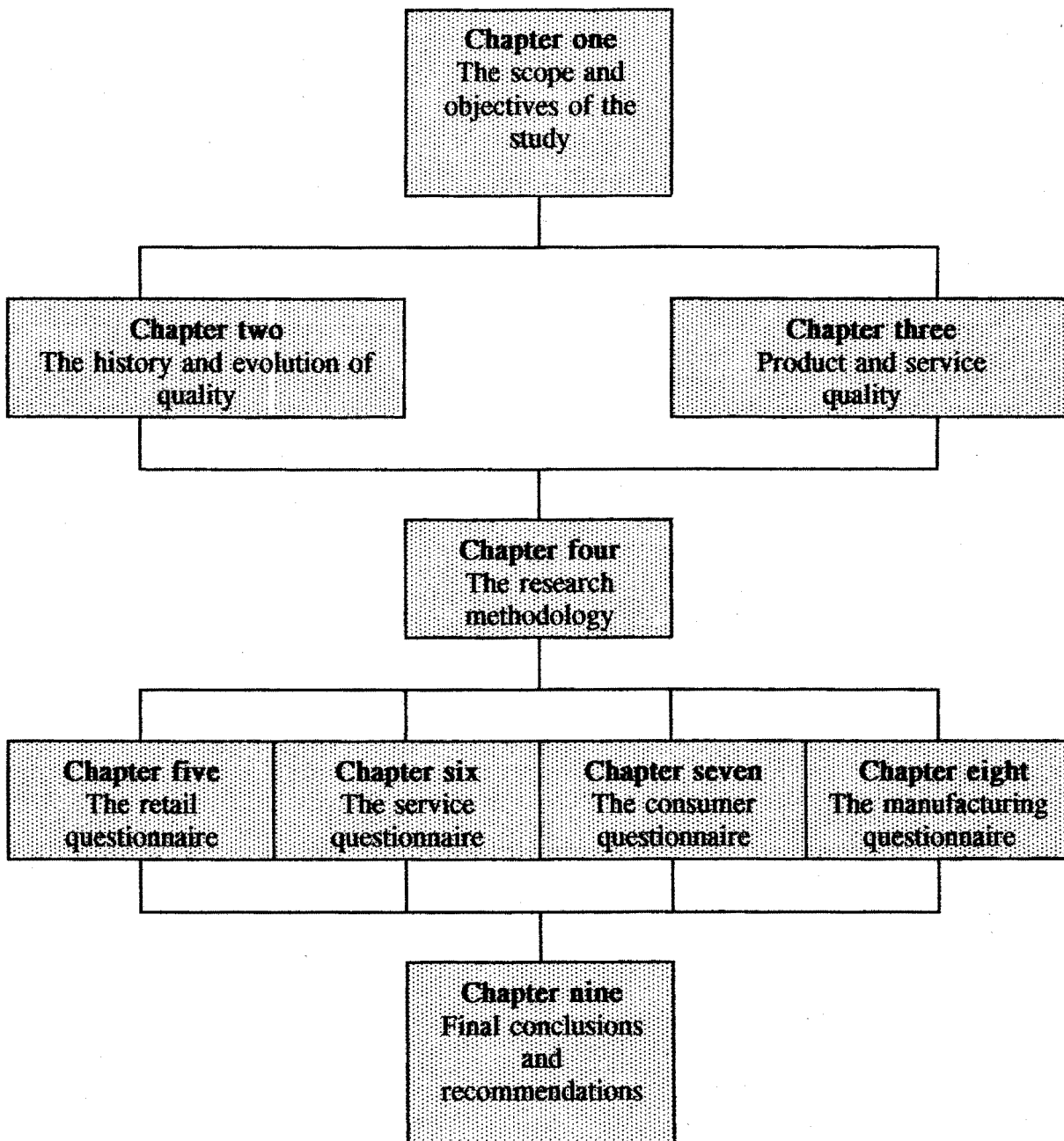
Existing literature does not attempt to link the management of quality and the consequent interaction of the participants of product and repair service quality (consumers, manufacturers, retailers and repair organisations). This work attempts to fill such a gap in the existing literature.

1.8 THE STRUCTURE AND ORGANISATION OF THE THESIS

The study is divided into nine chapters. **Chapter one** constitutes the scope and objectives of the study: an introduction; the resurgence of quality; problem definition; hypotheses; objectives of the study; limitations; and the expected contribution. **Chapter two** explores the quality management literature beginning with a historical account and progressing through a number of theorist's views to contemporary issues. **Chapter three** expands on product and service quality with special reference to colour television receivers; exploring and establishing the dimensions of product and service quality as well as the correlates of quality. **Chapter four** details the methodology used in the research, covering the four population groups in respect of their samples, questions, the statistics applied and the approach followed in reporting the results. The empirical results are reported in **Chapters five, six, seven and eight** covering retail, service, consumer and manufacturing sectors respectively. **Chapter nine** presents a summary of the most important findings of the study with a discussion of the

conclusions reached. Finally, suggestions are made about possible areas for future research. The structure of the thesis is shown in Figure 1.1.

Figure 1.1: The structure of the thesis



CHAPTER 2

THE HISTORY AND EVOLUTION OF QUALITY

2.1 INTRODUCTION

Banks (1989:4) expresses the view that quality control may be considered as old as the human race when activities that ensure a product or service satisfy a desired or specified standard are perceived as quality control activities.

In his earliest state, man was a gatherer and hunter of food and was therefore dependent on nature as the manufacturer. As man initiated manufacturing activities, by growing his own food, he did so as "usufacture", that is, manufacture for one's own use. Usufacture implied that quality activities were performed by the same individual. In these early times quality control acts were performed subconsciously by single individuals in their everyday activities.

According to Banks (1989:4) it is not known precisely when subconscious quality control came to an end. However, archaeological findings attest to conscious efforts in controlling quality, as can be observed by the perfection and endurance of Egypt's pyramids. Ancient Greeks and Romans left a legacy in quality control, especially in architecture and engineering, with some constructions still standing today. Juran (1990:25) explains that product and process designs attained high levels of proficiency in China's ancient times in that bronze wares from that era have been the focus of world attention. As time progressed, the science of quality control evolved with the technological advances of the human race.

The evolution and changes in the approach to quality control have occurred in four distinct

phases according to two of the world's most influential theorists on quality (Feigenbaum 1986; Juran 1991d). These phases are the craftsmanship era (Section 2.2), the inspection era (Section 2.3), the statistical era (Section 2.4) and the management era (Section 2.5). Garvin (1988:3) however, designates the management era as the quality assurance era and goes on to expand to a fifth phase which he calls the strategic management era (Section 2.6). According to Juran (1991d:18) these changes in approach to quality control have come about through steady evolution rather than dramatic breakthroughs with much overlap between these phases. The philosophies, principles and methods applied by the most influential quality leaders are discussed (Section 2.7).

Today the global trend in quality control has emerged as a formal management function and is no longer only manufacturing oriented but embraces functions such as finance, marketing and service which is summarised in Section 2.8.

2.2 THE CRAFTSMANSHIP ERA

Rissik (1947:24) summed up craftsmanship as man's ability to control the quality of his artifacts by means of personal skill aided by artistic judgement with the criterion of quality being ultimately the fitness of the object created to the purpose it subserves.

In the eighteenth and nineteenth centuries most manufacturing was performed by artisans and skilled craftsmen or by apprentices who were supervised by these master craftsmen. Tradesmen gained a reputation for quality products through skilled craftsmanship that was maintained over time by enforcing lengthy apprenticeship of newcomers to the trade. Pride of workmanship was vital. Manufacturing, as we know it today, did not exist and products were produced in small volumes by these master craftsmen (Garvin 1988:3). The effect of these activities was that the craftsman was both the producer and inspector with the result that quality standards were self established. The decision as to whether the product conformed to customer requirements or not, was made by the craftsman who had a significant personal stake in meeting his customers' needs for quality (Juran 1991d:19).

The doom of craftsmanship was heralded when the principle of interchangeability of component parts finally succeeded in revolutionising the concept of product quality (Rissik 1947:24). The application of interchangeability was initially constrained by the concept of exactness in that interchangeable parts were manufactured to meet exact dimensions. Experience eventually showed this to be impracticable and that some degree of tolerance was required in the manufacture of interchangeable parts. The realisation of the need for tolerance limits introduced the gauging system which established the principal of inspection.

2.3 THE INSPECTION ERA

According to Rissik (1947:155) H.F. Dodge is generally recognised as the pioneer and an authority on inspection, defined inspection as follows:

"Inspection is valuable as a measuring instrument when used solely for the purpose of separating the bad product from the good. But its greatest value and fundamental purpose is to provide information that will assist in controlling quality."

Banks (1989:6) supports the notion that the complexity of manufacturing escalated in the late eighteenth and early nineteenth century with increased industrialisation. The Industrial Revolution, according to Juran (1991d:19) made possible an enormous expansion of manufacture and consumption of goods which created what is known today as the factory system. This mass production was made possible by widescale use of power-driven machinery. The attainment of quality became less dependent on craftsmanship and more a matter of design, construction and maintenance of the manufacturing process. The craftsmen became factory employees and the master craftsmen became the production supervisors (Juran 1991d:20).

With the advancement of technology, the economic structure became more complex in that

it became necessary to introduce dealers, wholesalers and retailers to the producer-consumer cycle (Hayes & Romig 1989:6). Businessmen and executives soon became aware of the need to classify the labour force into smaller functional units thereby decreasing the activities and increasing specialisation for each work centre or department. The proprietor and the consumer could no longer conduct business on a one for one basis without separate departments such as finance, production and sales, for example, requiring involvement. A greater complexity in the overall industrial system started taking effect.

During the late nineteenth century the Taylor system of manufacturing was introduced in the United States of America which resulted in increased production and productivity without a corresponding increase in craftsmen (Juran 1991d:20). The craftsmen concept disappeared with Taylorism and so did quality achieved through skilled craftsmanship. According to Garvin (1988:5) Taylor gave the activity of inspection added legitimacy by singling it out as an assigned task. To be effective the inspector had to be a master craftsman and was responsible for the quality of finished work which had to suit him. Inspection thus remained the sole guarantor of quality which left in its wake a stream of poorer quality products in that quality was no longer being built into the product.

According to Juran (1991d) the early decades of the 20th century saw factory engineers being employed to develop new manufacturing processes. These newly engineered processes began to replace those that had been handed down by the craftsmen to keep pace with advances in technology and new product designs. As a result, advancements in managing quality did not keep up with those in technology. Quality had been delegated to the inspection departments with top management supporting investments needed to sustain and increase sales.

With increasing industrialisation vast numbers of unskilled industrial workers escalated. This necessitated production supervisors to organise a body of inspectors, representing the customer, to inspect the quality of finished products. In due course inspection became a significant feature of the industrial scene and many production industries introduced their own in-house inspection departments (Juran 1991d:20).

The main task of these inspection departments was to keep defective products from reaching customers by inspecting finished goods, usually separating the good from the bad (Juran 1991d:20). The assignment of responsibility for quality now became that of the inspection department and not the production department.

2.4 THE STATISTICAL ERA

Hayes and Romig (1989:6) claim that statistical methods were first applied to inspection problems as early as 1916 when the operating characteristic curve as a means of accepting quality, based on the law of probability, was introduced. Cumulative probability curves of the Poisson exponential distribution were prepared and published in 1926 in order to measure the probability of acceptance for these sampling plans. Tabulated individual and cumulated plans were prepared and published in 1949.

For some companies routine quality inspection was not good enough (Banks 1989:7). For example, an inspection engineering department was established at Western Electric's Bell Telephone laboratories in the United States of America to address the problem of extracting the maximum amount of information from the minimum amount of inspection data generated about the quality of the products manufactured (Garvin 1988:6). The group included world quality experts such as Dodge, Romig, Shewart, Edwards and Juran who were largely responsible for creating what is known today as the discipline of statistical quality control (Garvin 1988:6).

This group defined various terms associated with acceptance sampling which are still used today, such as "consumer risk", "producer risk", "probability of acceptance", "operating characteristic curves", "lot tolerance percent defective", "average total inspection", "double sampling" and " α and β type risks". By 1927 attribute sampling inspection tables, multiple sampling tables and average outgoing quality limit sampling tables were developed by this group. During the 1930's an increased application of these sampling techniques was experienced in the United States of America and abroad (Banks 1989:8). This

involved making the inspection departments of factories more efficient in that sampling inspection rather than 100 percent inspection was now provided.

According to Garvin (1988:6) Shewhart control charts were used to assist in controlling and improving quality during manufacture. The result is what today is called **"statistical quality control"**. The Shewhart control charts, however, did not attract serious attention until 1931 when Shewhart published his book **"Economic Control of Manufactured Product"** giving the discipline of quality control a scientific footing for the first time.

Shewhart is supported by Deming (1986:310) and Garvin (1988:7) that variations exist in all manufacturing processes which can be understood by the application of sampling and probability analysis. These techniques taught manufacturers that work processes could be brought under control by defining when a process should be left alone and when intervention was necessary. Control limits, according to Deming (1988:337), define the boundaries of random variation in completing a task with the need for intervention required when these limits were exceeded. Workers were thus given the ability to monitor their work and predict when they were about to exceed the control limits and possibly produce scrap.

According to Feigenbaum (1986:15) it took until the 1940's before statistical quality control was fully entrenched. This was necessitated by the tremendous mass production requirements of World War II. Juran (1991d:21) explains that the War Production Board of the United States of America decided to help industry by training companies in the tools of statistics covering probability theory, sampling theory and the Shewhart control chart. A few companies achieved spectacular gains with the Shewhart control chart inducing other companies to experiment with process control and sampling methods (Garvin 1988:11).

Statistical quality control declined in the United States of America after World War II due to the termination of defence contracts and the associated statistical quality control programs. According to Juran (1991d:23) most statistical quality control activities were judged to have failed the test of return on investment with the end result of widespread reduction in these

techniques occurring. Inspection planning and the use of sampling tables, however, survived.

After the World War II statistical quality control in Japan was given a boost by the visit of Deming in 1950 (Deming 1986:3). The defeat of Japan by the Allied forces compelled Japan to choose a new direction with national goals having to be met by peaceful means through foreign trade. Japan had a reputation for poor quality which was a major obstacle in penetrating Western markets. A revolution in quality was recognised, by the Japanese, as a requirement to recapture these markets. Deming is widely recognised as having started the quality revolution in Japan (Deming 1986:2). Juran (1991d:23) reasons that the Japanese revolution in quality, using statistical techniques, was due to the shock in losing the war; otherwise Japan would have seen no reason to change their approach to quality.

Since the late 1940's Taguchi introduced several new statistical concepts, used by many Japanese manufacturers, with unprecedented success (Roy 1990:xi). According to Roy (1990:8) Taguchi built upon Deming's observation that 85 percent of poor quality is attributable to the manufacturing process and only 15 percent to the worker. Taguchi developed a philosophy that any variation will cause a loss to society and employed statistical methods which included **"parameter design"**, **"tolerance design"**, **"the quality loss function"** and **"design of experiments"** using orthogonal arrays to support product and process design improvement (Banks 1989:16). His philosophy was developed into what is known as the **"Taguchi methods"**, but it was not until the 1970's that Taguchi promoted his work.

It took until 1980 before statistical quality control emerged as a strong force again in the United States of America. The term statistical process control (SPC) became the label of the movement. Deming was finally taken seriously by Western industrialists (Gabor 1990:5).

In the 1960's a new phase in quality control dawned. This was the quality management era that Feigenbaum (1986:16) described as total quality control. Prior to the 1960's, quality control activities were confined to the shop floor or the production department. Total quality

control advocated that all departments, not only manufacturing, had quality control responsibilities.

2.5 THE MANAGEMENT ERA

2.5.1 Introduction

During the 1950's quality control developed from sorting individual items and production lots to analysing data and establishing process controls. Managerial responsibility and systematic approaches enhanced quality control with attention being focused on design quality and reliability. These activities are confirmed by Juran and Feigenbaum with the appearance of their classic works, Juran's **Quality Control Handbook** and Feigenbaum's **Quality Control, Principles, Practice and Administration** (later revised and published as **Total Quality Control**).

Garvin (1988:12) explained that during the 1950's and 1960's quality control evolved from a manufacturing to a management discipline. The techniques of quality developed beyond statistics involving four additional elements, namely: **total quality control, zero defects, reliability engineering and quantifying the costs of quality**, which will be discussed in the following sections.

2.5.2 Total quality control

The term "**total quality control**" was first used by Feigenbaum. Since then, the idea has come to mean an approach to quality that is companywide involving all aspects of the control or management of quality. The activities from a quality standpoint, or the jobs of quality control as Feigenbaum (1986:64) calls it, could be grouped into four categories: **new design control, incoming material control, product control and special process studies**. To be successful, these activities required the cooperation of all the enterprise's departments with responsibilities clearly defined using elaborate matrices. Feigenbaum (1986:78) augments

his total quality control theory to a concept of a total quality system which not only recognises the importance of the four quality activities working individually, but also how well they are required to work together. The total quality system is seen as the foundation of total quality control providing the proper channels for product quality related activities to flow.

In 1962 the concept of quality circles was launched in Japan which was seen as a major development in total quality control and management in the Far East (Banks 1989:14). Quality circles involved the supervisors getting together with workers to solve quality problems on the factory floor and to train each other in quality control techniques. The principal characteristic of quality circles is the way in which they are structured to deal with company problems in an organised way. Juran (1991b:74) recognised the quality control circle development as an achievement of great importance and took active steps to inform the Western countries about it in June 1966 at the European Quality Conference held in Stockholm.

Although the total quality control approach in the East (quality circles) and the West (quality system) differed in their approach, both aimed at coordinating quality activities.

2.5.3 Zero defect programme

According to Banks (1989:14) the zero defect program evolved during the 1960's when the Martin Marietta Corporation was building Pershing missiles for the United States Army. This program achieved its objectives through worker motivation and involvement, to prevent mistakes by developing a constant, conscious desire to do the job right the first time. Halpin (1966:vii), who was the director of quality at the Martin Marietta Corporation, defined zero defects as:

"a management tool aimed at the reduction of defects through prevention".

The zero defect achievement, at the Martin Marietta Corporation, was a reflection of the management's own changed attitude (Garvin 1988:15). Crosby, who was later to become a leading quality theorist and an advocate of the zero defect approach, worked at the Martin Marietta Corporation in the 1960's as the director of quality for the Pershing missile project.

Although the zero defect concept was not universally accepted, many organisations failed in its implementation. Tenner and DeToro (1992:23) however, are of the opinion that senior management probably failed to implement the correct approach at those companies who blundered in executing a zero defect program.

Deming is highly critical of the zero defect concept in that he states:

"the supposition that everything is all right inside the specifications and all wrong outside does not correspond to this world" (Deming 1986:141).

Crosby (1984:75-77) claims that perfect quality is both technically possible and economically desirable, rekindled the concept of zero defects by emphasising motivation and employee initiative.

2.5.4 Reliability engineering

Reliability engineering first gained prominence after World War II when several military studies revealed that the vacuum tube appeared to be one of the focal points of trouble (Schooman 1968:12). In the early days of television, vacuum tubes were extensively used in the design of television receivers with most service problems being handled by the owner who replaced failed vacuum tubes. With the advancement of technology, transistorised and integrated circuitry replaced the vacuum tube with the result that the reliability of television receivers was improved. Dhillon (1983:1) also attributes the reliability awareness movement in the United States to these military studies after World War II. Banks (1989:11) ascribes

the recognition of a formal discipline in reliability to the early 1950's and that it took until 1957 for the Advisory Group on Reliability of Electronic Equipment (**AGREE**) to introduce the concepts of reliability. Feigenbaum (1986:571) however, recognises four basic steps that have been involved in the evolution of modern product reliability. These steps are:

- prediction and demonstration that product reliability has been achieved
- techniques used in the improvement of product reliability
- ongoing maintenance of reliability programmes
- integration of reliability activities into a complete company programme for quality.

Today most companies have reached the last step and are actively reducing failure rates, resulting in continued improvement in the reliability of their products.

2.5.5 The cost of quality

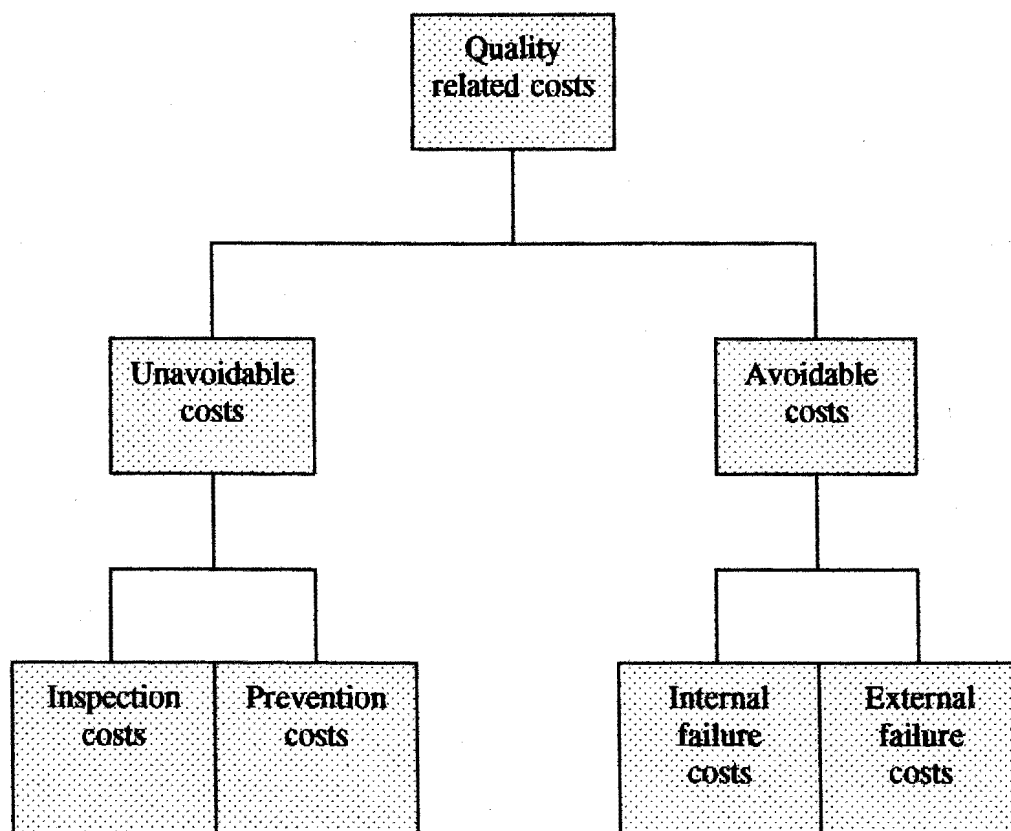
Prior to 1950 the costs of quality were applied to the activity of inspection with no reference to the broader aspects of quality. Juran, according to Garvin (1988:14), first raised the concept of quality costs in the first edition of his **Quality Control Handbook** in 1951. Juran divided the costs of quality into avoidable and unavoidable costs. Avoidable costs were those due to failures (both internal and external to an enterprise) with unavoidable costs associated with inspection and defect prevention activities (see Figure 2.1).

Managers were now able to quantify their quality costs and act in accordance with that knowledge. According to Banks (1989:15) the American Society for Quality Control finally recognised the importance of quality costing in 1971. It defined and classified these costs as preventive, appraisal, internal failures and external failures. Feigenbaum (1986:110) classified preventive costs and appraisal costs as belonging to the costs of control, and internal

failures and external failures as belonging to the costs of failure of control.

Prevention costs are the costs of any action taken to investigate, prevent or reduce failures and includes the cost of planning, setting up and maintaining a quality system. The **cost of inspection** (appraisal) includes the costs of inspecting and testing carried out during and on completion of manufacture. **Internal failure costs** are the costs of failure to achieve the desired quality during manufacture and includes the cost of scrap, rework and reinspection. **External failure costs** are the costs arising outside manufacturing due to the failure to achieve the desired quality and includes warranty claims and consequential losses of custom and goodwill.

Figure 2.1: Categories of quality cost and their subdivisions



The establishment of quality costs did not in itself solve any problems. It did however, support and intensify quality improvement activities which previously would have been recognised as belonging to the domain of the quality department into profitability opportunities recognised as everyone's priority concern in an enterprise (Fox 1993:326).



2.6 THE STRATEGIC MANAGEMENT ERA

Garvin (1988:20) explains that up until the strategic management era the approach to quality, although proactive, was viewed negatively in that the main objective was to prevent defects from occurring. Enterprises were taking a defensive approach rather than use quality as a basis for competition. This view changed in the 1970's and 1980's when quality was viewed as a competitive weapon and was being included in the strategic planning processes of many Western enterprises to combat competition from the Far East. Juran (1991c:81) contends that product quality is now widely recognised as a major force in the competitive market place and in international trade.

Juran and Gryna (1980:115) define strategic quality management as the process of establishing long range quality goals and defining the approach to meeting these goals. A key requirement is that upper management must develop quality policies from which quality goals may be derived and implemented. Although different approaches to strategic quality management are still evolving, Juran and Gryna (1980:116) are of the opinion that the following elements are common among them:

- a focus on customer needs in respect of strengths, weaknesses, opportunities and threats
- leadership by upper management to develop quality goals and strategies
- integrating quality strategies into business plans

- implementation of these plans by the various line departments instead of relying on the quality department.

2.7 QUALITY LEADERS: THEIR PHILOSOPHIES, PRINCIPLES AND METHODS

2.7.1 General

A historical background to the development in quality as presented in Sections 2.2 to 2.6 is essential to the understanding of quality management as it is practiced today. The contributions of the leaders in quality management who have enjoyed the widest recognition are Deming, Juran, Feigenbaum and Crosby. These leaders are just a sampling of a larger community of quality management thinkers but, nonetheless, offer the most influential approaches to the management of quality. Their contributions are analysed through their philosophies, principles and methods with appropriate critique.

2.7.2 The Deming approach

According to Flood (1993:13) Deming became very interested in the work of Shewhart and studied and employed his techniques and soon recognised that a statistically controlled management process gave managers the capacity to determine when to leave an industrial process alone and when to intervene. After World War II the Japanese became aware of his knowledge of Shewhart's techniques and invited him to Japan to deliver a series of lectures on quality. The Japanese credit much of their quality revolution to Deming's statistical process control based philosophy of quality. In recognition of his efforts the Japanese Union of Scientists and Engineers awards the Deming Prize annually to companies that have demonstrated outstanding contributions to product quality and dependability.

Deming summarised his concepts and principles in a series of fourteen points and seven deadly diseases in which he claimed that quality is primarily the result of senior management

actions and decisions and not the result of actions taken by workers.

Deming (1986:23) maintains that his fourteen points apply anywhere, to small organisations as well as large ones, to the service industry as well as to manufacturing. He also stressed that it is the system of work that determines how work is performed and it is only managers that can create the system.

The fourteen points are as follows.

- Create constancy of purpose for improvement of product and service. Management must look to the long term survival of the enterprise by providing jobs through innovation, research, constant improvement and maintenance.
- Adopt the new philosophy. Shoddy materials, poor workmanship, defective products and poor service must become unacceptable.
- Cease dependence on mass inspection. Quality comes not from inspection but from improvement of the process. Inspection is equivalent to planning for defects and is ineffective and costly.
- End the practice of awarding business on the price tag alone. This implies that purchasing departments should seek the best quality in a long term relationship with a single supplier for any one item.
- Improve constantly and forever the system of production and service. Improvement is not seen as a unique event but as a continuous effort to reduce waste and improve quality.
- Institute training on the job.

- Institute leadership with the aim of supervising people to help them do a better job. The job of a supervisor is not to tell people what to do, nor to punish them, but to lead.
- Drive out fear. Many employees are afraid to ask questions or to take a position, even when they do not understand what their job is or what is wrong. To ensure better quality and productivity, it is necessary that people feel secure.
- Break down the barriers between staff areas. Encourage different departments to work as a team so that problems may be foreseen and solved.
- Eliminate slogans, exhortations, targets for the work force.
- Eliminate numerical quotas. Quotas take into account only numbers and not quality or methods.
- Remove barriers to pride in workmanship. Too often, misguided supervisors, faulty equipment and defective materials stand in the way of good performance.
- Institute a vigorous program of education and retraining including teamwork and statistical methods.
- Take action to accomplish the transformation. A special top management team must be appointed to carry out the quality mission.

The seven deadly diseases are as follows.

- Lack of constancy of purpose. Without a constancy of purpose an enterprise has no long range plans for staying in business.

- **Emphasis on short term profits.**
- **Evaluation of performance, merit rating, or annual review.** Performance ratings build fear and leave people bitter, despondent and beaten. The effects can be devastating, for example, teamwork is destroyed and rivalry is nurtured.
- **Mobility of management.** Managers change jobs too often and never stay long enough in any one company to follow through on long term changes that are necessary for quality and productivity.
- **Running an enterprise on visible figures alone implies that the most important figures are unknown and unknowable.** The well known example of the multiplier effect of happy or unhappy customers is a typical example.
- **Excessive medical costs for employee health care, which increases the final costs of goods and service.**
- **Excessive warranty costs.**

To eliminate these managerial diseases, Deming (1986:23) prescribes his fourteen points as a cure. Deming's management philosophy and the role of statistical quality control, in the execution of his philosophy, are present in the fourteen points.

The cornerstone of Deming's philosophy is based on statistical process control which must be implemented where corrective action can be successfully instituted. Top management involvement is a key requirement with proper delegation of quality responsibilities at all levels in an enterprise. The recognition of training and leadership skills is vital in adopting Deming's philosophy with continuous improvements never ending.

The main weaknesses in Deming's principles and methods are the absence of intervening

solutions in union and political actions that are prevalent in Western society.

2.7.3 The Juran approach

Juran like Deming was also familiar with Shewhart's work and was actively involved in applying his techniques. Juran visited Japan during 1954 and unlike Deming did not hesitate to emphasise top and middle management's involvement in achieving quality (Flood 1993:18).

Juran (1986:20) developed what he called the "**Juran Trilogy**" as a basis for managing quality which was derived from financial management. The managerial processes used to manage the finances of an enterprise were applied to managing quality. The applicable financial management processes were financial planning (budgeting), financial control (cost and expense control) and financial improvement (cost reduction and profit improvement).

These were translated into quality planning, quality control and quality improvement briefly explained as follows.

Quality Planning

- Identify the customers, both external and internal.
- Determine customer needs.
- Develop product (goods and services) features that respond to customer needs.
- Establish quality goals that meet the needs of customers and suppliers alike at minimum cost.
- Develop a process that can produce the needed product features.
- Prove that the process can meet the quality goals under operating conditions.

Quality Control

- Decide what to control.
- Choose units of measurement.
- Establish measurement.
- Establish standards of performance.
- Measure actual performance.
- Interpret the difference between actual and standard.
- Take action on the difference.

Quality Improvement

- Prove the need for improvement.
- Identify specific projects for improvement.
- Organise to guide the projects.
- Organise for diagnosis.
- Diagnose to find the causes.
- Provide remedies.
- Prove that the remedies are effective under operating conditions.
- Provide for control to hold the gains.

Due to the parallels between finance and quality Juran often used his **"Trilogy"** to upper managers to explain the approach required to manage quality (Juran 1986:21).

The strength in Juran's approach to quality is the emphasis on management practice, management involvement and management commitment whilst recognising and understanding the needs of both internal and external customers. Juran's weakness is the inadequate attention given to the human dimensional aspects of motivation, leadership and worker involvement. In a similar manner, like Deming, Juran does not deal with cultural and political issues.

2.7.4 The Feigenbaum approach

Feigenbaum (1986:12) developed the approach that the responsibility for quality extended well beyond the manufacturing department. He also developed the concept that quality could not be achieved if products were poorly designed, inefficiently distributed, incorrectly marketed and improperly serviced and supported. Feigenbaum's approach to quality is a whole approach and was largely credited with the concept of Total Quality Control (Kathawala 1989:11). Vorley (1991:47) considers Feigenbaum's book, Total Quality Control, as a model for a quality management system (like BS5750 which is the basis of SABS 0157 and now developed into ISO 9000). Feigenbaum's philosophy, however, can be reduced to four simple steps (Feigenbaum 1986:10).

- Setting a quality standard.
- Appraising conformance to these standards.
- Acting when standards are exceeded.
- Planning for improvements in the standards.

According to Feigenbaum (1986:7) the customer determines quality and defines quality as:

"The total composite product and service characteristics of marketing, engineering, manufacture, and maintenance through which the product and service in use will meet the expectations of the customer."

Feigenbaum (1986:59) establishes nine fundamental factors affecting quality, that is, **markets, money, management, men, motivation, materials, machines and mechanisation, modern information methods and mounting product requirements.** (Kathawala 1989:11), however, reduces these factors to two distinct categories.

- Technological factors
- Human factors.

Feigenbaum (1986:65) advocates four factors or jobs in controlling quality pertaining to all stages of manufacturing. These are:

- new design control
- incoming material control
- product control
- special process studies.

New design control is targeted to eliminate problems before the start of formal production with incoming material control to take account of the quality of parts purchased through suppliers. Product control activities require the maintenance of quality during production whilst special process studies require the provision of ongoing product and process improvement.

Feigenbaum's total approach to quality is a major strength in eliminating uncoordinated quality activities. The emphasis on management and human participation is seen as strengths in generating motivation and creativity which is absent from Deming and Juran's approaches. The main weakness is the absence of a synthesis of the different management approaches into one applicable to the management of quality. In a similar manner, like Deming and Juran, Feigenbaum does not deal with cultural and political issues.

2.7.5 The Crosby approach

Crosby started his career in industry as an inspector and became a quality theorist by his best selling book **"Quality is Free"** in 1979 (March 1986:23). During his manufacturing career Crosby was successful in reducing the manufacturing defects in the production of missiles by embarking on a **"zero defects"** program.

According to Flood (1993:22) Crosby's philosophy can be found in five absolutes of quality management, namely:

- quality is defined as conformance to requirements
- there is no such thing as a quality problem -- problems are created by poor management
- it is always cheaper to do it right the first time
- the only performance measure is the cost of quality
- the only performance standard is zero defects.

Crosby, like Deming, developed a fourteen step quality improvement programme for action by management (Flood 1993:23). These fourteen points are as follows.

- Establish senior management commitment to quality so that all personnel will understand the management position with regard to quality.
- Form a quality improvement team with departmental managers serving as team leaders.
- Establish quality measurements for each activity throughout the company to allow for evaluation and correction.
- Evaluate the cost of quality so that opportunities for corrective action can be identified.
- Establish quality awareness by training supervisors and employees. This also includes the holding of regular meetings between management and employees to discuss non-conformance problems and to provide information regarding the quality programme.
- Instigate corrective action through encouragement of the work force and establish a structured organised and permanent approach to resolving problems.
- Establish an *ad hoc* committee for attaining zero defects and form teams to investigate

the zero defects concept and ways to implement it.

- Undertake supervisor and employee training so that all managers understand and can explain each step in the quality improvement programme.
- Hold a zero defect (ZD) day to establish the new attitude by celebrating the introduction of the zero defect programme.
- Employee goal setting must take place by allowing personnel to establish their own goals and to publish each team's targets.
- Error cause removal should follow the identification of problems that prevent error free work from being achieved.
- Establish recognition for those who meet goals or perform outstandingly by (non financial) award programmes.
- Establish and hold regular meetings of quality councils composed of quality professionals and team chairpersons, to communicate with each other and determine the action necessary to improve the quality programme.
- Do it all over again. This emphasises that quality improvement programmes never end once the goals are achieved.

It is clear that the Crosby approach is easier to grasp than those of Deming, Juran and Feigenbaum because he treats quality problems as tangible issues to be solved and rejects the idea that problems are persistent and unsolvable. The strong management and goal orientation of his zero defect approach can lead workers to become disenchanted as most problems are systemic rather than worker created. The Crosby approach emphasises the ongoing management of quality, but the fourteen points do not have the same amount of

emphasis on the principles of breakthrough and control or handling variation with statistical process control that is found with Deming and Juran.

2.7.6 A summary of the different approaches to quality

Demming, Juran, Feigenbaum and Crosby define quality uniquely by emphasising different aspects and have developed their own individual style or approach in achieving quality. Juran defines quality as **"fitness for use"**. Crosby emphasises quality as **"conformance to requirements"**. Deming claims that quality is **"pride of workmanship"** and Feigenbaum believes quality is **"customer determined"**.

All four agree that management and not the worker is responsible for the majority of quality related problems and any improvements in quality need to be initiated by management. The central theme in all their approaches to achieving quality is **"management commitment"**.

There is consensus on the following aspects.

- Quality starts with product design.
- Quality is a system of continuous ongoing improvement.
- The benefits of quality far outweigh the costs of quality.
- Their concepts are equally applicable to the service and manufacturing industry.
- Quality is dependent on departmental co-ordination.
- Quality cannot be inspected into a product or process.
- Statistical quality control is a useful tool in controlling quality.
- Training as an ongoing activity is important in achieving quality.

There is disagreement on the following aspects.

- The use of slogans. Only recommended by Crosby.

- A definite procedure in achieving quality. Both Deming and Crosby prescribe a fourteen point procedure to follow in achieving quality, whilst Feigenbaum explains four general steps and Juran recommends three steps.
- The use of employee participation in achieving quality. Only Crosby emphasises the use of quality councils or work circles.
- Zero defects. Only Crosby advocates the theory of zero defects.
- Quality management system. Only Feigenbaum develops a quality management based system theory incorporating all aspects of an enterprise.

Whilst these theories provide an understanding of quality management there appears to be no all encompassing correct approach. The dynamics of the difference in approach by the four theorists indicates a need to close the gaps in quality theory and management and sort out what they offer as a whole. There are two main areas of focus.

- The technical dimension of quality.
- The human dimension of quality.

The technical requirements are catered for largely by statistical and quantitative methods incorporating inspection, process control and reliability from design to final product or service delivery by all four theorists. The management of the human dimension of organisations, however, is not at all clearly provided for. The theorists declare their interest in the management of people within their differing philosophies and offer a few tangible principles and no common useable methods as is found in the technical dimension.

2.8 GLOBAL TRENDS AND FUTURE DEVELOPMENTS IN QUALITY

2.8.1 Total quality management

An examination of the theorists' views on quality shows that even these great leaders in quality could not agree to what the correct approach in managing quality should be, particularly the human dimension. As a consequence, a synthesis of organisational, technical, human and cultural elements of an enterprise started to be recognised which led to the Total Quality Management (TQM) movement during the 1980's.

Vorley (1991:55) interprets TQM as a technique aimed at motivating personnel in achieving quality by employing a philosophy which recognises that an enterprise's culture affects behaviour which in turn affects quality. The focus of attention being the performance of every activity in an enterprise and not only the product or service. The enterprise is recognised as having internal customers and suppliers as well as external customers and suppliers. Every department is required to identify its immediate customers and is accountable for identifying the needs of those customers and ensuring the product or service quality required of them. Every department therefore operates its own quality system with appropriate quality control techniques. TQM concerns establishing a management climate that encourages every individual to have a conscientious commitment to quality.

Stevenson (1993:104) explains that TQM is a philosophy that involves everyone in an organisation in the quest for quality, with customer satisfaction as the driving force. Everyone, from the chief executive officer down, must be involved and committed. The term "quality at the source" is emphasised, encouraging each worker to take responsibility for the quality of his or her work. A process called "Quality Function Deployment" (QFD) is employed, which involves customers in the design stage of new or redesigned products with the objective of trying to match customer requirements with engineering characteristics of a product.

Vorley (1991:55) explains that although there are many definitions and approaches to TQM, three elements need to be considered and addressed, namely systems, structure and culture. Flood (1993:41) concurs that several versions of TQM have evolved but emphasises the need to focus on systems thinking which is central to the total approach in managing quality. Although Flood (1993:48) develops ten main principles of TQM, they may be reduced to the three elements of systems, structure and culture, referred to by Vorley (1991:55).

- **Systems** refers to procedures that are required to be followed in accomplishing various tasks.
- **Structure** refers to the formal relationships within an enterprise.
- **Culture** refers to the enterprises policy, objectives, management style and employee attitude.

According to Flood (1993:50) TQM has emerged as the latest and most comprehensive vision of quality management. These different approaches to managing quality, however, started influencing a worldwide effort to standardise activities in the quality arena with the establishment of the ISO 9000 series standards in quality management during 1987.

2.8.2 The ISO 9000 series standards

The ISO 9000 series consists of comprehensive quality management concepts and principles written by members of a worldwide delegation known as the ISO/Technical Committee 176. The ISO 9000 set of guidelines were primarily written to help potential users (both customers/purchasers and suppliers) decide which quality assurance model is most appropriate and relevant to a particular contractual relationship as well as harmonising a large number of national and international standards. The South African Bureau of Standards (SABS) 0157 (parts 0 to 4) quality management system is the South African equivalent of ISO 9000 series.

The ISO 9000 series consists of five documents: three of which are models of quality assurance, namely ISO 9001 (design/development, production and servicing), ISO 9002 (production and installation) and ISO 9003 (final inspection and test) and two supporting guideline documents ISO 9004/5 which contain guidance on the technical, administrative and human factors affecting the quality of products and services. The ISO 9000 series lists the essential elements that make up a quality system starting with the responsibilities of management. Whole sections are devoted to each aspect of the quality system: marketing, design, procurement, production, measurement, post production, materials control, documentation, safety and use of statistical methods. The appropriate model of quality assurance is documented into a three tier quality manual covering policies, procedures and work instructions. Regular internal and external audits are conducted to ensure that compliance to the documented quality system is maintained.

The publication of the ISO 9000 series in 1987, together with the accompanying terminology standard (ISO 8402), has brought harmonisation on an international scale and has supported the growing impact of quality as a factor in international trade (Marquardt, Chove, Jensen, Petrick, Pyle, & Strahle 1991:25).

The following are the strengths and weaknesses of the ISO 9000 quality series standards.

Strengths are:

- a total approach to managing quality is emphasised
- accreditation promotes a positive image with greater credibility and acceptability
- a lowering of costs can be expected
- a documented system will ensure knowledge transfer and consistency.

Weaknesses are:

- flexibility and adaptability to change may be reduced
- service organisations need to be more adequately covered
- ongoing improvement is not promoted
- large organisations such as the military, police and the public service are not catered for
- simplicity for small enterprises needs to be preserved
- the inconsistency of audits
- ISO 9000 evaluates the systems of a company, but does not assess the management involvement in the pursuit of quality.

According to Lamprecht (1992:178) as more and more national standards begin to recognise the ISO 9000 series, it will become increasingly difficult to deny ISO's stature as a world standard.

China adopted the ISO 9000 series in 1991 and many American and West European countries have either adopted the ISO 9000 series or are currently studying the implication of adopting ISO 9000 (Lamprecht 1992:178-179).

2.8.3 Just-in-time manufacturing (JIT)

The JIT approach was developed at the Toyota Motor Company of Japan by Mr. Taiichi Ohno and several of his colleagues during the 1970's (Stevenson 1993:690). The term JIT

is used to refer to a repetitive production system in which both the movement of goods during production, and deliveries from suppliers, are carefully timed so that at each step of the process the next batch arrives for processing just as the preceding batch is completed. Moreover JIT represents a philosophy that encompasses every aspect of the process, from design to after sale of a product with the focus on quality which allows companies to function with small batches and tight schedules.

The key benefits of JIT are reduced inventory levels, high quality, flexibility, reduced lead times, increased productivity and equipment utilisation, reduced amounts of scrap and rework, and reduced space requirements.

JIT systems use a three-part approach to quality. One part is to design quality into the product and process. The second is to insist that suppliers provide high-quality materials and parts to minimise disruptions due to problems with incoming goods. The third approach is to make workers responsible for producing goods of high quality. A central technique of JIT systems is to minimise defects through the use of automatic detection of defects during production. Thus, the halting of production forces immediate attention to the problem, after which an investigation of the problem is conducted, and corrective action is taken to resolve the problem.

2.9 SUMMARY

The history and evolution of quality have manifested the changing nature of quality control and how it stands and is practised today. The technological advances of the human race and the contributions made by the quality experts have played a major role in the development of the quality discipline. Quality, in the 1990s, has developed into a management discipline recognising that it is a process that extends throughout all functions in an enterprise. Quality has become a way of managing a business and of focusing its engineering, production, sales and service upon user requirements. Since it was issued in 1987, the ISO 9000 quality systems standards has been used more and more as a potential market place requirement and

as a marketable enterprise feature throughout the world. There is now an opportunity for enterprises to implement a total quality system using ISO 9000 as a foundation upon which to build and expand specific industries - a quality system that complies to the external standard, but includes the specific requirements of the industry.

CHAPTER 3

PRODUCT AND SERVICE QUALITY

3.1 INTRODUCTION

A product may be considered as a transformation of matter and energy into a presumably desirable form. That is, it represents the output or result of economic activity (Schwartz 1992:35). The overall category of product, however, may be broken down into two classes: the tangible product (goods) and the intangible product (services). Goods products are therefore: tangible, storable, transportable and are purchased for capability of later performance. Service products, however, may be considered as: intangible, perishable, transportable (in some instances) and purchase is normally for immediate performance. Because the conceptual distinction between goods products and service products is not universally applied in the quality literature, the word "**product**" will refer to goods products and the word "**service**" will refer to services products (Schwartz 1992:36).

Product quality is reviewed and synthesised from the varying definitions arising from philosophy, economics, marketing and operations management in Section 3.2.1. The characteristics of services (**intangibility, heterogeneity and inseparability**) are acknowledged in developing a full understanding of service quality in Section 3.2.2. The quality of product and services are inferred from both intrinsic and extrinsic attribute cues. Various dimensions (intrinsic attributes) are examined to form the basic elements of product and service quality with the view to establishing a measurement methodology in Sections 3.2.1.1 and 3.2.2.1. Furthermore, the theory and evidence connecting quality to price, advertising, market share, costs and profitability, that is, the correlates of quality (extrinsic attributes) are explored in Section 3.3.

3.2 THE MEANING OF QUALITY

Quality is an extremely difficult concept to define in a few words; a trait it shares with many phenomena in business and social sciences (Brown, Edvardsson, Gummesson, & Gustavsson 1991:3). Crosby, Deming, Juran and Feigenbaum, all of whom have long manufacturing traditions, claim that their definitions, conclusions and recommendations work equally well for services (see Section 2.7.6). According to Brown *et al.* (1991:7) their insights can be applied to services as long as the specific characteristics of services are taken note of and are adjusted for.

From a holistic perspective, all enterprises produce and sell both products and services, with varying proportions of both, and, as a result, the management of quality must pay attention to both product and service quality and the synergy effects between them.

Although there are a large number of definitions of quality, it is prudent to create a deeper insight into the many dimensions that constitute quality so as to maintain perspective on the subject of managing quality.

3.2.1 Defining product quality

Garvin (1984:25), in a review of previous attempts to define product quality, concluded that the problem surrounding a definition of product quality, is that of coverage. Quality is studied in four disciplines: philosophy, economics, marketing and operations management. The result has been a host of competing perspectives, each based on a different analytical framework and employing its own terminology. According to Garvin (1984b:25) five principal approaches to defining product quality can be distinguished from these multi-disciplinary approaches.

The **transcendent approach** of philosophy views product quality as being synonymous with innate excellence; it cannot be defined precisely and is an unanalysable property learnt

through experience.

The **product-based approach** of economics views product quality as a precise and measurable variable. Quality is reflected by the presence or absence of measurable product attributes; it is based on more than preferences alone and can be assessed objectively.

The **user-based approach** of economics, marketing and operations management views product quality as consisting of its capacity to satisfy wants and on how well it fits patterns of consumer preferences. This is a highly subjective view of product quality because the elements are rooted in consumer preferences - the determinants of demand.

The **manufacturing-based approach** of operations management focuses on the supply side and is primarily concerned with engineering and manufacturing issues. Product quality is defined in terms of specifications and any deviation implies a reduction in quality. On the design side the implication is reliability and statistical quality control on the manufacturing side.

The **value-based approach** of operations management defines product quality in terms of costs and prices. According to this view, a quality product is one that provides performance at an acceptable price or conformance at an acceptable cost. Garvin (1984b:28) claims that the value-based approach is becoming more prevalent.

Steenkamp (1989:7) identifies four major approaches to product quality: (1) the **metaphysical approach of philosophy**, (2) the **production management approach**, (3) the **economic approach**, and (4) the **behavioural or perceived quality approach** of marketing and consumer behaviour. This approach to product quality is very similar to Garvin's approach. The metaphysical approach focuses on the things transcending nature recognising that quality cannot be defined precisely which equates to Garvin's transcendent approach. The production management approach concerns standardising manufacturing procedures, quality control and quality costs and may be likened to a blend of Garvin's manufacturing and

product based approaches to quality. The economic approach studies quality competition, market equilibrium when products differ in quality and consumer behaviour with respect to products that differ in objective quality which is comparable to Garvin's value-based approach to quality. The perceived quality approach concentrates on the way consumers form judgements about the quality of a product on the basis of incomplete information which is similar to the subjective user-based approach of Garvin.

Garvin (1984b:29) concludes that the reliance on a single definition of product quality is a frequent source of problems and suggests that enterprises cultivate different perspectives of product quality, particularly when introducing high quality products. Garvin (1984b:29) is critical of the homogeneous approaches to quality by Juran (fitness for use), Crosby (conformance to requirements), Deming (pride of workmanship) and Feigenbaum (customer determined) in that each is vague and imprecise in describing the ingredients of product quality (see Figure 3.1).

Garvin (1984b:29) suggests that the approach to product quality should be adjusted as products move from design to market as follows:

- product quality characteristics must first be identified through market research - a **user-based approach to quality**
- these characteristics must then be translated into identifiable product attributes - a **product-based approach to quality**
- the manufacturing process must then be designed and arranged so that the products can be made to meet these specifications - a **manufacturing-based approach to quality**.

Garvin (1984b:29) however, does not integrate the value-based approach into the process as products move from design to market. The researcher believes that the value-based approach

must be synthesised into this process to ensure that an acceptably costed and priced product meets the objects of both the enterprise and the targeted market.

Figure: 3.1 A summary of the quality theorist's views

<i>Juran</i>	<i>Crosby</i>
<u>User-based definition</u>	<u>Manufacturing-based definition</u>
<ul style="list-style-type: none"> ▪ Quality is fitness for use ▪ Focuses on aesthetics and perceived quality 	<ul style="list-style-type: none"> ▪ Quality is conformance to requirements ▪ Focuses on conformance and reliability
<i>Deming</i>	<i>Feigenbaum</i>
<u>Value-based definition</u>	<u>Value-based definition</u>
<ul style="list-style-type: none"> ▪ Quality is pride of workmanship ▪ Productivity increases with process improvement ▪ Total product cost is more important than the price 	<ul style="list-style-type: none"> ▪ Quality is customer determined ▪ The determinants are: <ul style="list-style-type: none"> - actual use - selling price of product

In moving away from a homogeneous approach, Garvin (1984b:30) identifies eight dimensions of product quality.

3.2.1.1 The dimensions of product quality

Garvin (1984b:30) elaborates on his five definitions of quality by identifying performance, features, reliability, conformance, durability, serviceability, aesthetics and perceived quality

as the dimensions of product quality. Each dimension is viewed as being self contained and distinct with the possibility of any product having a high ranking on one dimension and a low ranking on another. The dimensions cover a broad range of concepts: some objective, others not; some timeless and others shifting with changing fashions; some with inherent characteristics of products whilst others having ascribed characteristics.

The discussion of product quality dimensions is detailed below using the approach of Garvin (1984b:30), whilst exemplifying their relationship in as much as they relate to colour television receivers.

3.2.1.2 Performance

Performance refers to the **primary** operating characteristics of a product. For a colour television receiver these would include clarity of **sound** (power output, percentage distortion and noise limited sensitivity audio) and **picture** (brightness, contrast, colour purity and noise limited sensitivity video) and tuner sensitivity (ability to receive distant stations). From these attributes, performance can be measured and objective comparisons against competing products can be made by competing manufacturers or by an independent body such as the South African Bureau of Standards (SABS). It is unlikely that consumers will attempt to measure these attributes and therefore the connection between quality and performance will be subjective. Identifying the best brand (highest quality) will therefore be extremely difficult to identify from the consumer's perspective. This dimension of product quality consequently combines elements of both product-based (because the manufacturer can measure the applicable attributes) and user-based (customer applies subjectiveness to needs) approaches.

3.2.1.3 Features

Features are those secondary characteristics that supplement the product's basic functioning. Some examples employed on colour television receivers are: remote control operation, simulcast operation, headphone facilities, teletext facilities, audio/video input and output

operation, automatic tuning, stereo audio operation, child-lock facilities and multi-system operation. The distinction between performance (primary characteristics) and features (secondary characteristics) is difficult to separate in many instances. As a consequence, the customer may consider the difference as improved performance, and therefore higher quality. Features such as product performance involve objective and measurable attributes. For example, the distance at which the remote control function operates, can be measured.

3.2.1.4 Reliability

Reliability is defined as the ability of a product to perform without failure of a specified function, under given conditions, for a specified period of time (Juran, Gryna & Bingham 1979:7). A controversial question frequently asked is: Does **"reliability"** form part of **"quality"** or does **"quality"** form part of **"reliability"**? Quality and reliability are irrevocably linked and attempting to separate them is futile (Higgins 1992:4). The probability of performing without failure can be converted to a measurement. The most common measures of reliability are the mean time to failure (MTTF), the mean time between failures (MTBF) and the failure rate per unit time. Reliability is determined largely by the quality of design with the attainable reliability, inherent in the design, called **"intrinsic reliability"**. Achieved reliability is that reliability demonstrated by the product in the consumer's environment and is usually less than the intrinsic reliability because it includes the manufacturing effects on product reliability. Achieved reliability is what is experienced by the consumer and is therefore a more accurate and representative term in measuring reliability. Juran *et al.* (1979:9) refers to an alternative method of measuring achieved reliability and calls it the **"guarantee service rate"**. This measurement of reliability may be expressed as a ratio or as a percentage of service calls under warranty. Garvin (1983:66) suggests a similar method in measuring reliability and uses the number of service calls (excluding consumer instruction calls) recorded during the product's first year of warranty and calls it the **"service call rate"**. The exclusion of consumer instruction calls is valid as these may be considered as avoidable calls and do not constitute a failure of the product. The researcher, however, prefers the term **"warranty failure rate"** as this characterises

the measurement of achieved reliability during the warranty period more accurately.

Because these measures require a product to be in use for some period of time, the application of failure rates with respect to colour television receivers should pose no problems, particularly during the warranty period. The warranty period is suggested as a basis of measurement because it is unlikely that field failure information will be readily available from the manufacturers outside of this period.

It is important not to confuse reliability with conformance or even reliability estimates based on life tests in a laboratory. The evaluation of achieved reliability requires actual use of a colour television receiver over a period of time (the warranty period being specified) plus the collection and interpretation of data on performance and failures during the warranty period.

3.2.1.5 Conformance

This dimension of quality is related to the degree to which a product's design and operating characteristics match prescribed standards (Garvin 1984b:31). Juran *et al.* (1979:31) claim that knowledge of conformance to specifications (prescribed standards) is required to:

- provide protection to the user when usage experience is not yet available
- provide working criteria to those who lack knowledge of fitness for use
- create an atmosphere of law and order
- protect innocents from unwarranted blame.

Garvin (1984b:31), in the opinion of the researcher, oversimplifies conformance by relating conformance to the incidence of internal and external failures, and in so doing confuses the dimension of conformance with the dimension of reliability. Juran *et al.* (1979:32) contrasts

the occurrence of a product conforming to specification, which is automatically assumed to be fit for use, with a product failing to conform to specification by raising the question: **"Is the product fit for use?"** From this analysis a non-conforming product may be either defective and therefore not suitable for use or non-conforming in respect of a specific specification but suitable for use, that is, fit for use. This dichotomy reflects the importance of design specifications to reflect fitness for use and therefore the needs of consumers. The extent to which a product conforms to specification is called **"quality of conformance"** (Juran *et al.* 1979:6).

Colour television receivers are highly sophisticated pieces of equipment, incorporating numerous specifications which can result in consumers and retailers expecting perfectionism, particularly in high priced models. As a result, confusion in respect of product conformance between the manufacturer, retailer and the consumer can be expected to occur.

A manifestation of this confusion may result in newly sold colour television receivers, in good working order, being exchanged for a new model or a different brand, various consumer instruction calls, discounts and requests for modifications. Any non-conforming products arising due to **failures** must be considered as reliability failures so as not to confuse the dimension of reliability with conformance.

3.2.1.6 Durability

Durability is a measure of product life and can be defined as the amount of use one gets from a product before it physically deteriorates (Garvin 1984b:31). When repair is possible, as with colour television receivers, durability takes on another dimension. In the context of repairability, durability may be regarded as the amount of use one gets from a product before it breaks down and replacement is considered as preferable to repair (Garvin 1984b:31).

The dimensions **durability** and **reliability** are closely linked in so far as any decision to scrap or repair a product is concerned because the frequency and cost of repairs and

inconvenience versus the cost of replacement by purchasing a new product must be considered. Any increase or decrease in product life may not be due to changes in product design, materials or workmanship, but political and economic factors may play a role. For example, television viewing hours may have increased considerably due to improved programmes, high cost of cinema entertainment, increase in sport and political coverage and the unbanning of overseas television programmes. Durability figures are, therefore, impacted upon by economic, political and technical dimensions and any interpretation must take cognisance of these factors.

3.2.1.7 Maintainability

Garvin (1984b:32) erroneously applies the use of the term **serviceability** instead of **maintainability** for the sixth dimension of product quality. Serviceability, as described by Garvin (1984b:32), incorporates three of the dimensions of service quality (courtesy, responsiveness and competence) which are not tangible product attributes but intangible service quality dimensions.

Dhillon (1983:259) and Feigenbaum (1986:595) give a quantitative definition by defining maintainability as:

"the probability that a product will be restored to a satisfactory condition within a specified period of time, after performing maintenance according to prescribed procedures and resources."

The generally accepted measure of maintainability given in the literature, is expressed by the term **"mean time to repair"** (MTTR) (Juran *et al.* 1979:36). Feigenbaum (1986:585) emphasises the importance and relationship of maintainability to product availability because the effective restoration of a defective product, particularly during the warranty period, cannot be underestimated due to the perceived impact it will have on the quality of the product and its long term reliability.

Maintainability is sometimes erroneously called "**repairability**". The main difference is that repairability is strictly concerned with the time it takes to physically repair the product whereas maintainability includes other related factors such as logistical support, for example, the availability of spare parts.

Maintainability is an inherent part of product design planning. If the design fails to give consideration to maintainability, the result will be either a high cost of maintenance during the service life or costly design changes later in the product development cycle. In the television industry modular design has been implemented in some instances in order to reduce the time required for diagnosis and remedy in the field. This implies that the fault need only be localised to the module level, after which the defective module is unplugged and replaced.

Maintainability is not only influenced by design practices, but procedures, facilities, equipment, availability of spare parts and diagrams and personnel must be integrated through the maintenance system and used to perform maintenance and repair operations.

3.2.1.8 Aesthetics

Aesthetics is a subjective dimension of product quality and refers to how a product looks, feels and sounds and is clearly a matter of personal judgement. Colour television receivers are not only purchased for their entertainment and news value, but also for its appearance and finish which are sometimes required to be integrated with existing furniture. Often the colour television receiver is interfaced with other equipment to enhance its entertainment value which may include high fidelity systems, video recorders and decoders. The design and size of the colour television receiver's cabinet is mostly impacted on by speaker positioning, either side or front mounted, picture tube size and the availability and cost of various materials such as wood and plastic. The shape, finish and first impressions are important elements affecting the buying behaviour of colour television consumers, particularly when assessing an unknown product.

3.2.1.9 Perceived quality

This dimension of product quality can be as subjective as the assessments of aesthetics (Garvin 1984b:32). When comparing different brands, consumers often rely on advertising or the retailer's reputation and image when complete information about a product's attributes is not available. In these circumstances products will be evaluated less on their objective characteristics than on their images, advertising or brand names.

The dimensional approach to product quality helps to explain the differences in the five multi-disciplinary definitions of product quality (see Figure 3.2).

Figure 3.2: A summary of the differences in approaches to product quality

Product-based approach

- Performance
- Features
- Durability

User-based approach

- Aesthetics
- Perceived quality
- Durability

Manufacturing-based approach

- Conformance
- Reliability

Value-based approach

- Performance at a price
- Maintainability

Transcendent approach

- Perceived quality
-

The unbundling of the concept of product quality into these eight dimensions has the following implications for industry:

- enterprises can compete on the basis of quality by targeting a few dimensions for special attention (market niches) and therefore not pursue all dimensions at once, that is, a strategic approach to quality
- disaggregating the concept of product quality allows enterprises to optimise operational requirements
- enterprises can enjoy high profits despite varying approaches to product quality.

Important issues to address in the research would be the relative importance of the various dimensions of product quality shaping retailer; consumer and service behaviour in the context of the research hypotheses. In addition, manufacturing operations may be applying tradeoffs between the various dimensions of product quality and research must therefore uncover the true meaning of quality in the colour television industry.

3.2.2 Defining service quality

Definitions and measurements of quality have come largely from the product or manufacturing sector (see Chapter 2). Knowledge about the product or manufacturing sector, however, is insufficient to understand service quality. In service the core **"product"** is performance; it is performance that consumers purchase. Moreover, unlike products, performance is generally sold before being produced and is of an intangible nature which makes it more difficult for consumers to imagine and desire -- there are no knobs to turn, buttons to push or pictures to see.

In order to obtain an understanding of service quality, the three well-documented characteristics of services must be acknowledged (Parasuraman, Zeithaml & Berry 1984:2).

-
- Services are **intangible**. Most services cannot be counted, measured, inventoried, tested and verified in advance of sale to assure quality.
 - **Heterogeneity** of services. Uniform performance is difficult to assure -- especially labour intensive industries -- because what the enterprise intends delivering may be entirely different from what the consumer receives.
 - The production and the consumption of many services are **inseparable**. Quality in services is not engineered in a factory and then delivered intact to the consumer. There are many intervening and interrelated activities required in performing a service.

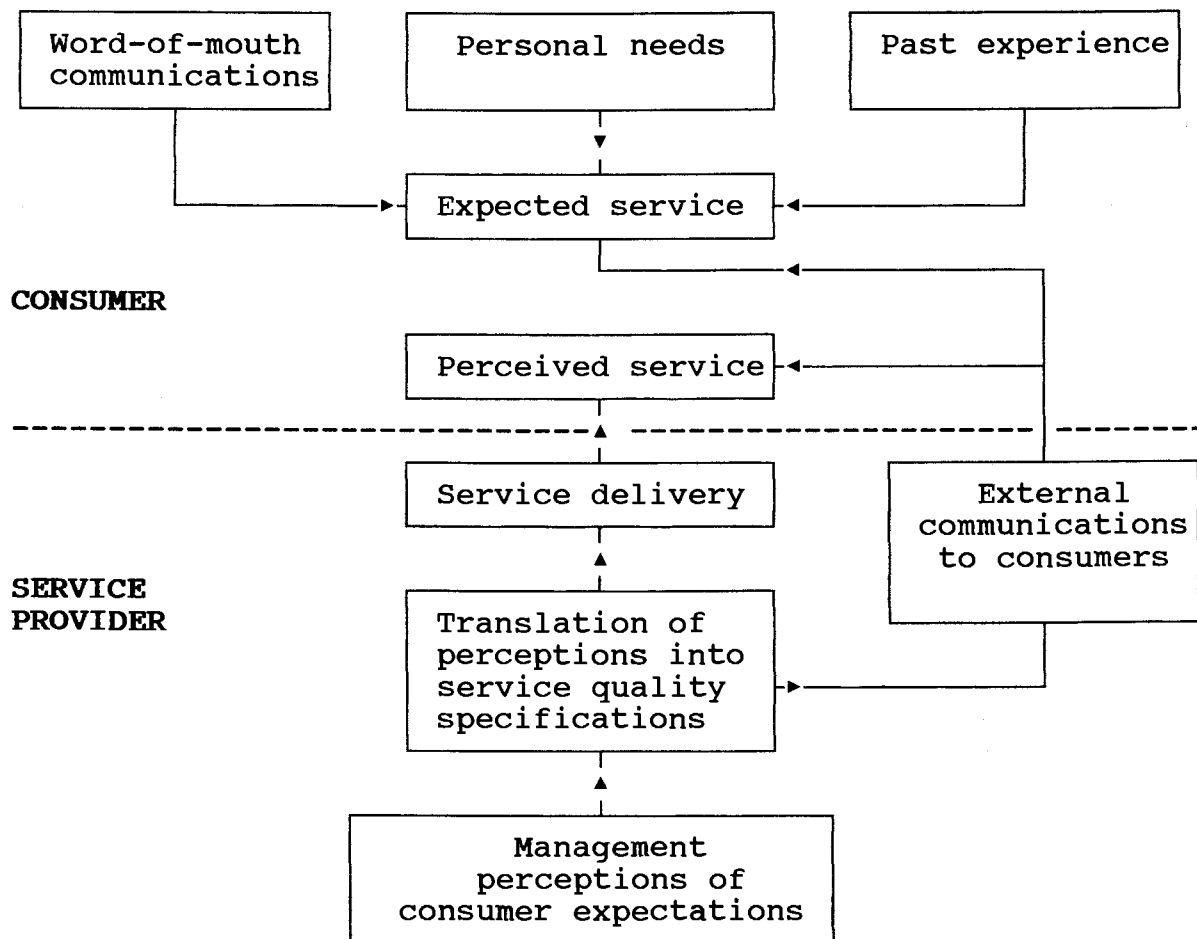
According to Parasuraman *et al.* (1984:3), researchers and managers of service enterprises concur that service quality involves a comparison of expectations with performance and defines service quality as follows:

"Service quality is a measure of how well the service level delivered matches customer expectations. Delivering quality service means conforming to customer expectations on a consistent basis".

Parasuraman *et al.* (1984:7), after an exploratory investigation, developed a general service quality model which contains consistent patterns and commonalities among different service industries (see Figure 3.3).

Five perception gaps or discrepancies are recognised as affecting service quality and are briefly described in conjunction with Figure 3.3. When these gaps exist quality is at stake and by narrowing or closing these gaps the right quality is achieved.

Figure 3.3: Service quality model



Source: Parasuraman, A., Zeithaml, V.A., & Berry, L.L. 1984. A conceptual model of service quality and its implications for future research. *Marketing Science Institute*, Report no. 84-106:7.

Gap one: This gap can occur between consumer expectations and management perceptions of those expectations.

Gap two: This gap can occur between management perceptions of consumer expectations and the enterprises service quality specifications.

Gap three: This gap can occur between service quality specifications and actual service delivery.

Gap four: This gap can occur between actual service delivery and external communications about the service.

Gap five: This gap can occur between the expected service and the perceived service from the consumer's standpoint and is called the perceived service quality. The service quality that the consumer eventually perceives depends on the size and direction of this gap which, in turn, is dependent on the nature of gaps one to four. Therefore: $\text{Gap 5} = f(\text{Gap 1, Gap 2, Gap 3, Gap 4}) = \text{service quality}$. Good service quality therefore implies meeting or exceeding what consumers expect from service.

The consumer's comparison of expected service with perceived service quality (Gap 5) has identified ten specific dimensions (determinants) that influence consumer's assessments of service quality (Parasuraman *et al.* 1984:13). The discussion on the dimensions of service quality that follows is based on the theory espoused by Parasuraman *et al.* (1984:13).

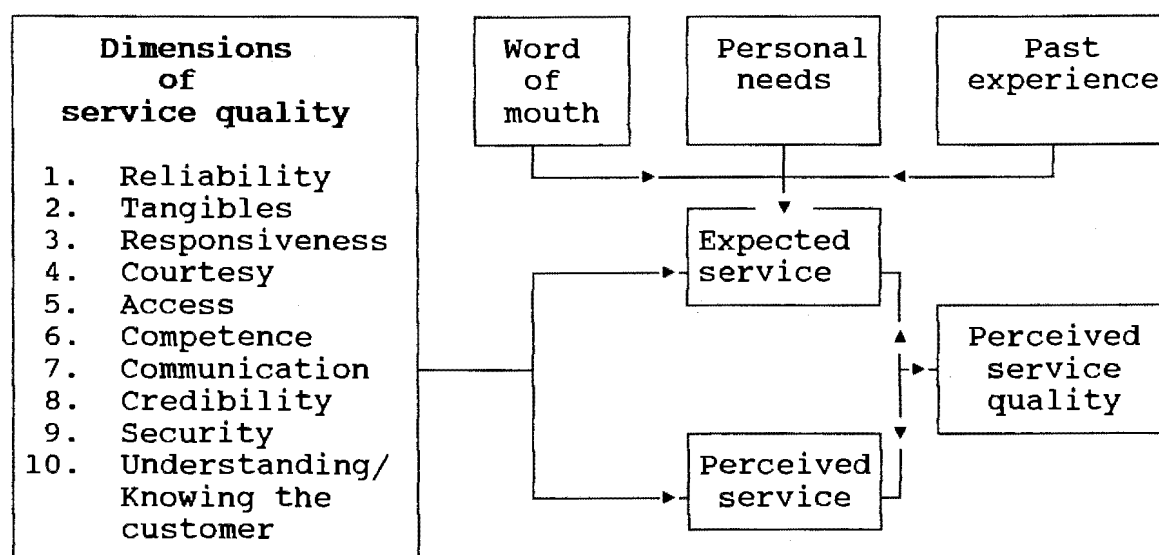
3.2.2.1 The dimensions of service quality

The relationship between the dimensions of service quality and the service quality model is illustrated in Figure 3.4.

Figure 3.4 shows perceived service quality representing the discrepancy between consumer expectations and perceptions. The key factors of personal needs, past experience and word-of-mouth communications influence consumer expectations with the ten dimensions representing the evaluative criteria consumers use to assess service quality. Each dimension is viewed as being self contained and distinct with a degree of overlap recognised. Parasuraman and Berry (1991:16), however, point out that research has shown that the above dimensions of service quality may be reduced to five **general** dimensions. These are:

delivery, reliability, tangibles, responsiveness, assurance and empathy.

Figure 3.4: Determinants of perceived service quality



Source: Parasuraman, A., Zeithaml, V.A, & Berry, L.L. 1984. A conceptual model of service quality and its implications for future research. *Marketing Science Institute*, Report no. 84-106:15.

The dimensions in Figure 3.4 are provided below with appropriate discussion exemplifying their implications and relationships, using television service repairs as an example of a service provider.

The service repair of a colour television receiver is, however, not a "pure" service, as this service is associated with a tangible product. Besides service repairs, sales and deliveries, installations of colour television receivers are additional services to be found in the colour television industry.

3.2.2.2 Reliability

This involves the ability of the service provider to perform the promised service dependably and accurately, which implies "right the first time" performance at the designated time. The reliability of colour television receiver repair consists of diagnosing and repairing the **cause** of the fault and not only the symptom whilst adhering to promised times. Any other potential failures should also be brought to the notice of the consumer and repaired if requested. Reliability testing after repair should be considered, in appropriate circumstances, to ensure that the cause and not the symptom of failure has been actioned.

3.2.2.3 Tangibles

This includes the physical facilities, equipment, personnel and communications' materials. Television service facilities, documentation and personnel (technicians and support staff) should be presentable at all times. Shoddy vehicles and equipment, for example, will give consumers the impression that repairs will be conducted in a similar fashion.

3.2.2.4 Responsiveness

This concerns the willingness or readiness of the service provider's employees to provide service. It involves timeliness of service, for example, by initiating repairs quickly and calling the consumer back promptly about the status of the repair.

3.2.2.5 Courtesy

This pertains to the politeness, respect, consideration and friendliness of contact personnel, for example, telephonist receiving service calls. It also includes consideration for the consumer's property. For example, when delivering repaired colour television receivers to the consumer's home, service personnel should be careful not to cause any damage or disturbance.

3.2.2.6 Access

This involves approachability and ease of contact. Waiting time to receive service, convenient hours of operation and location of service facilities (workshop) are some of the features of access applicable to television repairs.

3.2.2.7 Competence

This implies possession of the required skills and knowledge to perform the required service. Qualifications and training of service technicians, in the repair of colour television faults, and the knowledge and skill of operational support personnel are essential ingredients.

3.2.2.8 Communication

This involves keeping consumers informed in a language that they can understand and listening to consumers. In the television service context it implies that language should not be too technical for the consumer to understand and sufficiently technical for those consumers who have the required knowledge. The technical content as well as the level of sophistication of the language used must, therefore, be adjusted for consumers with differing levels of knowledge and education.

3.2.2.9 Credibility

This includes trustworthiness and honesty. Contributing factors are the name and reputation of the service enterprise. In South Africa many small towns and suburbs have one or two television service providers comprising of personnel who are personally known to the community and are, therefore, preferred to the larger enterprises who operate from locations further away. Consequently, many of the larger service providers appoint the local television repairer as their agent for reasons such as credibility, availability and cost.

3.2.2.10 Security

This involves freedom from danger, risk or doubt. Physical safety in obtaining service at the facilities of the service provider and safety of product use, after repair, are implied.

3.2.2.11 Understanding/Knowing the consumer

Making an effort to understand the consumer's needs are denoted. Consumer complaints on high technology products (for example, colour television receivers) are seldom accurately described, due to lack of knowledge and technical terms. This may require the service provider to establish the specific requirements of the consumer to effect a proper repair.

In reducing the above ten dimensions to five general dimensions (reliability, tangibles, responsiveness, assurance and empathy) Parasuraman and Berry (1991:16) simplify the understanding and application of the dimensions of service quality by lessening the influence of overlap between them.

The dimension of assurance, according to Zeithaml, Parasuraman and Berry (1990:25), may be equated to courtesy, competence, credibility and security. The dimension of empathy is equated to access, communication and understanding/knowing the consumer.

The relative importance (established empirically) of the five dimensions according to Parasuraman *et al.* (1991:16) is given in Table 3.1. Reliability is generally the most critical of the five dimensions and is the core of service quality.

By characterising the concept of service quality in terms of these five dimensions, quality performance for various industries can be assessed and targeted more objectively. For example, bank customers would rate security as a very important characteristic and therefore the dimension of assurance would be a prime determinant in the banking industry.

Table 3.1: The relative importance of the dimensions of service quality

Dimension	Percentage
Reliability	32
Responsiveness	22
Assurance	19
Empathy	16
Tangibles	11
Total	100

Source: Parasuraman, A & Berry, L.L. 1991. *Marketing Services: Competing through Quality*. New York: The Free Press, 16.

For the colour television service repair industry the implications for acceptable service quality would be expected to focus on:

- targeting reliability for special attention
- responsiveness to product downtime
- displaying empathy on a consistent basis
- providing assurance in a professional manner
- ensuring that tangible factors such, as service facilities, equipment and tools, are regularly maintained and presentable.

Important issues to address in the research would be the relative importance of the various dimensions of service quality shaping retailer, service repairer, manufacturer and consumer behaviour in the context of the research hypotheses for the colour television industry.

3.3 THE CORRELATES OF QUALITY

In order for enterprises to use quality competitively the association with key measures of business performance (costs, market share and profitability) and high quality products and services must be evaluated. Deming (1986:3), Garvin (1988:69) and Parasuraman *et al.* (1991:18) suggest that enterprises who produce on a continuous basis, high quality products and services, benefit by lowering costs, higher profit margins and larger market shares. Moreover, quality affects all the variables that constitute the profit formula (Brown *et al.* 1991:6). The theory and evidence linking quality to price, advertising, market share, costs, productivity and profitability requires interpretation and its relationship to the dimensions of quality for the television industry are discussed in Sections 3.3.1 to 3.3.6.

3.3.1 Price

Prices are particularly important in services because of their intangibility and are used as a viable indicator of a service's level and quality. The invisibility of services makes that which is visible (price) even more important to consumers' purchasing decisions (Parasuraman *et al.* 1991:102). In contrast to services, products and their prices are both tangible, allowing more objective comparisons to be made. A stronger and more positive correlation between price and service should, therefore, be expected. Garvin (1988:71) states that product quality and price may or may not be positively correlated and are dependent on whether perceived or actual quality is being measured and whether or not price is being used as a means of product differentiation.

Garvin (1988:74), in summarising leading correlation studies, states that product quality and price lack a consistent association although positive correlations were found in hedonic studies

equating product quality with performance and features. Ziethaml *et al.* (1990:127) believe that price sets expectations for the quality of service, particularly when other cues to quality are not available. Service prices should, therefore, be determined carefully so as to convey the appropriate quality signal.

The quality of colour television receivers is more likely to display a positive correlation to price because of its durable nature and the strong influence that size, performance and features have on price. Repair service quality and pricing relationships only arise with "out of warranty" repairs with service pricing expected to be largely influenced by travelling and component costs.

3.3.2 Advertising

Most enterprises advertise the features of their products and services, using catchy jingles (chimes) that involve their product or service name but few invest in producing commercials that stress quality (Mullejans 1986:57). The main reason given is that advertising quality is a long term strategy whilst advertising a product or service feature is a short term strategy. This implies that the advertising of quality cannot be used as a simple ploy to attract consumers because they will eventually realise that the product or service does not meet with their expectations.

Garvin (1988:76) contends that advertising and quality are related in some circumstances and that advertised products are not more dependable than products without advertising.

The product quality dimensions of durability, maintainability and reliability of colour television receivers will only be learned through experience over a period of time. However, the product quality dimensions of performance, features, aesthetics and perceived quality will be learned on delivery and installation. Thus, the relationship between quality and advertising can only be assessed over a period of time if the dimensions of performance, features, aesthetics and perceived quality relating to product quality are acceptable.

Coordination and communication between advertising and service providers are pivotal in closing the hiatus between service delivery and communications (Gap 4) to outside consumers (Ziethaml *et al.* 1990:119). It is common for colour television service repairers to advertise same day service or to specify a time period in which to restore a faulty product back to working order. Alternatively, a loan television receiver is sometimes promised if repairs are expected to take longer than advertised. Failure to meet these promises will also be learned through experience by the consumer.

Theorists claim that higher levels of advertising will be associated with higher levels of quality for products and services that are required to be experienced by the consumer (Garvin 1988:74).

3.3.3 Market share

Profit Impact of Marketing Strategy (PIMS) data confirm that high quality products and services increase sales and market share (Shetty & Buehler 1988:9). Garvin (1988:77) also points out that PIMS data show that quality and market share are positively correlated, especially where consumers are well-informed.

The lowering of prices to increase market share is a short-lived strategy as competitors can easily match decreases in price. Quality improvement, however, is much more difficult for competitors to match as it requires more time, money and effort. Conversely, a reduction in quality can suddenly reduce sales, harm the competitive position of an enterprise, reduce consumer loyalty and impact negatively on market share.

According to Patch (1984:16) any amelioration in quality, with the objective of improving market share, should be directed at improving the most important aspects of the product or service image. These aspects include not only adherence to written specifications but the many non-specified aspects, for example:

- willingness to carry inventory of finished product
- response to requests for emergency resolution of problems
- co-operation in the design or redesign of products
- attitudes of people contacting the consumers
- functionality and design of packaging
- support of advertising.

In addition, a review of product characteristics involved in the decision to purchase a product or service will enhance marketing results.

Failure to satisfy consumers' demands for quality is likely to have serious implications resulting in the loss of sales due to superior quality offered by competitors.

3.3.4 Costs

The historical relationship between quality and cost was the belief that better quality required higher cost; quality and cost are positively related. Using a product-based approach to quality, the implication of improving performance, for example, may require that more expensive components be used. The development and quantification of the concept of total quality costs (see Chapter 2), however, has had the objective of equipping enterprises with the necessary practical tools and detailed economic knowledge for identifying and managing their quality costs. Quality costs are now defined as any expenditures on manufacturing or service in excess of those that would have been incurred if the product or service had been built or performed correctly in the first instance. The cost of failure is only part of the cost of quality. Poor quality begets poor quality and some of the poor quality ends up in the

hands of the consumer. An unhappy consumer tells his friends, with the multiplying effect of an unhappy consumer being an unknown or unknowable cost. Analysts now argue that quality and cost are inversely related in that improved conformance and reliability lead to lower total costs of quality.

According to Garvin (1988:81), however, research has manifested conflicting findings in the relationship between quality and costs. The varying results of these studies have reflected the differences in the definitions of quality used by different enterprises in different industries. In the context of these conflicting findings the relationship between quality and costs will be an important element for the colour television industry in the Republic of South Africa.

3.3.5 Productivity

Productivity can simply be defined as **"a ratio of output to input"** (Stevenson 1993:36). The output can be the number of units produced in a given period with inputs representing the resources used to produce the output. A typical colour television receiver is a combination of components, machinery, labour, energy and capital. Productivity indicates how well an enterprise utilises its labour, capital and resources in that the fewer resources per unit of output, the more productive the enterprise. Improved productivity, therefore, reduces cost and enhances competitiveness and profitability.

Quality improves productivity by eliminating defects which, in turn, reduces labour and/or machine hours, inspection, scrap and waste. In addition to eliminating internal defects, fewer warranty service calls will further decrease the material and labour required to repair defective products. A reduction in defects results in less costs which can be used to increase profit margins and/or lower prices for improved sales. Garvin (1988:84) supports the notion that the linkage between quality and productivity comes down to changes in the defect rate without a corresponding increase in input costs. Calculating the cost of poor quality is therefore a convincing technique that signifies that quality affects productivity and profitability (Shetty & Buehler 1988:8). The cost of poor quality is simply an expenditure,

either manufacturing or service, above that incurred if the product or service was made right in the first instance. Reworking products, inspecting components and product lost to due to scrap, all lower productivity and jeopardise the enterprise's competitive position.

The quality of products/services and productivity are closely linked and would appear to be positively correlated especially when quality is measured as conformance or reliability and productivity is measured as labour productivity or total factor productivity (Garvin 1988:89).

3.3.6 Profitability

According to Garvin (1988:89) there are two ways in which improved quality might lead to higher profitability. The first is through larger market shares. Strategies to increase profitability may therefore include improving the quality of products and services by targeting various quality dimensions for improvements. For products this may include improved performance and features and for services, improved reliability and responsiveness may be required. Any costs in achieving these improvements must be outweighed by consequent increases in market share and revenue so as to obtain higher profits.

Secondly, quality improvements may arise through lower costs. Fewer failures, either internally or externally, for example, will result in lower costs and therefore improved profitability as long as defect prevention costs do not exceed the costs of failure.

The key for obtaining maximum profits via quality is the development of a quality system which can achieve and maintain the competent design of a product and the process by which it is manufactured (in the case of products) or delivered (in the case of services).

Empirical studies indicate that a strong positive association between quality and profitability exists particularly when the PIMS measure of relative quality is used (Garvin 1988:89).

3.4 SUMMARY

The literature study has shown that there is no agreement on the definition and meaning of product quality. Garvin's approach (see Section 3.2) is useful in that he does not rely on a single or homogeneous definition of product quality and recognises the different approaches from the perspective of user, manufacturing, engineering, marketing and sales. The holistic approach of Garvin is useful in synthesising the meaning of product quality from the perspective of the most renowned quality theorists namely: Juran, Crosby, Deming and Feigenbaum.

The dimensions of product quality (**performance, features, reliability, conformance, durability, maintainability, aesthetics and perceived quality**) were expanded upon to help explain the different approaches and definitions of product quality. The importance of the various dimensions of product quality shaping retailer, consumer and service behaviour is seen as an important element in establishing the meaning of product quality in the television industry.

It was established that knowledge about product quality is insufficient in understanding service quality due to the **intangibility, heterogeneity and inseparability** nature of service operations. The service quality model (see Figure 3.3) developed by Parasuraman, Zeithaml and Berry is useful in determining service quality. Service quality is defined as the gap between the expected service and the perceived service from the consumer's standpoint. The comparison of expected service with perceived service identified five dimensions or determinants (**reliability, responsiveness, assurance, empathy and tangibles**) that influence consumer's assessments of service quality. The importance of the various dimensions of service quality shaping retailer, consumer and service behaviour is also seen as an important element in establishing the meaning of repair service quality in the television industry.

When managing the quality of products and services, the differences, commonalities and areas

of overlap between products and services were identified as being important to recognise.

The importance of **price, advertising, market share, costs, productivity and profitability** were interpreted with regard to their relationship to the dimensions of product and service quality for the television industry. The correlates of quality were explored because of the need to use quality competitively in industry.

For some industries it is relatively simple to distinguish between products and services. The colour television industry, however, incorporates both products and services with the consumer interested mainly in services (news and entertainment), even though he may seem to buy products (television receiver). In addition, colour television service enterprises (retailers and repairers) usually interact directly with consumers, without intervening merchants, resulting in direct feedback on their performance. In contrast, the manufacturers of colour television receivers do their selling through an intermediate chain of retailers, resulting in a lack of direct feedback from the consumers. The linking of customer satisfaction with quality alone cannot provide a basis for action and therefore more refined measures are required.

The literature study has also shown that management of quality has developed from a product oriented approach to include and recognise services as an equally important component during the 1980's. The integration of products and services into a synthesised quality management approach is a key requirement for any manufacturing industry to remain competitive. This approach recognises that a poorly manufactured product will impact negatively on the quality of service provided, or conversely, poor repair service will impact negatively on the quality of the product manufactured.

The methodological approach of the research will test whether the research hypotheses are valid using empirical data obtained from questionnaires, the structure of which, is largely determined from the literature study.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 INTRODUCTION

The primary objective of the research is to test the validity of the hypotheses mentioned in Chapter 1, Section 1.4. In order to achieve this, six questionnaires (two for the manufactures and one each for the retailers, service repairers and consumers) were pilot tested amongst a small sample of individuals from each population group. The results from the pilot study were used to upgrade the final questionnaires.

To maintain the project within budgeted constraints the scope of the study was reduced from the initial plan to cover the entire Republic of South Africa to the Gauteng provincial area only. The length and complexity of the questionnaires necessitated the use of interviewers in the main study and only the manufacturing questionnaires were posted. The number of questionnaires used in the main study resulted from a compromise between cost limitations and an acceptable sample size.

The complexity in establishing a proportionate sample for the consumer questionnaire necessitated understanding it's composition first (see Section 4.2) followed by the retail questionnaire (see Section 4.3), the service questionnaire (see Section 4.4), and the manufacturing questionnaire (see Section 4.5). The statistical tests and the level of significance used are covered in Sections 4.6 and 4.7 respectively.

4.2 THE CONSUMER QUESTIONNAIRE

4.2.1 General

The consumer questionnaire consists of sixty two questions covering three parts: general information (eleven questions), product quality (seven questions), and service quality (forty four questions of which the first twenty-two cover expectations and the remainder perceptions). An example of this questionnaire is given in Appendix C.

Part one of the questionnaire identifies the manufacturer of the respondent's colour television receiver, their preferences and whether they have experienced any failures, their perception of quality and their ranking of product and service quality dimensions. The questions in part two of the questionnaire endeavour to ascertain the respondent's rating of their colour television receiver(s) in respect of product quality dimensions using a five point scale. The questions in part three establish the perceptions and expectations of those respondents who have experienced repairs to their colour television receiver(s) using a seven point scale.

4.2.3 The sampling strategy

The Bureau for Statistical and Survey Methodology (STATOMET) at the University of Pretoria was briefed to determine a proportionate sample for the Gauteng area. The data from the All Media Product Survey (AMPS) for October 1994 was used for this purpose. A matrix profiling specific criteria was developed indicating the sample structure. The matrix criteria included:

- population number of households owning a colour television receiver
- population sectors by race (Black, Asian, Coloured and White)
- by geographic area (Pretoria, Johannesburg, East Rand, West Rand, Soweto and Vaal

triangle including Sebokeng).

From this matrix an allocation table was constructed indicating the number of interviews to be conducted in the specific geographic areas and this is indicated by the figure shown in brackets in Table 4.1. A total of 250 consumers was interviewed. To ensure that the inclusion of respondents was meaningful to the study, interviewers were required to screen respondents by entering the home and establishing that a colour television receiver was available and working. This led to problems in black areas as many respondents were afraid that the survey was to "check on television licences". This slowed the study down considerably as there was a high rate of unwillingness to participate in the study. All submitted questionnaires were, however, from respondents who have colour television receivers in their households.

Table 4.1: Frequency breakdown of television ownership in the Gauteng area

Group	Households	AREA						
		Pretoria	Johannesburg	East Rand	West Rand	Soweto	Vaal triangle	Total
Asian	Television ownership	3111	12831	2318	1470	—	760	20490
	Population	3964 (1)	16485 (4)	5414 (2)	1470 (0)	—	921 (0)	28254 (7)
Black	Television ownership	43544	14888	58257	6200	69919	24250	217058
	Population	65175 (17)	27837 (7)	84944 (21)	11750 (3)	107201 (27)	37803 (10)	334710 (85)
Coloured	Television ownership	3024	17190	3043	1644	—	509	25410
	Population	4491 (1)	25290 (7)	7451 (2)	3476 (1)	—	783 (0)	41491 (11)
White	Television ownership	134459	150227	141955	47949	—	36534	511124
	Population	152196 (39)	164598 (42)	161737 (41)	54874 (14)	—	43355 (11)	576760 (147)
Gauteng household population		225826 (58)	234210 (60)	259546 (66)	71570 (18)	107201 (27)	82862 (21)	981215 (250)

4.3 THE RETAIL QUESTIONNAIRE

The retail questionnaire consists of thirty questions covering three parts: general information (ten questions), product quality (seven questions), and service quality (thirteen questions). An example of this questionnaire is given in Appendix A.

Part one of the questionnaire identifies the respondent's position in the company, level of experience, his preferences, his perception of quality and his ranking of service quality dimensions. The questions in part two of the questionnaire endeavour to ascertain the respondent's rating of product quality dimensions for each colour television manufacturer on a five point scale. The questions in part three establish the respondent's rating of service quality dimensions for each colour television manufacturer on a five point scale.

Table 4.2: Retail sample by area (a frequency breakdown)

Area	Chain store	Independent store	Total
Johannesburg	85	16	101
Pretoria	30	15	45
East Rand	38	4	42
Vaal Triangle	7	1	8
West Rand	3	1	4
Total	163	37	200

The retail questionnaire was answered by sales persons, sales managers and store managers directly involved with colour television retail sales in the province of Gauteng in the Republic of South Africa. A total of 200 persons was interviewed. The names and addresses of the

retailers were obtained from the Furniture Traders Association of South Africa. From Table 4.2, 81.5% of the respondents interviewed are involved with colour television retail sales in large chain stores such as Dions, Morkels, Hyperama, etcetera, with the balance being made up from smaller retailers.

4.4 THE SERVICE QUESTIONNAIRE

The service questionnaire consists of twenty-six questions (see Appendix B). Of these twenty-five are structured and only one (Part one: question seven) is unstructured (or open ended). Part one covers general information about the respondent and his or her perceptions and experience in repairing colour television receivers. Part two covers product quality with questions structured to ascertain a rating on every dimension for each manufacturer. Part three covers service quality with questions structured to ascertain a rating on every dimension for each manufacturer.

Table 4.3: Service sample by area (a frequency breakdown)

Area	Maxicare	Mastercare	Early Bird	Independents	Total
Johannesburg	1	22	5	46	74
East Rand	3	1	3	25	32
Soweto	0	0	0	31	31
Vaal Triangle	0	0	1	24	25
Pretoria	0	1	3	12	16
West Rand	0	5	1	7	13
Total	4	29	13	145	191

The service questionnaire was answered by technicians, foremen, service managers and business owners directly involved with colour television repairs in the province of Gauteng in the Republic of South Africa. A total of 191 persons was interviewed (see Table 4.3).

The names and addresses of the service repair organisations were obtained from the colour television manufacturers. The manufacturer's own service departments were not included in the survey in order that an unbiased comparison between the manufacturers is obtained.

4.5 THE MANUFACTURING QUESTIONNAIRE

Two questionnaires are used. The **supervisor/technical questionnaire** was answered by supervisors and technicians involved with the day-to-day activities of various manufacturing functions because of their good insight into the causes of quality problems during manufacture. The **senior management questionnaire** was answered by each manufacturer's managing director or general manager in order to obtain information relating to performance, policies and strategies.

One senior management questionnaire (see Appendix E) and fifteen supervisor questionnaires (see Appendix D) were posted to all eight manufacturers. Unfortunately TVMANH declined to participate and TVMANG was liquidated during the survey and did not return any questionnaires. Sixty-two supervisor questionnaires were returned giving a response rate of 68.9%.

4.6 THE STATISTICAL TESTS USED

The quality management questionnaires included both open-ended and structured questions (see Appendices A to E). The open-ended questions have not been subjected to any statistical hypothesis testing and have not been analysed. In the case of the structured questions, the main consideration in the selection of test statistics is the nature of the response scale given to each question. Although an effort was made to provide scales that can be considered

quantitative, or of at least ordinal-measurement strength, some variables such as the brand of colour television receiver are simply qualitative (or categorical) by nature.

The framework used in the repair service quality section of the study is centred around the Parasuraman *et al.* (1984:15) conceptual model of service quality using the **SERVQUAL** instrument. Only consumers having experienced repairs to their colour television receiver were required to complete the **SERVQUAL** instrument. Service quality index (Q) is defined as the discrepancy between the consumer's perceptions (P) of the actual quality of service received, and his or her expectations (E) of that service, where $Q = E - P$ and E and P are the ratings on the corresponding expectation and perception statements respectively. An average between each corresponding expectation and perception is calculated with all positive scores indicating that the service repairers did not meet with the expectations of the consumers. An assessment along each of the five service dimensions by averaging the difference scores on items making up the dimension is determined with an average score across all five dimensions providing an overall measure of service quality.

In order to keep the analysis and the interpretation of the statistical results as clear and simple as possible, the following test statistics have been selected in order to establish whether any two or more questions (or variables) are related.

- **Chi-square (χ^2) test statistic** where the two variables being related are both considered to be of nominal strength. An example would be in relating imported to locally manufactured colour television quality.
- **F-test statistic** where two or more sample means are compared using analysis of variance (ANOVA) for unbalanced data. An example would be in comparing a mean quality characteristic performance of the various manufacturers. In relating a characteristic to the manufacturers a significant F-test value would indicate that the manufacturers have different mean levels of performance. According to Sirkin (1995:299) the ANOVA is a robust technique and may be applied to five point ordinal

data which were extensively used in the study.

- The **Kruskal-Wallis** non-parametric test was used as an alternative to the ANOVA F-test (in cases where cell sizes were too small or normality of data could not be assumed) as well as a back up to the ANOVA F-test (in cases where normality assumptions could be questioned).

The SAS statistical software (version 6.1: copyright by SAS Inc., Cary N.C., USA) was used incorporating FREQ, UNIVARIATE, GLM and NPARIWAY procedures for this study.

Three specific aspects of the statistical analysis requires further clarification, namely the applicability of the ANOVA tests, the choice of a multiple comparison test and the assumptions underlying the interpretation of ranked data.

4.6.1 Application of ANOVA F-tests

According to Nowaczyk (1988:337) the ANOVA can be applied to five point ordinal data in the case of groups having cell sizes of $n \geq 15$. This requirement resulted in the deletion of all groups having $n < 15$ from the consumer questionnaire data and the need to utilise Kruskal-Wallis for the manufacturing questionnaire data as it contained small group sizes having $6 \leq n \leq 15$. All significant F-tests were compared against the Kruskal-Wallis test to confirm significant findings.

4.6.2 Multiple comparison of means

When comparing more than two means, an ANOVA F-test indicates whether the means are significantly different from each other, but it does not indicate which means differ from which other means. Multiple comparison methods (also called mean separation tests) provide more detailed information about the differences among the means. Multiple comparisons imply that more than one comparison among three or more means are investigated.

When interpreting multiple comparisons, the failure to reject the hypothesis that two or more means are equal does not necessarily imply that the population means are in fact equal. Failure to reject the null hypothesis may imply only that the difference between the population means, if any, is not large enough to be detected with the given sample size. Given three sample means, the largest and smallest may be significantly different from one another, while neither is significantly different from the middle one. It is noteworthy that nontransitive results of this type occur frequently in multiple comparisons.

The overall type-1 error rate for all the comparisons (the comparison-wise error rate), between the manufacturers using the ANOVA F-test is used to determine whether statistical significance exists. However, a preliminary F-test controls only the experiment-wise error rate under the complete null hypothesis. Further comparisons are made if the F-test is significant, using Tukey's studentised range test to control the type-1 experiment-wise error rate and Duncan's multiple-stage test to control the type-1 comparison-wise error rate. Duncan's method controls the comparison-wise error rate and not the experiment-wise error rate for each comparison between the manufacturers at the specified level of significance. Several published studies have claimed that Duncan's method is superior to Tukey's (SAS/STAT 1990:946). As a consequence Duncan's method is extensively used in the study.

4.6.3 The assumptions underlying the interpretation of ranked data

The interval between the ranking scores are assumed to be evenly spaced in respect of variables that required ranking. This assumption allowed simple proportionality to be applied to ranked variables, using the ranking score as a weight to determine its representation and importance to the study.

4.7 THE LEVEL OF SIGNIFICANCE

Conventionally, the values 0.05 and 0.01 are used as levels of significance for the statistical tests performed. The reasons for these rather severe levels of significance is to control the

so-called type-1 errors (that is to limit the risk of incorrectly rejecting the null hypothesis, or concluding a significant result). Most research should, however, be just as concerned with missing a significant result (type-2 error). Winer (1971:14-15) argues that when both types of errors are equally important, levels such as 0.20 (and possibly 0.30) are more appropriate than the conventionally used 0.05 and 0.01 levels.

Another consideration in the choice of the level of significance is the actual sample size. In this research the sample sizes for the consumers (250), retailers (200) and service repairers (191) are relatively large with the result that the statistical tests performed are relatively powerful (that is significant results are easily obtained). Due to its general acceptance (Kerlinger 1986:157), it has been decided to use an overall level of significance of 0.05.

CHAPTER 5**THE RETAIL QUESTIONNAIRE****5.1 INTRODUCTION**

According to Deming (1986:186) sales persons indicate that their problems are common, regardless of the type of product or service. They are: poor quality of the product or service, wrong count, mistakes in orders and slow delivery. Sales personnel, who ultimately keep a company in business, find it difficult to sell quality that does not come up to the customer's requirements.

The purpose of the retail questionnaire is to test the validity of the hypotheses mentioned in Chapter 1, Section 1.4, that there is a need by for the manufacturers to improve the quality of colour television receivers, for the service repair organisations to improve their repair service quality and for the manufacturers to improve their quality control procedures. In order to achieve this the following is ascertained:

- what the overall response is to each question in the questionnaire;
- whether any significant difference in service and product quality exists between the manufacturers; and
- what the retailers, as an industry, agree on in respect of service and product quality dimensions.

5.2 THE SURVEY SAMPLE

The retail questionnaire was answered by salespersons, sales managers and store managers directly involved with colour television retail sales in the province of Gauteng in the Republic of South Africa. A total of 200 persons was interviewed. The names and addresses of the retailers were obtained from the Furniture Traders Association of South Africa.

Table 5.1: Composition of sample in terms of retail category and area (a percentage breakdown)

Retail category	Area					Row total
	Pretoria	East Rand	Johannesburg	Vereeniging	West Rand	
Chain store	15.0	19.0	42.5	3.5	1.5	81.5
Independent	7.5	2.0	8.0	0.5	0.5	18.5
Column total	22.5	21.0	50.5	4.0	2.0	100.0

Table 5.2: Composition of sample in terms of retail category and position in company (a percentage breakdown)

Retail category	Position in company			Row total
	Sales person	Sales manager	Store manager	
Chain store	70.0	4.5	7.5	82.0
Independent store	15.5	1.5	1.0	18.0
Column total	85.5	6.0	8.5	100.0

A detailed percentage breakdown of the sample is shown in Tables 5.1, 5.2 and 5.3 in terms of area, position in the company and experience of the various retail categories. In Table 5.1, the retail category is cross-tabulated with the area in the province of Gauteng. Table 5.2 shows the cross-tabulation between retail category and position in company. Similarly, Table 5.3 shows the cross-tabulation between the position in the company and experience.

From Table 5.2 the sales persons form the largest single group, followed by the management group which is relatively small, being divided into the sales managers and store managers. The level of experience of the retail sample has a mean of 6.13 years and a standard deviation of 4.61 with 45.5% having more than six years of selling experience.

Table 5.3: Composition of the sample in terms of position in the company and experience (a percentage breakdown)

Position in company	Experience (in years)					Row total
	(0-5)	(6-10)	(11-15)	(16-20)	(21-25)	
Sales person	48.0	27.5	7.0	2.5	0.5	85.5
Sales manager	2.5	1.5	1.5	0.5	0.0	6.0
Store manager	4.0	2.5	1.0	1.0	0.0	8.5
Column total	54.5	31.5	9.5	4.0	0.5	100.0

5.3 THE STATISTICAL RESULTS

There are thirty questions in the questionnaire (see Appendix A). Of these twenty-nine are structured and only one (Part one: question six) is unstructured (or open ended). Part one covers general information about the respondent and his or her perceptions and experience in selling colour television receivers. Part two covers **product quality** with questions

structured to ascertain a rating on every dimension for each manufacturer. Part three covers **service quality** with questions structured to ascertain a rating on every dimension for each manufacturer.

5.3.1 Interest in the SABS mark by the consumers

A colour television receiver bearing the SABS mark is an indication that the product complies with:

- an industry agreed upon specification in respect of performance and safety,
- an ISO 9000 quality management system during manufacture.

As a consequence of the fact that South African legislation does not require a television manufacturer to comply with the SABS mark, it is attempted to ascertain whether the SABS mark is a significant quality characteristic (from the consumer's perspective) when purchasing a colour television receiver. All products, however, do have to comply with minimum safety requirements and this does not imply that generally accepted quality procedures are being implemented during manufacture.

In question 4 (Part one) the respondents are asked to rate the attention given by consumers, on a scale ranging from 1 ("very little") to 5 ("very high") when purchasing a colour television receiver, with SABS mark. The retail sample has a mean of 2.47 and a standard deviation of 1.39 with 55.8% indicating that **little or very little** attention is given by the consumers to the SABS mark.

The same question was asked in the consumer questionnaire (Part one: question six). The results from these questionnaires have been summarised in Table 5.4. In the consumer questionnaire a mean of 3.29 and a standard deviation of 1.32 was obtained with only 23.6% indicating that **more than average** attention is given to the SABS mark by the consumers.

In testing for statistical significance between the means of the consumer sample and the retail sample we find that:

$$Z_{\text{calc}} = (3.29 - 2.47) / \sqrt{(1.32^2/250 + 1.39^2/197)} \\ = 6.308$$

$$\text{Now } Z_{\text{table}} = Z_{0.05} \text{ (one tailed)} = 1.65$$

Since $Z_{\text{calc}} > Z_{0.05}$ there is evidence that there is a statistical significant difference in the means. This difference may be due to the fact that the retailers are not aware of the consumer concern regarding compliance to the SABS mark and are perhaps expressing a subjective opinion.

Table 5.4: A comparison between the retail and consumer questionnaires with regard to the SABS mark

Questionnaire	Response categories (attention to SABS mark)					
	Very little	Little	Medium	High	Very high	Total
CONSUMER						
Frequency	42	17	67	75	49	250
Percent	16.8	6.8	26.8	30.0	19.6	100
RETAIL						
Frequency	70	40	30	38	19	197
Percent	35.5	20.3	15.2	19.2	9.6	100

5.3.2 A comparison between local manufacture and imported colour television receivers

The retailers sell both imported and locally manufactured colour television receivers and are

therefore ideally suited to comment on the quality performance of local manufacture versus imports.

In question 5 (Part one) the respondents are asked whether the quality of South African manufactured colour television receivers are below world standards. The same question was asked in the service questionnaire (Part one: question 6). Table 5.5 summarises these responses.

Table 5.5 A comparison between the retailers and service repairers on whether the quality of South African manufactured colour television receivers are below world standards.

Category	Response			
	Yes	No	Don't know	Total
RETAIL				
Frequency	58	112	28	198
Percent	29,3	56.6	14.1	100
SERVICE				
Frequency	46	98	45	189
Percent	24.3	51.9	23.8	100

A Chi-square (χ^2) test of significance between the retailers and the service repairers for the "yes" and "no" responses results in a value of 0.166 giving a probability value under the null hypothesis of 0.683 which is not significant at the 0.05 level. However, by including the "don't know" responses to the "yes" and "no" responses a χ^2 value of 6.071 is obtained giving a probability value under the null hypothesis of 0.048 which is significant at the 0.05 level. From these results, it is clear that there is no perceived difference in the quality of locally manufactured colour television receivers and imported sets.

5.3.3 The relationship between price, quality and after sales service

According to Deming (1986:32) quality, service and price cannot be left to the thrust of competition for price with an ever increasing demand for uniformity and reliability occurring in today's business environment. Although correlation studies have shown a weak relationship between quality and price, durable goods have normally displayed a stronger relationship than non durables (Garvin 1984a:72). The importance of consumer insistence on acceptable after sales service, product quality and price are investigated in order to establish whether consumers have any significant preferences which the manufacturers, retailers and service repair organisations may not have discerned.

In question 7 (Part one), the respondents are asked to rank price, quality and after sales service based on enquiries received from consumers purchasing colour television receivers.

In order to establish consumer preference between price, quality and after sales service a weight of 3 is multiplied with the first ranking score followed by a weight of 2 for the second ranking score and a weight of 1 for the third ranking score. By expressing each category's weighted total ranking score as a percentage of the total weighted scores for all the categories, the overall preference is obtained from the percentage column in Table 5.6.

The results in Table 5.6 indicate that quality is seen by the retailers to be the most preferred variable followed closely by price, and after sales service positioned last, by a substantial margin. Quality differences can only be translated into price differences provided that the differences can be explained to the consumer and the consumer regards the differences as a form of superior quality. These results indicate that the consumer may have difficulty in translating the quality of colour television receivers into price differentials and visa versa.

Table 5.6: Comparison between price, quality and after sales service

Category	Ranking			
	One	Two	Three	%
PRICE	73	77	40	36.2
QUALITY	90	72	28	38.8
SERVICE	27	41	122	25.0

5.3.4 Retail preference of manufacturer

In question 8 (Part one), the retailers are asked to rank their preference of a South African colour television manufacturer. The ranking for each manufacturer is shown in Table 5.7.

In order to establish the most preferred manufacturer a weight of 8 is multiplied with the first ranking score followed by a weight of 7 for the second ranking score and so on. By expressing each manufacturer's weighted total ranking score as a percentage of the total weighted scores for all the manufacturers, the overall preference of manufacturer is obtained from the percentage column in Table 5.7.

From these results it is clear that TVMANA (18.8%) and TVMANB (18.2%) have substantial representation in the sample. With TVMANC and TVMAND being preferred third and fourth respectively, it is noteworthy that these four manufacturers have been in existence the longest, and are therefore more experienced (see Table 8.21).

Table 5.7: Ranking of manufacturer by the retailers

Manufacturer	Ranking								
	One	Two	Three	Four	Five	Six	Seven	Eight	%
TVMANA	106	52	19	8	2	2	0	0	18.8
TVMANB	64	90	25	8	2	0	0	0	18.2
TVMANC	10	19	58	57	30	9	2	2	13.6
TVMAND	2	18	54	57	23	15	9	3	12.4
TVMANF	5	15	31	42	50	21	0	0	10.9
TVMANH	1	8	18	44	89	0	0	0	10.2
TVMANE	4	10	15	27	39	41	23	11	9.0
TVMANG	5	1	9	14	33	32	32	37	6.8

5.3.5 The retail definition of colour television receiver quality

According to Plsek (1987:29) the effective management of quality begins with a good definition of quality. Garvin (1984b:39) concludes that quality is a complex and multifaceted concept and is a great source of confusion to managers in different functions who frequently fail to communicate precisely what they mean by the term.

In question 9 (Part one) the retailers are asked to rank the quality definitions espoused by the quality theorists (Demming, Crosby, Juran and Feigenbaum) in order to obtain insight into the meaning of colour television receiver quality in South Africa. In order to establish the most preferred definition of quality, a weight of 5 is multiplied with the first ranking score followed by a weight of 4 for the second ranking score and so on. By expressing each definition's weighted total ranking score as a percentage of the total weighted scores for all the definitions, the overall preference of a definition for colour television receiver quality is obtained from the percentage column in Table 5.8.

From these results, it is ascertained that there is no significant agreement on a definition for colour television receiver quality and that the key lies in understanding that quality is not a singular characteristic but that many characteristics or dimensions may contribute to the meaning of quality in the eyes of the retailer.

Table 5.8: Ranking of product quality definitions by the retailers

Definitions of quality	Ranking					
	One	Two	Three	Four	Five	%
Meeting customer expectations	59	37	41	40	22	22.37
Pride of workmanship	48	39	38	41	33	20.93
Fitness for use	24	49	52	37	37	19.52
Zero defects	45	40	23	25	66	19.09
Conformance to requirements	23	35	44	56	41	18.08

5.3.6 A comparison between the manufacturers on repairs, price, demand and advertising

5.3.6.1 Frequency of repairs

A high frequency of product repair is synonymous with poor quality resulting in unnecessary warranty expenses and dissatisfied consumers. In question 10 (Part one), the respondents are asked to rate each manufacturer on how frequently their colour television receiver brand(s) require repairs, using a scale ranging from 1 ("very low") to 5 ("very high"). Table 5.9 shows the mean rating, analysis of variance and the Duncan grouping for the colour television manufacturers from the perspective of the retailers. It must be noted that the means with the

same letter are not significantly different at the 0.05 level. It is clear from these results that TVMANA and TVMANB have a significantly lower frequency of repair in comparison to the other manufacturers, whereas TVMANH and TVMANG are considered to have a significantly higher frequency of repair in comparison to the other manufacturers. The remaining manufacturers (TVMAND, TVMANC, TVMANE and TVMANF) are considered to have a low to medium frequency of repair to their brands.

From these results it may be concluded that the reliability of the majority of the manufacturers' products have not been optimised and that opportunities for improvement do exist. Although reliability is determined largely by the quality of design, the achieved reliability is being expressed by the retailers in Table 5.9 which is affected by lapses in quality of conformance by the manufacturers.

Table 5.9: Frequency of repairs by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	194	1.4639	A		
TVMANB	197	1.5381	A		
TVMAND	163	2.3620	B		
TVMANC	191	2.4607	B		E
TVMANE	126	2.6905	C		E
TVMANF	102	2.8039	C		F
TVMANH	27	3.0370	D		F
TVMANG	119	3.2941	D		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	431.96	61.71	59.4	.0001
Error	1111	1154.98	1.03		
Corrected	1118	1586.95			

5.3.6.2 Manufacturers commanding the lowest priced colour television receivers

Although correlation studies have shown a relatively weak relationship between quality and price, durable goods have normally displayed a stronger relationship particularly when there are obvious differences in performance or features (Garvin 1988:72-74). In question 10 (Part one), the respondents are asked to rate each manufacturer on being able to command the lowest price, using a scale ranging from 1 ("very low") to 5 ("very high").

Table 5.10 shows the mean rating and the Duncan grouping for the colour television manufacturers from the perspective of the retailers. From these results, TVMANA and TVMANB command a significantly **higher** price whereas TVMANG is significantly **lower** in price in comparison to the other manufacturers.

Table 5.10: The lowest price by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	166	3.6627	A		
TVMANB	167	3.6467	A		
TVMAND	142	2.9789	B		
TVMANC	169	2.8639	B		
TVMANE	111	2.4595	C		
TVMANF	91	2.5275	C		
TVMANH	26	2.5000	C		
TVMANG	106	2.1509	D		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	281.39	40.19	39.6	.0001
Error	970	984.40	1.01		
Corrected	977	1265.79			

By comparing Table 5.9 with Table 5.10 there appears to be a relationship between price and quality. For example, TVMANA and TVMANB are rated low on frequency of repairs (good quality) and high on price (expensive), whereas TVMANG manifests a reverse association.

5.3.6.3 Manufacturers commanding the highest demand for colour television receivers

Feigenbaum (1986:42) states that the current intense buyer demands for products of consistently high quality has never been greater than in today's market place. However, if a high quality product is one with superior performance or a large number of features, it will generally be more expensive and will sell in smaller volumes (Garvin 1988:76).

Table 5.11: The demand for colour television receivers by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	199	4.0308	A		
TVMANB	194	3.8814	A		
TVMAND	163	3.3190	B		
TVMANC	189	3.1481	B		
TVMANE	123	2.8455	C		
TVMANF	100	2.3800	D		
TVMANG	115	2.1913	D		
TVMANH	26	2.0769	D		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	459.00	65.57	64.6	.0001
Error	1097	1112.61	1.01		
Corrected	1104	157.61			

In question 10 (Part one) the respondents are asked to rate each manufacturer on the demand for their brand(s) using a scale ranging from 1 ("very low") to 5 ("very high").

Table 5.11 shows the mean rating and the Duncan grouping for the demand of the various brands of colour television receivers from the perspective of the retailers. From these results, TVMANA and TVMANB command a significantly higher demand for their brands whereas TVMANF, TVMANG and TVMANH brands are significantly lower in comparison to the other manufacturers. TVMAND and TVMANC brands are rated second highest in the group followed by TVMANE in third position. These results may be explained by the fact that, when quality preferences are clearly evident to the consumer, such quality differences are decisive in market demand. All other factors being equal, or alternatively, when quality preferences are slight, the decisive factor in market demand is usually the marketing skills.

5.3.6.4 The most effective advertising by manufacturer

Theorists claim that for major home appliances, higher levels of advertising will be associated with higher quality products (Garvin 1988:74). The urge to develop quality reputations has stimulated manufacturers to develop product quality and quality controls to levels which back up the advertising.

In question 10 (Part one) the respondents are asked to rate each manufacturer on the effectiveness of his advertisements using a scale ranging from 1 ("very low") to 5 ("very high").

Table 5.12 shows that the advertising provided by TVMANA and TVMANB is significantly more effective than the other manufacturers which may explain the significantly higher demand for their products as discussed previously. TVMAND and TVMANC are second, followed by TVMANE, TVMANF, TVMANG and TVMANH last respectively.

Table 5.12: The effectiveness of the colour television manufacturer's advertisements

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	196	4.0306	A		
TVMANB	197	3.8579	A		
TVMAND	163	3.0613	B		
TVMANC	191	2.9110	B		
TVMANE	125	2.1440	C		
TVMANF	100	2.0000	C	D	
TVMANG	115	1.8609	C	D	
TVMANH	28	1.6786	D	D	
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	744.89	106.41	90.5	.0001
Error	1107	1301.99	1.17		
Corrected	1114	2046.89			

Although a heavily advertised product is just as likely to be of poor quality, it is plausible that consumers, who may not be able to judge the differences in product quality, will depend on advertising to communicate quality differences and therefore the effectiveness of advertising is an important variable in determining quality. TVMANA uses the slogan "the quest for zero defects" to differentiate their quality which may explain their significant rating.

5.3.7 The ranking of product quality dimensions

In order to discover which product quality dimensions may be singled out for special attention the respondents are asked, in question 1 (Part two), to rank all eight quality dimensions in respect of their importance to colour television receivers.

The ranking for each quality dimension is shown in Table 5.13. In order to establish the most preferred dimension a weight of 8 is multiplied with the first ranking score followed by a weight of 7 for the second ranking score and so on. By expressing each dimension's weighted total score as a percentage of the total weighted scores for all the dimensions, the overall preference of dimension is obtained from the percentage column in Table 5.13.

From Table 5.13, the overall ranking of colour television receiver quality dimensions from the perspective of the retailers reveals that reliability (15.1%), performance (14.1%) and durability (13.9%) have substantial representation in the sample.

From these results, a colour television manufacturing company choosing to compete on the basis of quality, would probably single out reliability, performance and durability for special attention. In doing so, high performance and reliability will require, for example, careful attention to design whereas durability will require the use of long-lived components.

Table 5.13: Ranking of product quality dimensions

Quality dimensions	Ranking								
	One	Two	Three	Four	Five	Six	Seven	Eight	%
Reliability	44	30	29	38	19	12	11	13	15.1
Performance	39	32	30	19	18	18	24	17	14.1
Durability	33	38	18	25	28	22	11	21	13.9
Maintainability	15	32	39	19	19	25	32	15	12.7
Perceived quality	22	19	21	27	35	31	34	7	12.4
Features	16	21	30	25	34	29	26	16	12.3
Conformance	20	12	18	31	29	35	30	22	11.4
Aesthetics	8	12	12	13	19	26	27	80	8.1

It is clear that the different dimensions of quality require different forms of expertise and it is unlikely that manufacturers will prosper by trying to succeed on all dimensions simultaneously. A possible solution would therefore involve a segmentation strategy employing a limited set of objectives, utilising tradeoffs among the various dimensions of quality and between these dimensions and the objectives of cost, market share and profitability.

5.3.8 Overall quality of the manufacturers brands

In question 2 (Part two) the respondents are asked to use the eight product quality dimensions and rate the manufacturers on a scale ranging from 1 ("very low") to 5 ("very high") according to the overall quality of their colour television receiver brands.

Table 5.14: The overall quality of the manufacturers brands

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	196	4.2551	A		
TVMANB	197	4.1320	A		
TVMAND	167	3.5988	B		
TVMANC	194	3.5206	B		
TVMANE	134	3.1940	C		
TVMANF	95	2.8211	D		
TVMANG	132	2.6061	D		E
TVMANH	45	2.4444			E
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	403.69	57.67	45.7	.0001
Error	1152	1453.89	1.26		
Corrected	1159	1857.58			

Table 5.14 shows that TVMANA and TVMANB brands are significantly better in overall quality than the other manufacturers. TVMAND and TVMANC are second, followed by TVMANE with TVMANF, TVMANG and TVMANH respectively.

From these results a statistically significant difference between the manufacturers exists with only TVMANA and TVMANB being rated above average, that is "high overall quality", based on the eight product quality dimensions. TVMANF, TVMANG and TVMANH colour television receiver brands were rated below average for their overall quality whilst TVMAND, TVMANC and TVMANE were rated marginally above average (3) for overall quality. These results indicate that there is an opportunity for the majority of the manufacturers to improve their overall quality from the perspective of the retailers.

5.3.9 Product design

Feigenbaum (1986:617) emphasises the importance of product design by explaining that customer quality satisfaction begins during new product development and experience shows that the acceptance of a new product depends heavily upon the quality of design.

In question 3 (Part two) the respondents are asked to indicate on a scale ranging from 1 ("very low") to 5 ("very high") the extent to which product design was the possible cause of quality complaints received. A repetition of similar complaints was used as a basis of establishing whether design flaws are present.

The results in Table 5.15 indicate that a statistically significant difference between the manufacturers exists. TVMANG is the only manufacturer to receive an above average to high rating for quality complaints relating to design flaws, whereas TVMAND, TVMANB and TVMANA received a low rating and the remaining manufacturers all receiving a low to average rating. A low rating implies that there are no chronic design flaws and that conformance to design is being reflected. It is noteworthy that TVMANG is the only manufacturer undertaking original product design activities Dreissel (1993).

Table 5.15: Product quality design of the manufacturers brands

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANG	115	3.2000	A		
TVMANH	33	2.8788	A		B
TVMANF	93	2.6129	C		B
TVMANE	121	2.4711	C		
TVMANC	193	2.4508	C		
TVMAND	169	2.2604	C		D
TVMANB	195	2.0769			D
TVMANA	195	1.9846			D
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	143.36	20.48	14.5	.0001
Error	1106	1561.25	1.41		
Corrected	1113	1704.62			

5.3.10 Workmanship

The individual operator in the factory is the key to the production of products of satisfactory quality. They must be challenged as individuals to put their best effort and skill into producing quality products by the actions of their supervisors who in turn must be backed by management. Deming (1986:77) emphasises the need for the operators to take pride in his or her work to ensure acceptable workmanship.

The cabinet finish on a colour television receiver involves the moulding of the plastic front and rear sections followed by spray painting and the printing of logos and names of various brands. Assembly work comprises the mounting of controls and chassis to the front and rear sections of the cabinet and the mounting of the tube to the front section of the cabinet. The

finish is particularly important as the consumer is constantly viewing the product when in use. Any blemish on the front section of the cabinet or the viewing surface is of critical importance and therefore it is incumbent on management to train operators to interpret the acceptability of product finish adequately. The assessment of product finish requires the responsible operator to view the product under proper lighting conditions and from a defined distance in order that subjectiveness is eliminated as far as possible. The assembly of large components and operating controls must survive transportation, storage and handling and eventual use by the consumer.

In question 4 (Part two) the extent to which poor workmanship (external finish and assembly) being the possible cause of quality complaints, is investigated. The respondents are asked to indicate on a scale ranging from 1 ("very low") to 5 ("very high") their experience in quality complaints arising from poor workmanship for each manufacturer.

Table 5.16: External workmanship of the manufacturers brands

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANG	121	2.9421	A		
TVMANH	39	2.4872	B		
TVMANF	96	2.4167	B		
TVMANC	196	2.3929	B		
TVMAND	170	2.3353	B		
TVMANE	129	2.2558	B		
TVMANB	196	2.1276	B		
TVMANA	195	2.0256	B		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	74.57	10.65	6.6	.0001
Error	1134	1829.55	1.61		
Corrected	1141	1904.12			

From Table 5.16 it can be seen that a statistically significant difference between the manufacturers exists. It is noteworthy that all the manufacturers are rated low to average with regard to workmanship which implies that poor workmanship, being the probable cause of quality complaints, is not a significant factor in giving rise to quality complaints.

TVMANG, with a Duncan grouping of "A", is the only manufacturer that shows a statistically significant difference from the rest of the manufacturers. These results indicate that product workmanship, which is observable to the retailers, in the form of cabinet assembly and finish, is generally acceptable to the retailers and consumers and is therefore not a significant factor in contributing to quality complaints.

5.3.11 Packaging

According to Feigenbaum (1986:594) there is not much point in having a product with a highly reliable design, carefully manufactured, if its reliability is seriously deteriorated because of poor protection and rough handling during shipping. The design of packaging is essential to the achievement of the necessary levels of reliability. Packaging design is normally evaluated by simulating transportation by impact testers and vibration tables. Trial shipments can also be made which are representative of what may be encountered.

In question 5 (Part two) the respondents are asked to indicate to what extent packaging is the possible cause of quality complaints using a scale ranging from 1 ("very low") to 5 ("very high").

The results in Table 5.17 indicate that there are statistically significant differences in the effectiveness of the various manufacturer's packing design. The low ratings indicate that all the manufacturers' packaging designs are low contributors to quality complaints.

Table 5.17: Packaging of the manufacturers brands

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANG	136	1.7868	A		
TVMANE	132	1.6970	A		B
TVMAND	172	1.6512	A		B
TVMANB	194	1.6237	A		B
TVMANA	195	1.6154	A		B
TVMANC	195	1.6000	A		B
TVMANF	115	1.4870			B
TVMANH	66	1.4545			B
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	8.60	1.22	1.1	.3495
Error	1197	1317.34	1.10		
Corrected	1204	1325.95			

5.3.12 Installation

It is essential to ensure proper operation of a colour television receiver by installing the product according to proper instructions and maintaining it through use. Many television receiver installations require the erection and alignment of an external antenna system, the tuning and programming of the different broadcasts and in some instances the integration of video recorders, decoders and high fidelity systems are required. Juran *et al.* (1979:15-6) indicates that consumer installation needs are:

- eliminate, as far as possible, the need for installation operations to be performed by the user

- simplify and foolproof the installation through product design
- prepare clear, illustrated, step-by-step written instructions for the user.

Due to the complexity involved, demonstrations by the retailers and clearly written operation manuals by the manufacturers, are essential ingredients to assist consumers with their television installations.

In question 6 (Part two) the respondents are asked to indicate, using a scale ranging from 1 ("very low") to 5 ("very high"), to what extent are quality complaints due to installation errors.

Table 5.18: Installation of the manufacturers brands

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANG	132	2.1970	A		
TVMAND	172	2.1337	A		
TVMANE	133	2.0376	A		B
TVMANB	196	1.9490	A		B
TVMANC	195	1.9487	A		B
TVMANA	196	1.9386	A		B
TVMANF	109	1.9266	A		B
TVMANH	62	1.7903			B
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	13.45	1.92	1.4	.1928
Error	1187	1605.54	1.35		
Corrected	1194	1618.99			

The results from Table 5.18 indicate that there are statistically significant differences between the different manufacturers brands with regard to the installation complaints.

However, the retailers low rating for the different manufacturers brands indicates that the consumers understand how to use their colour television receivers. From this, it is concluded that the manufacturers have well prepared instruction manuals with the retailers providing proper instruction for use to the consumers.

In addition, installation by specialists (for example, antenna equipment) appears to be properly carried out. However, the knowledge of actual usage and operation, which takes place, can only become available from field observation and complaint analysis.

5.3.13 Responsiveness

Quality complaints flow in to the manufacturers from a variety of sources, such as: consumers, retailers and service repairers. The mode of communicating complaints is also diverse: letters, telephone calls, personal visits and newspaper reports. The complaints may also be addressed to various departments: sales, service, quality control and various managers. The retailers generally telephone their complaints through to the manufacturer's service department, who then initiates a service call in accordance with their company procedures.

The identification of the "vital few" complaints which are responsible for the bulk of failures is extremely important in reducing costs relating to failures and satisfying consumers needs. The retailers are the first to be approached when problems occur with consumer products and are therefore ideally situated to report on the responsiveness of the manufacturers in dealing with consumer problems, especially new problems. Responsiveness also concerns the willingness or readiness of the manufacturers to provide service. It involves timeous service by initiating repairs quickly and calling the consumer back promptly about the status of the repair. The response to newly discovered field problems is indicative of the competency of

the manufacture's quality system to act timeously.

Table 5.19: Responsiveness of the manufacturers to newly discovered field problems

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANB	195	3.8205	A		
TVMANA	194	3.7732	A		
TVMANC	193	3.6891	A		
TVMAND	167	3.6287	A		
TVMANE	123	3.3659			B
TVMANF	88	3.1250			B
TVMANG	112	2.9821			B
TVMANH	33	2.8182			B
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	102.43	14.63	10.5	.0001
Error	1097	1520.10	1.38		
Corrected	1104	1622.53			

In question 7 (Part two) the respondents are ask to indicate the responsiveness of the manufacturers, using a scale ranging from 1 ("very low") to 5 ("very high"), in acting on newly discovered problems. Table 5.19 shows that there is a statistically significant difference in the responsiveness between the manufacturers. The majority of the manufacturers have a mean rating between 3 and 4, which is an above average response in acting on newly discovered problems on their products. TVMANG and TVMANH, however, are grouped below a rating of 3 which is a low response. A high to very high response by the manufacturers would indicate that their management is committed to reducing their quality costs and gaining the confidence of the consumers in their efforts to improving quality.

These results indicate that the manufacturers are not responding timeously enough to solving newly discovered problems on their colour television receivers in the field. The analysis and feedback of quality complaints from the field to the manufacturers quality department for corrective action is a vital component of any quality management system.

5.3.14 The ranking of service quality dimensions

In order to establish the meaning of colour television repair service quality it is important to establish which dimensions can be singled out for special attention. In question 1 (Part three) the respondents are asked to rank all five service quality dimensions in respect of their importance to colour television receiver repairs. In order to establish the most preferred dimension of service quality, a weight of 5 is multiplied with the first ranking score followed by a weight of 4 for the second ranking score and so on. By expressing each dimension's weighted total ranking score as a percentage of the total weighted scores for all the dimensions, the overall preference of service quality dimensions for colour television repair service quality is obtained from the percentage column in Table 5.20.

From Table 5.20, the overall ranking of the repair service quality dimensions indicates that reliability (25.3%) and responsiveness (23.7%) have substantial representation in the sample. From these results, a manufacturing company would probably single out reliability and responsiveness for special attention when conducting repairs to defective colour television receivers.

The reliability of a repair requires the diagnosing and repair of the **cause** of the fault and not only the symptom implying that the promised service is delivered. Responsiveness involves timeliness of service by initiating repairs quickly and calling the consumer back promptly about the status of the repair. Although the dimensions of assurance, tangibles and empathy are not as important, they should be applied appropriately.

Table 5.20: Ranking of service quality dimensions

Quality dimensions	Ranking					
	One	Two	Three	Four	Five	%
Reliability	75	50	39	20	12	25.3
Responsiveness	63	46	37	35	15	23.7
Assurance	30	51	45	46	24	20.6
Tangibles	14	23	45	55	59	15.9
Empathy	15	25	28	40	87	14.5

5.3.15 The average time to repair a colour television receiver

The average time to repair a colour television receiver is not only influenced by design practices, but procedures, facilities, equipment, availability of spare parts and personnel must all be integrated through the service repair system and used to perform the repair operations.

In question 2 (Part three) the respondents are asked to indicate the average time (in days) to repair a colour television receiver for each of manufacturer's service departments. From Table 5.21 the average time to repair varies from 9.525 days to 12.345 days with no statistically significant differences existing between the manufacturer's service departments. The average repair time for a colour television receiver, obtained from Table 5.21, is 10.28 days.

These results indicate that colour television receivers are not easily restored to service after failure. A downtime of 10 days appears to be unacceptable. The work force, skills, technical data, test equipment and support facilities in the colour television industry are the main factors that could contribute to the poor downtime. Support facilities involved with the availability of spare parts, generally recognised as the main contributor influencing downtime, may therefore be lacking in the industry.

Table 5.21: Average time to repair by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANG	116	12.345	A		
TVMANH	56	10.804	A		
TVMAND	164	10.457	A		
TVMANF	95	10.105	A		
TVMANA	183	10.066	A		
TVMANB	182	10.049	A		
TVMANE	117	9.778	A		
TVMANC	183	9.525	A		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	669.99	95.71	0.87	.5315
Error	1088	120010.32	110.30		
Corrected	1095	120680.31			

5.3.16 Warranty failures of colour television receivers

In question 3 (Part three) the respondents are asked to estimate the percentage of colour television receivers sold which require exchange, a single repair, two repairs and three or more repairs. From Table 5.22 it can be seen that 17.54% of all the colour television receivers sold are either exchanged or require a single service call during the warranty period. Colour television receivers are normally exchanged for a new product if found to be defective at initial switch-on.

These results indicate that the manufacturers are either not instituting adequate final inspection or their reliability efforts are inept. The high number of multiple failures, evidenced by the

need to repair some receivers more than once during the warranty period, as seen in Table 5.22, seems to suggest that design and reliability flaws exist.

Table 5.22: Warranty failures

Warranty failures	Percentage failures
Products requiring exchange	7.22
Products requiring a single repair/service call	10.32
Products requiring two repair/service calls	6.71
Products requiring three or more repair/service calls	4.90

5.3.17 Educating the consumer

Juran *et al.* (1979:15-6) maintains that even with clear, well illustrated instructions, a distressing number of consumers are still unable to use their products as intended by the manufacturer. Although presentations and explanations by the retailers to the consumers, in the use of a product, helps to eliminate opportunities for errors and omissions, the integration of a colour television receiver with related products such as video recorders, decoders, audio and satellite equipment can be quite complicated and confusing.

An avoidable warranty service call may be considered as a service call arising as a result of consumer ignorance of product knowledge (Higgins 1992:28). These calls are not considered as calls arising due to product failure or a poorly designed product but nevertheless impact as costs on the manufacturer. Reducing these calls is not limited to the manufacturer's service departments but the retailers must also provide the necessary product education and assistance for the consumer.

In questions 5 and 6 (Part three), the respondents are asked to indicate the attention given to educating and assisting consumers with installations when purchasing a colour television receiver. From the sample, 71.5% indicated that their company gives above average attention to educating the consumer on product knowledge. Only 55% indicated that average attention is given to ensuring a proper installation after the sale, is achieved. It is interesting that such a high percentage of retailers give above average care to educating the consumer on product knowledge and their concern for the installation of colour television receivers is mediocre.

5.3.18 Complaints

It is important to distinguish between quality-oriented complaints and complaints arising due to other matters. A quality complaint implies the existence of a quality deficiency and not complaints that could have been avoided if, for example, the directions in the owner's manual were followed. Juran *et al.* (1979:15-8) maintains that the retail network strongly influences the volume and nature of complaints that give rise to service calls. Avoidable complaints giving rise to service calls have an impact on a manufacturer's profitability and should be investigated for common patterns of causation (Juran *et al.* 1979:15-7).

In questions 4 and 7 (Part three) the respondents are asked to indicate on a five-point scale ranging from 1 ("very little") to 5 ("very high") the attention given by their company to repair service quality as well as the attention given to ensuring that a complaint is valid before placing a service call with the manufacturer's service department.

From the sample, 82.5% indicated that their company gives above average attention to repair service quality and 78% ensure that a complaint is valid or genuine before placing a service call. As expected, a high percentage of retailers indicate that they give above average care to repair service quality.

5.3.19 A comparison between the manufacturer's service departments

5.3.19.1 Repair service quality

The manufacturer's customer service department activities are closely linked with field quality performance and includes:

- operating of owned repair service centres and the utilisation of independent repair agents
- administration of original product warranties and follow-on contracts (service contracts)
- technical assistance in the form of information on specifications, parts supply, monitoring of product field performance and user application
- training of maintenance and repair personnel.

The hypotheses mentioned in Section 1.4 imply that the quality of colour television repair service needs improvement. In order to establish the performance of the manufacturer's repair service quality, the dimensions of service quality (reliability, responsiveness, tangibles, assurance and empathy) are used as a basis for comparison. In questions 8 to 13 (Part three) the respondents are asked to indicate, on a five-point scale ranging from 1 ("very low") to 5 ("very high"), their estimate of the service quality provided by the manufacturer's service organisations.

Question 8 establishes an overall estimate of repair service quality of the manufacturers and is summarised in Table 5.23. From these results, TVMANB, TVMANA, TVMANC, TVMAND and TVMANE are providing medium to high repair service quality while TVMANF, TVMANG and TVMANH are providing low to medium repair service quality.

Table 5.23: Repair service quality by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANB	197	3.9695	A		
TVMANA	199	3.8744	A		
TVMANC	195	3.7744	A		B
TVMAND	170	3.5824	C		B
TVMANE	128	3.3750	C		
TVMANF	97	2.9381	D		
TVMANG	118	2.8475	D		
TVMANH	37	2.7568	D		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	187.35	26.76	25.1	.0001
Error	1133	1208.78	1.06		
Corrected	1140	1396.14			

The manufacturers differ significantly with regard to repair service quality. TVMANE, TVMANF, TVMANG and TVMANH are significantly different to TVMANB, TVMANA and TVMANC.

It is interesting that the older manufacturers consisting of TVMANA, TVMANB, TVMANC and TVMAND are providing an above average level of repair service quality. However, the newer manufacturers of colour television receivers such as TVMANE, TVMANF, TVMANG and TVMANH are providing a mediocre level of repair service quality, making extensive and almost exclusive use of appointed agents (see Table 8.32). The exclusive use of service agents by TVMANG and TVMANH was confirmed by Dreissel (1993).

5.3.19.2 Repair service facilities

Repair service facilities are normally regarded as the service quality dimension of **tangibles** which include the physical facilities, equipment, personnel and communication materials. The implication of this dimension is that colour television service facilities, documentation and personnel (technicians and support staff) should be presentable at all times. Shoddy vehicles and equipment, for example, will give consumers the impression that repairs will be conducted in a similar fashion.

In question 9 (Part three) the respondents are asked to indicate a rating for each of the manufacturer's repair service facilities. These are summarised in Table 5.24.

Table 5.24: Repair service facilities by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	196	4.1684	A		
TVMANB	196	4.0663	A		B
TVMANC	191	3.8377			B
TVMAND	166	3.8133			B
TVMANE	126	3.5000	C		
TVMANF	89	3.4045	C		
TVMANH	38	3.2368	C		
TVMANG	114	2.8333	D		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	180.15	25.73	22.6	.0001
Error	1108	1264.40	1.14		
Corrected	1115	1444.55			

These results indicate that the manufacturers differ significantly with regard to repair service facilities. TVMANA, TVMANB, TVMANC, TVMAND, TVMANE, TVMANF and TVMANH all provide above average repair service facilities whereas TVMANG is the only manufacturer that provides below average service facilities that are significantly different to all the other manufacturers.

It is interesting that the newer manufacturers of colour television receivers such as TVMANE, TVMANF, TVMANG and TVMANH, who use only appointed service agents are rated significantly lower than the older and more established manufacturers such as TVMANA, TVMANB, TVMANC and TVMAND.

5.3.19.3 Responsiveness

Responsiveness is concerned with the willingness or readiness of the manufacturer's service department employees to provide service. It involves timeliness of service, for example, by initiating repairs quickly and calling the consumer back promptly about the status of the repair.

In question 10 (Part three) the respondents are asked to indicate a rating for responsiveness for each manufacturer's service department which is summarised in Table 5.25.

From these results, TVMANA, TVMANB, TVMANC, TVMAND, TVMANE, TVMANF and TVMANG all provide above average responsiveness to service repairs whereas TVMANH is the only manufacturer providing below average responsiveness to service repairs.

From Table 5.25, it can be seen that the manufacturers differ significantly with regard to the dimension of responsiveness. TVMANE, TVMANF, TVMANG and TVMANH are significantly lower in responsiveness to TVMANA, TVMANB and TVMANC.

TVMANE, TVMANF, TVMANG and TVMANH, who use mainly appointed service agents, are less responsive and are rated below the older and more established manufacturers of TVMANA, TVMANB, TVMANC and TVMAND.

Table 5.25: Responsiveness of the manufacturer's service department

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	196	4.1990	A		
TVMANB	197	4.1980	A		
TVMANC	195	4.0564	A	B	
TVMAND	170	3.8882		B	
TVMANE	131	3.6107	C		
TVMANF	97	3.4742	C	D	
TVMANG	120	3.2750		D	
TVMANH	34	2.9412	E		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	145.01	20.71	22.7	.0001
Error	1132	1034.91	0.91		
Corrected	1139	1179.93			

5.3.19.4 Reliability

The reliability of a colour television repair implies that the service provider performs the promised service dependably and accurately which denotes "right the first time" performance at the designated time. The reliability of a repair also consists of diagnosing and repairing the **cause** of the fault and not only the symptom whilst adhering to promised time schedules.

In question 11 (Part three) the respondents are asked to indicate a reliability rating for each

manufacturer's service department which is summarised in Table 5.26.

From these results, TVMANA, TVMANB, TVMANC, TVMAND, TVMANE, TVMANF and TVMANG all provide above average reliability for service repairs whereas TVMANH is the only manufacturer providing below average reliability.

From Table 5.26 it can be seen that the manufacturers differ significantly with regard to service repair reliability. TVMANF, TVMANG and TVMANH are significantly different to TVMANA, TVMANB, TVMANC, TVMAND and TVMANE.

Table 5.26: Reliability of the manufacturer's service department

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	197	4.1878	A		
TVMANB	197	4.1269	A		
TVMANC	197	3.8020	B		
TVMAND	170	3.7824	B		
TVMANE	130	3.5154	B		
TVMANF	96	3.1979	C		
TVMANG	121	3.0661	C		
TVMANH	35	2.7429	D		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	194.41	27.77	24.5	.0001
Error	1135	1287.97	1.13		
Corrected	1142	1482.38			

In Section 5.3.14 the retailers indicated reliability to be the most critical of the five service quality dimensions and is therefore the core of repair service quality. It is interesting to note

from Table 5.26 that only TVMANA and TVMANB are rated high to excellent in providing reliable service to consumers requiring repairs to their colour television receivers.

These results show that the majority of the manufacturers are not providing a very high level of reliable repair service to the retailer's customers.

5.3.19.5 Assurance

Assurance implies possession of the required skills and knowledge to perform the service. Qualifications and training of service technicians and the knowledge and skill of operational support personnel are essential ingredients. Assurance also implies trustworthiness and honesty. Contributing factors are the name and reputation of the service enterprise particularly when appointed agents are used.

In question 12 (Part three) the respondents are asked to indicate an assurance rating for each manufacturer's service department which is summarised in Table 5.27. From these results, TVMANA, TVMANB, TVMANC, TVMAND, TVMANE, TVMANF and TVMANG all provide average to above average assurance for service repairs whereas TVMANH is the only manufacturer providing below average assurance.

From Table 5.27, it can be seen that the manufacturers differ significantly with regard to the service repair dimension of assurance with TVMANH performing significantly poorer than all the manufacturers.

In Section 5.3.14 the retailers ranked assurance third in importance after reliability and responsiveness respectively. It is interesting to note that TVMANA, TVMANB, TVMANC and TVMAND, having a high proportion of their repairs conducted by their own service department, are regarded by the retailers as providing a high level of assurance to consumers requiring repairs to their television receivers.

These results show that more than 50% of the manufacturers are not providing a high level of assurance when carrying out repairs on colour television receivers. The service quality dimension of assurance is likely to play a more vital role in the future, particularly when increasingly more service agents are appointed in the disadvantaged areas.

Table 5.27: Assurance of the manufacturer's service department

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	198	4.5202	A		
TVMANB	198	4.4192	A		
TVMANC	194	3.9639	B		
TVMAND	171	3.9415	B		
TVMANE	130	3.5308	C		
TVMANF	94	3.1596	D		
TVMANG	121	2.9917	D		
TVMANH	34	2.5588	E		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	360.17	51.45	57.6	.0001
Error	1132	1012.14	0.89		
Corrected	1139	1372.31			

5.3.19.6 Empathy

The dimension of empathy, according to Zeithaml *et al.*, (1990:25), may be equated to access, communication and understanding/knowing the consumer. This involves approachability and ease of contact as well as understanding the consumer's needs. Consumer complaints on colour television receivers are seldom accurately described due to lack of knowledge and technical jargon, requiring the service provider to establish the specific

requirements of the consumer to effect a proper repair.

In question 13 (Part three) the respondents are asked to indicate an empathy rating for each manufacturer's service department. This is summarised in Table 5.28. From these results, TVMANA, TVMANB, TVMANC, TVMAND, TVMANE and TVMANF all provide above average empathy for service repairs whereas TVMANG and TVMANH are the only manufacturers providing below average empathy.

Table 5.28: Empathy of the manufacturer's service department

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	198	4.0354	A		
TVMANB	198	3.9444	A	B	
TVMANC	194	3.7887	A	B	
TVMAND	171	3.6608		B	
TVMANE	129	3.2868	C		
TVMANF	92	3.0435	C	D	
TVMANG	121	2.9091		D	
TVMANH	36	2.6111	E		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	202.59	28.94	25.3	.0001
Error	1138	1296.16	1.14		
Corrected	1138	1499.16			

From Table 5.28 it can be seen that the manufacturers differ significantly with regard to the service quality dimension of empathy. TVMANE, TVMANF, TVMANG and TVMANH are significantly different to TVMANA, TVMANB, TVMANC and TVMAND.

In Section 5.3.14 the retailers ranked the service quality dimension of empathy last in importance. It is interesting to note from Table 5.27 that only TVMANA and TVMANB are regarded by the retailers as providing a high level of empathy to consumers requiring repairs to their television receivers.

These results show that 75% of the manufacturers are not providing a high level of empathy when carrying out repairs on colour television receivers.

5.4 SUMMARY

The retail questionnaire has revealed that significant differences in service and product quality exists between the manufacturers, with TVMANA and TVMANB being regarded by the retailers as the most preferred of the colour television manufacturers.

The retailers indicated that the consumers regard quality first, above price and after sales service respectively. No significant agreement on a definition for colour television receiver quality was found and that quality is, therefore, not a singular characteristic but consists rather of many characteristics or dimensions.

None of the manufacturers were found to have a very low frequency of repair to their brands and that approximately 17.5% of all sets sold require at least one repair or an exchange for a new product during the warranty period. This finding strongly supports the hypothesis that there is a need from the retailers for the South African manufacturers to improve the quality of colour television receivers. This may also suggest that there is a need to improve the quality control procedures employed by the colour television manufacturers.

A strong relationship between price, product demand, effective advertising and quality was found. For example, high quality, expensive products, effective advertising and high product demand were found to be associated.

The ranking of colour television receiver quality dimensions indicated that reliability, performance and durability should be singled out for special attention, should a manufacturing company choose to compete on the basis of quality.

Workmanship and product packaging were not found to be significant factors in giving rise to quality complaints. TVMANG is the only manufacturer to receive an above average to high rating for quality complaints resulting from product design flaws, whereas all the remaining manufacturers received a low to average rating. It is noteworthy that TVMANG is the only manufacturer involved with local design activities.

The retailers indicate that consumers understand how to operate their colour television receivers implying that the manufacturers have well prepared operating manuals from which both the retailers and the consumers are able to learn about the product. It is interesting that such a high percentage of retailers gives above average care to educating the consumer on product knowledge while concern about installation is mediocre. Manufacturers, however, are not responding timeously enough to solving newly discovered problems on their brands in the field even though a very high percentage of the retailers indicates that only valid service calls are placed with the manufacturers. This finding is consistent with the hypothesis that there is a need to improve the quality control procedures employed by the colour television manufacturers.

The dimensions of service quality were used to establish the performance of the manufacturer's repair service quality. The results indicate that the older manufacturers consisting of TVMANA, TVMANB, TVMANC, and TVMAND provide an above average level of repair service quality. However, the newer entrants of TVMANE, TVMANF, TVMANG and TVMANH are providing a mediocre level of repair service quality. It is noteworthy that the new manufacturers make extensive and almost exclusive use of appointed agents (see Section 8.3.2.6) while the more established manufacturers use their service departments and a few appointed agents in outlying areas. These findings support the hypotheses that repair service quality needs improvement.

CHAPTER 6

THE SERVICE QUESTIONNAIRE

6.1 INTRODUCTION

An important consumer need is the availability of service over the operating life of a product. The manufacturer's active and most important responsibility, in providing service, is with the warranty period which is normally in the range of one to three years for colour television receivers. During the warranty period an opportunity exists for good feedback to improve the quality and reliability of products from the service organisations. According to Juran *et al.* (1979:4-6) the failure of the manufacturer's service departments or agents to bridge the gap between their views and those of the consumers has been a major factor in stimulating the rise of other forces in the economy which offer to help bridge the gap, for example, consumer organisations, industry associations and standardisation bodies. Inefficiencies in service organisations, just as in manufacturing, raises prices to the consumer resulting in the lowering of living standards (Deming 1986:183).

The purpose of the service questionnaire is to test the validity of the hypotheses mentioned in Chapter 1, Section 1.4, that there is a need for the colour television manufacturers to improve product quality, repair service quality and their quality control procedures. In order to achieve this the following is ascertained:

- what the overall response is to each question in the questionnaire;

-
- whether any significant difference in service and product quality exists between the manufacturers; and
 - what the service repairers, as an industry, agree on in respect of service and product quality dimensions.

6.2 THE SURVEY SAMPLE

The service questionnaire was answered by technicians, foremen, service managers and business owners directly involved with colour television repairs in the province of Gauteng in the Republic of South Africa. A total of 191 persons was interviewed (see Table 6.1).

Table 6.1: Composition of sample in terms of service agent category

Service agent	Frequency	Percent	Cumulative frequency	Cumulative percent
Independent	145	75.9	145	75.9
Mastercare	29	15.2	174	91.1
Early Bird	13	6.8	187	97.9
Maxicare	4	2.1	191	100.0

The names and addresses of the service repair organisations were obtained from the colour television manufacturers. The manufacturer's own service departments was not included in the survey in order that an unbiased comparison between the manufacturers is obtained.

From Table 6.1 the independent repairers form the largest single group, followed by Mastercare, Early Bird and Maxicare. Table 6.2 shows the frequency breakdown of the respondents interviewed with field and/or workshop technicians representing 61.3% and

technical management representing 38.7%.

Table 6.2: Composition of sample in terms of responsibility category

Responsibility category	Frequency	Percent	Cumulative frequency	Cumulative percent
Business owner	44	23.0	44	23.0
Field	42	22.0	86	45.0
Workshop	42	22.0	128	67.0
Field + Workshop	33	17.3	161	84.3
Service manager	24	12.6	185	96.9
Foreman	6	3.1	191	100.0

From Table 6.3, 68.6% of the respondents have qualifications exceeding N3 or matriculation. The level of experience of the respondents in the service sample have a mean of 7.9 years and a standard deviation of 7.2 (see Part one: question three).

Table 6.3: Composition of sample in terms of highest education level obtained

Educational qualification	Frequency	Percent	Cumulative frequency	Cumulative percent
University degree	7	3.7	7	3.7
Technical diploma	76	40.4	83	44.1
Trade test	46	24.5	129	68.6
N3/Matric/Lower	59	31.4	188	100.0

6.3 THE STATISTICAL RESULTS

There are twenty-six questions in the service questionnaire (see Appendix B). Of these twenty-five are structured and only one (Part one: question seven) is unstructured (or open ended). Part one covers **general information** about the respondent and his or her perceptions and experience in repairing colour television receivers. Part two covers **product quality** with questions structured to ascertain a rating on every dimension for each manufacturer. Part three covers **service quality** with questions structured to ascertain a rating on every dimension for each manufacturer.

6.3.1 Service repairer preference of manufacturer

In question 5 (Part one) the service repairers are asked to indicate their preference of South African colour television manufacturer by ranking according to a given list. The most preferred manufacturer is obtained using the weighted ranking score method (see Section 5.3.4). The results are given in the percentage column in Table 6.4.

From Table 6.4 TVMANA (19.9%) and TVMANB (18.3%) have substantial representation in the sample. It is significant that both the retailers and service repairers agree on their ranking of the first four preferred manufacturers (compare Table 6.4 with Table 5.7), that is, TVMANA first, TVMANB second, TVMANC third and TVMAND fourth.

It is interesting that TVMANA, TVMANB, TVMANC and TVMAND have been manufacturing colour television receivers since 1974 when the government initially granted television manufacturing licenses (see Section 1.1 and Table 8.21). The similar results obtained between the retailers and the service repairers, in respect of manufacturer preference, may therefore be influenced by the period that manufacturers have been manufacturing colour television receivers rather than by the quality of product manufactured.

Table 6.4: Ranking of preferred manufacturer by the service repairers

Manufacturer	Ranking								
	One	Two	Three	Four	Five	Six	Seven	Eight	%
TVMANA	86	39	7	8	3	6	1	0	19.9
TVMANB	41	58	20	16	10	3	1	1	18.3
TVMANC	6	15	37	42	30	12	7	1	14.0
TVMAND	6	13	48	38	16	17	7	4	13.9
TVMANE	1	16	23	16	21	36	26	9	11.0
TVMANG	7	9	8	12	23	26	33	30	9.1
TVMANF	2	2	6	14	34	37	36	17	8.8
TVMANH	1	1	1	3	11	12	36	80	5.0

6.3.2 A comparison between local manufacture and imported colour television receivers

The service repairers maintain both imported and locally manufactured colour television receivers and are therefore ideally situated, particularly from the technical viewpoint, to comment on the quality and reliability performance of local manufacture versus imports.

In question 6 (Part one) the respondents are asked whether the quality of South African manufactured colour television receivers are below world standards. From the sample, 24.3% respondents indicated that South African manufactured products were below world standards, whereas 51.9% did not agree, whilst 23.8% indicated that they were not sure.

The same question was asked in the retail questionnaire (Part one: question 5) with 29.3% of the respondents indicating that South African manufactured products were below world standards, whereas 56.6% did not agree and 14.1% indicated that they were not sure. Table 6.5 summarises these responses.

A Chi-square (χ^2) test of significance between the retailers and the service repairers for the "yes" and "no" responses results in a value of 0.166 giving a probability value under the null hypothesis of 0.683 which is not significant at the 0.05 level. From these results, it is clear that there is no statistically significant difference in the quality of locally manufactured colour television receivers and imported sets even though a significant number of respondents was not sure.

Table 6.5: A comparison between the retailers and service repairers on whether the quality of South African manufactured colour television receivers are below world standards

Category	Response			
	Yes	No	Don't know	Total
RETAIL				
Frequency	58	112	28	198
Percent	29.3	56.6	14.1	100
SERVICE				
Frequency	46	98	45	189
Percent	24.3	51.9	23.8	100

6.3.3 The effect of the SABS mark on quality

As a consequence of the fact that South African legislation does not require a television manufacturer to comply with the SABS mark, it is important to ascertain whether the SABS mark bearing colour television receivers are superior in quality to those that are not, based

on repairs performed by the service repairers. Due to the nature of their work, the service repairers are suitably positioned to comment on whether SABS mark bearing colour television manufacturers produce superior quality products to those that do not.

In question 8 (Part one) the respondents are asked to indicate by how much the SABS mark bearing colour television receivers are superior in quality to those that are not. A five-point scale is used ranging from 1 ("none") to 5 ("very superior"). A mean of 3.13 with a standard deviation of 1.06 was obtained indicating that the service repairers consider SABS mark bearing colour television receivers to be almost on par with non-mark bearing television receivers. From the sample, 25.0% of the respondents indicated that mark bearing products were inferior in quality to non-mark bearing products with 35.0% indicating that mark bearing products were equivalent in quality and 40.0% indicated that mark bearing products were superior in quality.

6.3.4 The service repairer definition of colour television receiver quality

In question 9 (Part one) the service repairers are asked to rank the quality definitions espoused by the quality theorists (Demming, Crosby, Juran and Feigenbaum) in order to obtain insight into the meaning of colour television receiver quality. The most preferred definition of quality is obtained using the weighted ranking score method (see Section 5.3.5). The results are given in the percentage column in Table 6.6.

From these results there is no significant agreement on a definition for colour television receiver quality. As mentioned previously, when analysing the same question put to the retailers (see Section 5.3.5), the key lies in understanding that quality is not a singular characteristic. It is not surprising that the service repairers and retailers differ in their understanding of colour television quality. For example, the retailers prefer a more customer oriented definition ("meeting customer expectations"), while the service repairers prefer a more operator aligned definition ("pride of workmanship") of quality.

Table 6.6: Ranking of product quality definitions by the service repairers

Definitions of quality	Ranking					
	One	Two	Three	Four	Five	%
Pride of workmanship	43	53	30	30	28	21.92
Zero defects	58	29	18	11	68	19.93
Fitness for use	26	37	51	43	27	19.71
Meeting customer expectations	21	41	42	57	23	19.28
Conformance to requirements	36	24	43	43	38	19.17

6.3.5 Product quality

6.3.5.1 A comparison between the manufacturers on the frequency of repairs

As with all quality characteristics, the reliability requirements of a product are determined by its consumer's requirements in use. The frequency of failure of a product in the field provides information on the ability of the manufacturers to design, assemble and test their products to perform their intended function.

In question 1 (Part two) the respondents are asked to rate each manufacturer on how frequently their colour television receiver brand(s) require repairs. A five-point scale is used ranging from 1 ("very low") to 5 ("very high"). Table 6.7 shows the mean rating and the Duncan grouping for the colour television manufacturers. It must be noted that the means with the same letter are not significantly different. It is clear from these results that TVMANA has a significantly lower frequency of repair in comparison to the other manufacturers. However, on the other end of the spectrum TVMANG has a significantly higher frequency of repair. From these results no manufacturer is considered to have a very

low frequency of repair to their products and therefore it may be concluded that the reliability of colour television receivers have not been optimised and that opportunities for improvement exist.

It is interesting that the retailers rate the frequency of repair marginally higher than the service repairers but agree on the order in which the manufacturers experience repairs to their products - compare Table 5.9 with Table 6.7.

Table 6.7: Frequency of repairs by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	186	2.0269	A		
TVMANB	186	2.5323	B		
TVMANC	184	2.8207		C	
TVMAND	177	2.8249		C	
TVMANE	132	3.0152	D	C	
TVMANF	130	3.1462	D		
TVMANH	72	3.2778	D		
TVMANG	139	3.5683			E
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	244.17	34.88	30.4	.0001
Error	1198	1376.56	1.14		
Corrected	1205	1620.73			

It is easy to show that functional defects are absent on a product such as a colour television receiver. All that is required is to simply switch the product on and by systematically operating the controls and observing the output, confirmation of functionality is obtained. Reliability defects, however, are the most difficult of all to locate because they do not manifest immediately. The difficulty of testing for reliability defects has been the main

reason for colour television receivers requiring burn-in during manufacture. Thus, insufficient burn-in or product ageing during manufacture may be the main cause of failures in the field and in particular during the warranty period.

6.3.5.2 A comparison between the manufacturers on product life

Durability refers to the useful life of a product before it physically deteriorates and repair is impossible or replacement is regarded as preferable to repair. Garvin (1984b:31) maintains that durability and reliability are closely linked. A product that fails more frequently is likely to be scrapped earlier than one that is more reliable.

In question 2 (Part two) the respondents are asked to rate each manufacturer on the durability of their colour television receiver brands. A five-point scale is used ranging from 1 ("very poor") to 5 ("excellent").

The results in Table 6.8 indicate that statistically significant differences between the manufacturers exists. It is noteworthy that TVMANA and TVMANB have a mean rating exceeding 4, implying that the durability of their products is considered to be good and in some instances excellent. TVMANF, TVMANG and TVMANH on the other hand are rated below 3, implying below average to poor durability.

The durability results are similar to the reliability findings (long product life is associated with low frequency of repair) thus supporting Garvin's notion that durability and reliability are linked. Durability estimates should be interpreted with care. An increase in the life of a colour television receiver may be due to technical improvements. For example, valves used in earlier models have been replaced with transistors and the increased use of integrated circuits has reduced the number of discrete components and therefore the probability of failure. In addition, environmental changes have been responsible for the decrease in the durability of colour television receivers in South Africa. For example, an increase in the number of programmes and extended viewing time results in more use of the product by

consumers.

Table 6.8: Longest product life by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	189	4.4180	A		
TVMANB	189	4.1746	B		
TVMANC	189	3.5397	C		
TVMAND	180	3.5333	C		
TVMANE	132	3.0682	D		
TVMANF	124	2.9032	D		
TVMANG	129	2.4419	E		
TVMANH	63	2.4127	E		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	533.08	76.15	113	.0001
Error	1187	797.28	0.67		
Corrected	1194	1330.36			

It is unclear to what extent technical improvements and environmental changes have impacted on the durability of colour television receivers in South Africa. However, the overall results from the service repairer's ratings indicate that the majority of the manufacturer's products manifest an above average to good durability performance.

6.3.5.3 A comparison between the manufacturers on maintainability

The degree of satisfaction a consumer obtains from a product or, in other words, its value depends on how well it works; how much is paid for it; whether it works; whether it can be repaired and the elapsed time before service is restored when it has failed; and how much it costs to keep it in working condition.

In question 2 (Part two) the respondents are asked to rate each manufacturer on the ease in which repairs are carried out on their colour television receiver brands. A five-point scale is used ranging from 1 ("very poor") to 5 ("excellent").

Table 6.9: Maintainability by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	189	3.1799	A		
TVMANB	189	3.1376	A		
TVMAND	180	3.0889	A		
TVMANF	124	3.0645	A		
TVMANC	189	3.0423	A		
TVMANE	133	3.0226	A		
TVMANH	64	2.9219	A		
TVMANG	128	2.9141	A		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	8.15	1.16	1.08	.3749
Error	1188	1283.62	1.08		
Corrected	1195	1291.78			

The results in Table 6.9 show that there is no statistical significant difference between the manufacturers - the Duncan grouping is identical for the colour television manufacturers.

A mean rating of 3, which is average, indicates that an opportunity exists in improving the restoration time of defective colour television receivers to a working condition and that no manufacturer has a distinct advantage.

To attain a proper balance between maintainability and other parameters it requires that the manufacturers give consideration to various alternatives and trade-offs, for example, **modular**

versus **non-modular** construction. Modular design requires added design and production costs but reduces the time required for diagnosis and remedy in the field. The fault is localised to the modular level, after which the defective module is replaced. For some modules, the cost of field repair exceeds the cost of manufacturing new units in the factory and in such cases design for throw away is a viable option. Another example is to **minimise complexity**. By populating the printed circuit board with components on both sides reduces material and production costs but increases the time required for diagnosis and repair.

6.3.5.4 A comparison between the manufacturers on product design

It is important to ensure that product design and its manufacture will provide the intended consumer quality satisfaction in use. A few specific consumer quality requirements are product features, reliability, safety, reasonable tolerances, appropriate service and maintainability features and adequate packaging requirements.

In question 2 (Part two) the respondents are asked to rate each manufacturer on the design of their colour television receiver brands. A five-point scale is used ranging from 1 ("very poor") to 5 ("excellent").

The results in Table 6.10 show that statistically significant differences between the manufacturers exists. The mean rating and the Duncan grouping shows TVMANA and TVMANB to have an above average to good rating with TVMANF, TVMANH and TVMANG being rated below average to poor. It is noteworthy that TVMAND, TVMANC and TVMANE obtained only average performance ratings.

These results may imply that product design reviews have not been formally procedurised in the majority of the manufacturers. Product design review considers the examination of product concepts, drawings, specifications, production plans, components and sub assemblies, as well as the full assembly and all equipment used to ensure consumer satisfaction.

Table 6.10: Product design by manufacturer

Manufacturer	No. of Responses	Mean Rating	Duncan Grouping		
TVMANA	189	4.0265	A		
TVMANB	189	3.8201	B		
TVMAND	180	3.2778	C		
TVMANC	189	3.2487	C		
TVMANE	133	3.0301	D		
TVMANF	124	2.8306	D	E	
TVMANH	64	2.6719		E	
TVMANG	128	2.4609	F		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	303.50	43.36	60.4	.0001
Error	1188	853.41	0.72		
Corrected	1195	1156.91			

6.3.5.5 A comparison between the manufacturers on overall quality

In question 2 (Part two) the respondents were asked to rate the manufacturers according to the overall quality of their colour television receiver brands. A five-point scale is used ranging from 1 ("very poor") to 5 ("excellent"). Table 6.11 shows that TVMANA and TVMANB products are significantly better in overall quality than the other manufacturers. TVMAND and TVMANC are second followed by TVMANE with TVMANF, TVMANH and TVMANG respectively.

From these results only one manufacturer (TVMANA) was rated good to excellent with TVMANB being rated marginally below good. TVMANF, TVMANH and TVMANG colour television receiver brands were rated below average for their overall quality whilst TVMAND, TVMANC and TVMANE were rated marginally above average for overall

quality. These results indicate that there is a need for the majority of the manufacturers to improve their overall quality.

Table 6.11: Overall quality by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	188	4.24468	A		
TVMANB	188	3.95213	B		
TVMAND	179	3.32961	C		
TVMANC	188	3.30851	C		
TVMANE	132	3.03788	D		
TVMANF	123	2.93496	D		E
TVMANH	63	2.63492	E		E
TVMANG	127	2.56693	E		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	362.25	51.75	81.5	.0001
Error	1180	749.04	0.63		
Corrected	1187	1111.30			

It is interesting that the results from the retailers and service repairers in respect of overall quality are very similar (compare Tables 5.14 with Tables 6.11).

6.3.5.6 A comparison between the manufacturers on workmanship

Workmanship implies that both mental and physical abilities are required through which manufacturing personnel perform operations essential to quality. To achieve this, quality education and training activities must maximise exposure, experience and employee participation in quality problem solving and troubleshooting. Enthusiastic participation and support from all manufacturing personnel is central to achieving quality.

Table 6.12: Workmanship by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	188	4.44149	A		
TVMANB	188	4.22340	B		
TVMAND	179	3.54749	C		
TVMANC	188	3.54255	C		
TVMANE	130	3.09231	D		
TVMANF	126	3.01587	D		
TVMANH	65	2.69231	E		
TVMANG	127	2.64567	E		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	449.51	64.22	100	0.000
Error	1183	753.74	0.64		
Corrected	1190	1203.26			

In question 3 (Part two) the respondents were asked to rate the manufacturers in respect of workmanship being the possible cause of quality problems in the field. A five-point scale is used ranging from 1 ("very poor") to 5 ("excellent").

In Table 6.12 it can be seen that statistically significant differences exists between the manufacturers. TVMANH and TVMANG were the only manufacturers to be rated below average for workmanship performed, whilst TVMANA and TVMANB obtained a rating between good to excellent. These results may indicate that only four manufacturers are providing adequate training and motivation in respect of assembly operations. Employee participation will enable companies to pinpoint, examine, analyse and solve problems, often quality, but also productivity, to achieve international standards of workmanship. Only by seriously integrating employee participation within a companywide total quality framework can its effectiveness be consistent over the long term thereby guaranteeing excellence in

workmanship.

6.3.5.7 The quality of components

The major challenge that has resulted from more complex consumer products, with increased functions and performance requirements, is the need for a high degree of reliable components used. Components possess qualities which are collectively so vital that they are one of the main factors in deciding the quality of the final product. Some of the components used in television receivers are relatively simple, for example resistors, capacitors and semiconductor devices. However, more complicated and costly components such as large-scale integrated circuits and cathode-ray tubes, are also used. Electronic components have undergone an astonishing rate of development. For example, resistors have gone from carbon composition to chip form with capacitors now also being found in chip form. Integrated circuits are now capable of carrying thousands of circuit elements on a tiny semiconductor chip. These developments have made additional demands on manufacturers by requiring them to introduce new orders of precision and protection against failure due to electric static discharge.

In question 3 (Part two) the respondents were asked to rate the manufacturers in respect of components being the possible cause of quality problems in the field. A five-point scale is used ranging from 1 ("very poor") to 5 ("excellent").

In Table 6.13 it can be seen that a statistically significant difference exists between the manufacturers with TVMANA performing significantly better than all the manufacturers. From Table 6.13 it is interesting that none of the manufacturers obtained a rating of good to excellent. In comparing the ratings in Table 6.12 with Table 6.13 it is clear that component failure is contributing more than poor workmanship to field quality problems.

According to Feigenbaum (1986:576) the "infant mortality" period for electronic products is caused by early failure of weak components due to non-random assignable causes. This period is typified by an initial high failure rate which drops off. An increased burn-in period,

during manufacture is a possible solution to the component failures occurring in the field. The absence of anti-static protection of some components, particularly integrated circuits, during manufacture may also be a contributing factor to field failures.

Table 6.13: The quality of components used by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	189	3.5661	A		
TVMANB	189	3.4497	A		B
TVMAND	180	3.2611			B
TVMANC	189	3.1058	C		
TVMANE	131	3.0611	C		
TVMANF	127	2.8661	C		D
TVMANH	65	2.7231			D
TVMANG	128	2.6172			D
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	111.75	15.96	14.7	0.000
Error	1190	1293.30	1.09		
Corrected	1197	1405.06			

6.3.5.8 A comparison between the manufacturers on packaging

The packaging and transportation specifications by which a colour television receiver will be protected as well as the selection of the transportation by which the product will be moved to the retailer from the manufacturer are important considerations that will keep the product functioning according to the design intent.

In question 3 (Part two) the respondents were asked to rate the manufacturers in respect of packaging being the possible cause of quality problems in the field. A five-point scale is used ranging from 1 ("very poor") to 5 ("excellent").

Table 6.14: Packaging by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANB	173	3.9595	A		
TVMANA	173	3.9249	A		
TVMANC	173	3.5954	B		
TVMAND	164	3.4695	B		C
TVMANE	115	3.3130	D		C
TVMANF	113	3.2212	D		
TVMANG	112	3.0893	D		E
TVMANH	59	2.9831			E
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	115.81	16.54	21.9	0.000
Error	1074	809.55	0.75		
Corrected	1081	925.37			

In Table 6.14 the manufacturers differ significantly with regard to packaging being the possible cause of quality complaints occurring in the field. The ratings range from average to good indicating that although improvements could be made, no major problems appear to be arising from packaging defects. These results concur with the findings in the retail questionnaire (see Section 5.3.11).

Packaging design is normally evaluated by simulating transportation by impact testers and vibration tables. Trial shipments can also be made which are representative of what may be encountered. Institutions such as the SABS provide a service for the industry and are able

to verify whether design criteria are being met.

6.3.5.9 A comparison between the manufacturers on soldering

The manufacture of a television receiver involves the interconnection among many parts (approximately 1 000 components for a 51cm colour television receiver) and each of these is a potential source of circuit failure. Controls on completed joints are based on visual inspection and therefore the variables such as solder temperature, flux density and exposure time need to be well controlled to ensure reliable solder joints. Although the visual appearance of good solder joints has been well defined in the industry, solder defects are one of the major reasons for field defects occurring on some colour television receivers during the warranty period (Higgins 1992:138).

Table 6.15: Soldering by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	185	4.3838	A		
TVMANB	186	4.2043	A		
TVMANC	185	3.6054	B		
TVMAND	176	3.5682	B		
TVMANE	126	3.1587	C		
TVMANF	121	3.0909	C		
TVMANG	127	2.8583	D		
TVMANH	62	2.6774	D		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	360.08	51.44	74.9	.0001
Error	1160	797.19	0.69		
Corrected	1167	1157.27			

In question 4 (Part two) the respondents were asked to rate the manufacturers on their solder quality. A five-point scale is used ranging from 1 ("very poor") to 5 ("excellent").

It is clear from the results shown in Table 6.15 that TVMANA and TVMANB have a significantly higher rating in comparison to the other manufacturers. However, on the other end of the spectrum TVMANG and TVMANH have a significantly lower rating (poor to average) with the remaining manufacturers of TVMANC, TVMAND, TVMANE and TVMANF having an average to good rating for their products. A good to excellent rating would indicate that failures due to soldering defects are minimal and that the soldering process is probably well controlled. This implies that the majority of the manufacturers (75%) are experiencing solder defects on their products requiring repairs.

6.3.5.10 A comparison between the manufacturers on product assembly

Colour television receivers are built from numerous parts, progressing through a series of assemblies into sub-components which are then synthesised into a final product. Various assembly techniques are used: machine insertion, hand insertion, mechanical, electrical and chemical. As a consequence, these various assembly operations create many intermediate quality characteristics, requiring detailed specifications and strict process control. Many of the parts require standards, tools, gages and methods to ensure that assembly operations perform smoothly resulting in reliable products being manufactured.

In question 4 (Part two) the respondents were asked to rate the manufacturers on their assembly quality. A five-point scale is used ranging from 1 ("very poor") to 5 ("excellent").

The results in Table 6.16 indicate that significant differences between the manufacturers exists with no manufacturer having a mean rating of 4 and above. The majority of manufacturers consisting of TVMANA, TVMANB, TVMAND, TVMANC, and TVMANE are rated above average for their products. A good to excellent rating would indicate that failures due to assembly defects are minimal and that the various assembly processes are probably well

controlled. This implies that the majority of the manufacturers (62.5%) are experiencing a high number of assembly defects on their products requiring repairs.

Table 6.16: Product assembly by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	188	3.7394	A		
TVMANB	187	3.5561	A		B
TVMAND	179	3.3520	C		B
TVMANC	187	3.1765	C		D
TVMANE	129	3.1008	C		D
TVMANF	124	2.9677			D
TVMANG	130	2.7077	E		
TVMANH	64	2.5781	E		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	145.13	20.73	18.1	.0001
Error	1180	1352.46	1.14		
Corrected	1187	1497.59			

6.3.5.11 A comparison between the manufacturers on alignment

Colour television receivers are subjected to numerous critical alignment criteria during manufacture and these are: system voltage, intermediate frequency for vision and sound, colour matrixing, automatic gain control, automatic frequency control, focus, picture height and position, convergence, purity and white-balance. All of these criteria impact on the performance of the product which requires operators to be properly trained to interpret requirements that must meet with engineering specifications and consumer expectations.

In question 4 (Part two) the respondents were asked to rate the manufacturers on their

alignment quality. A five-point scale is used ranging from 1 ("very poor") to 5 ("excellent").

Table 6.17: Product alignment by manufacturer

Manufacturer	No. of Responses	Mean Rating	Duncan Grouping		
TVMANA	186	3.7097	A		
TVMANB	186	3.5376	A	B	
TVMAND	177	3.3277	C	B	
TVMANC	187	3.3102	C	B	
TVMANF	122	3.1066	C		
TVMANE	127	3.0945	C		
TVMANG	128	2.7422	D		
TVMANH	63	2.5238	D		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	128.03	18.29	16.8	.0001
Error	1168	1272.25	1.09		
Corrected	1175	1400.28			

The results in Table 6.17 shows that statistically significant differences between the manufacturers exist. It is clear from these results that no manufacturer has a mean rating of 4 and above and that the majority of manufacturers consisting of TVMANA, TVMANB, TVMAND, TVMANC, TVMANF and TVMANE are rated above average for their products. A good to excellent rating would indicate that failures due to alignment defects are minimal and that the various alignment processes are probably well controlled. This implies that the majority of the manufacturers (62.5%) are experiencing a high number of alignment defects on their products requiring repairs.

6.3.5.12 A comparison between the manufacturers on product testing

The main purpose of testing and inspection is to determine whether products conform to a standard or specification. This is often called "acceptance testing", or "product acceptance". Some quality characteristics and defects are very important and others are not. This has led to a seriousness classification for both quality characteristics and defects with some degree of overlap between them. The implication of the seriousness classification is that inspectors are required to receive appropriate training so as to judge conformance to requirements.

In question 4 (Part two) the respondents were asked to rate the manufacturers on their test and inspection quality. A five-point scale is used ranging from 1 ("very poor") to 5 ("excellent").

Table 6.18: Product testing by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	191	4.0262	A		
TVMANB	185	3.9405	A		B
TVMAND	175	3.4114			B
TVMANC	191	3.2565			B
TVMANG	126	2.6667	C		
TVMANH	63	2.6508	C		
TVMANE	191	2.0052	D		
TVMANF	191	1.9110	D		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	843.54	120.51	86.0	.0001
Error	1305	1828.82	1.40		
Corrected	1312	2672.36			

The results in Table 6.18 indicates that statistically significant differences between the manufacturers exists. It is clear from these results that only one manufacturer (TVMANA) has a mean rating of 4 and above (good to excellent) and that half of the manufacturers are rated below average (TVMANG, TVMANH, TVMANE and TVMANF) for their products. A below average rating for inspection and testing for half of the manufacturers is indicative of a serious deficiency existing in the planning and management of quality in the colour television industry.

6.3.5.13 The responsiveness of the manufacturers to solving newly discovered quality problems in the field

Quality complaints flow in to the manufacturers from a variety of sources such as: consumers, retailers and service repairers. The service repairers generally telephone their complaints through to the manufacturer's sales department or the quality department. Not only does this information alert management to the need for rapid product corrective action but also provides valuable input toward the development of new models and similar products. In question 5 (Part two) the respondents were asked to rate the manufacturers on their responsiveness to solving newly discovered quality problems in the field. A five-point scale is used ranging from 1 ("very poor") to 5 ("excellent").

The results in Table 6.19 indicate that statistically significant differences between the manufacturers exist. It is noteworthy that the majority of the manufacturers (62.5%) have a mean rating of 3 to 3.5, which is marginally above average, and that TVMANF, TVMANG, and TVMANH are rated below average for responsiveness to solving newly discovered problems in the field.

A lack of understanding of the importance and timely response to newly discovered field problems may be the primary reason for the large number of warranty failures occurring in the colour television industry. A period of time elapses from the time a product is sold by the manufacturer to the retailer until it reaches the consumer. This period of time is variable

and is dependent on a number of factors such as credit terms, quantity discounts, storage facilities and varying consumer purchasing patterns. This time lag allows unknowable defects, particularly time related, to accumulate in large numbers before corrective action is able to be taken. Fast, automatic response to help a company's personnel prevent poor quality is the life blood of the quality control department which appears to be lacking in the industry.

Table 6.19: Responsiveness of the manufacturers to field problems

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	184	3.5598	A		
TVMANB	187	3.4973	A	B	
TVMAND	180	3.2944	C	B	
TVMANC	186	3.1935	C		
TVMANE	132	3.0455	C	D	
TVMANF	127	2.8031	E	D	
TVMANG	133	2.6842	E	F	
TVMANH	72	2.5139		F	
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	132.21	18.99	17.7	.0001
Error	1193	1273.05	1.06		
Corrected	1200	1405.25			

6.3.5.14 The ranking of product quality dimensions

Due to the various connotations of quality existing in the television industry and that quality does not pertain to a single aspect of a product the researcher attempts to establish the meaning of colour television receiver quality from the perspective of the service repairers.

In question 6 (Part two) the respondents are asked to rank all eight quality dimensions in respect of their importance to colour television receivers. The ranking of the dimensions of product quality are obtained using the weighted ranking score method. The ranking for each dimension is shown in Table 6.20.

From Table 6.20 it is interesting that the service repairers do not rank maintainability first as this aspect has a direct impact on their ability to perform efficiently.

These results indicate that a manufacturing company choosing to compete on the basis of quality, would probably single out reliability, maintainability, durability and conformance for special attention. In doing so, high reliability will require special attention to design with conformance to requirements necessitating precision testing to ensure specifications are met whereas durability will require the use of long-lived components and exceptional maintainability requiring a strong customer service department.

Table 6.20: Ranking of product quality dimensions

Quality dimensions	Ranking								%
	One	Two	Three	Four	Five	Six	Seven	Eight	
Reliability	52	27	19	25	25	24	6	3	15.8
Maintainability	25	32	31	32	19	24	11	7	14.5
Durability	22	27	36	24	17	13	28	14	13.5
Conformance	27	32	19	16	21	17	17	32	12.8
Performance	15	18	23	35	32	18	23	17	12.3
Features	12	28	23	15	22	39	29	13	12.0
Perceived quality	3	10	22	25	35	22	42	22	10.2
Aesthetics	25	8	7	9	10	25	26	71	8.9

It is clear that the different dimensions of quality require different forms of expertise and it is unlikely that manufacturers will prosper by trying to succeed on all dimensions at once. A possible solution would, therefore, involve a segmentation strategy employing a limited set of objectives utilising tradeoffs among the various dimensions of quality and between these dimensions and the objectives of cost, market share and profitability.

6.3.6 Service quality

6.3.6.1 Service quality dimensions

The meaning of colour television repair service quality, as with product quality, is established by finding out which dimensions can be singled out for special attention. In question 1 (Part three) the respondents are asked to rank all five service quality dimensions in respect of their importance to colour television receiver repairs.

In order to establish the most preferred dimension of service quality the weighted ranking score method is used. The ranking for each dimension is shown in Table 6.21.

Table 6.21: Ranking of service quality dimensions

Quality dimensions	Ranking					
	One	Two	Three	Four	Five	%
Reliability	70	46	14	27	22	24.3
Responsiveness	41	47	46	29	16	22.6
Assurance	11	44	53	50	21	19.1
Empathy	39	18	23	34	64	17.3
Tangibles	18	25	41	39	56	16.7

From Table 6.21 reliability (24.3%), responsiveness (22.6%) and assurance (19.1%) have substantial representation in the sample.

From these results, a manufacturing company would probably single out reliability, responsiveness and assurance for special attention when conducting repairs to defective colour television receivers. It is interesting that the service repairer's rankings are similar to those of the retailers (see Table 5.20).

The reliability of a repair requires the diagnosing and repair of the cause of the fault and not only the symptom. Assurance entails approachability, politeness, respect, consideration and friendliness. Responsiveness involves timeliness of service, for example, by initiating repairs quickly and calling the consumer back promptly about the status of the repair. Although the dimensions of tangibles and empathy are not as important, they should be applied appropriately.

6.3.6.2 The average time to repair a colour television receiver

The average time to repair a colour television receiver is not only influenced by design practices, but procedures, facilities, equipment, availability of spare parts and personnel must all be integrated through the service repair system and used to perform the repair operations.

In question 2 (Part three) the respondents are asked to indicate the average time (in hours) to repair a colour television receiver, excluding travelling and administration time, for each of the manufacturer's products. From Table 6.22 the average time to repair varies from 2.51 hours to 3.25 hours with no statistically significant differences existing between the manufacturers.

These results indicate that colour television receivers are not easily restored to service after failure. An average repair time of 2.75 hours (calculated from Table 6.22) appears to be unacceptable. The work force, skills, technical data, test equipment and support facilities in

the colour television industry are probable factors contributing to the poor repair time.

Table 6.22: Average time to repair by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANH	89	3.2517	A		
TVMANF	126	2.9587	A		
TVMANG	130	2.8638	A		
TVMANE	129	2.8155	A		
TVMAND	171	2.6532	A		
TVMANB	177	2.6124	A		
TVMANC	179	2.6089	A		
TVMANA	179	2.5073	A		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	48.99	6.99	0.33	.9385
Error	1172	24538.38	20.94		
Corrected	1179	24587.37			

6.3.6.3 The adequacy of service quality as perceived by the service repairers

In question 3 (Part three) the respondents are asked to rate their firm's repair service quality in relation to their competitors. A five-point scale is used ranging from 1 ("much worse") to 5 ("much better"). From the sample, 28% of the respondents indicated that their repair service quality was the same, 47.1% indicated that theirs was a little better and 24.9% indicated that their repair service quality was much better. The mean score obtained is 3.97 with a standard deviation of 0.73. However, when asked, in question 4 (Part three) if they feel any pressure to increase the service quality of their firm's repair service 49.2% indicated that a lot of pressure is applied, 29.1% indicated sufficient pressure, 9.5% indicted too much pressure and 12.2% indicted that little or no pressure is applied. When asked how much

attention is given to repair service quality, 58.3% of the respondents indicted a lot of attention, 28.3% sufficient attention, 9.1% too much attention and 4.2% little to no attention. On a five-point scale ranging from 1 ("no attention") to 5 ("too much attention") a mean of 3.72 with a standard deviation of 0.70 is obtained. These results indicate that both external (consumers) and internal (management) pressure of approximately the same order of magnitude is being applied to the service repairers to improve their repair service quality.

In Table 6.23 a comparison between the independent service repairers and the non-independent service repairers of Mastercare, Maxicare and Early Bird is made in respect of external pressure to improve their repair service quality.

Table 6.23: A comparison between the service repairers

Service repairers	Response categories					
	None	Little	Sufficient	A Lot	Too Much	Total
Independent						
Frequency	9	10	41	68	15	143
Percent	6.3	7.0	28.7	47.6	10.5	100
Non Independent						
Frequency	1	3	14	25	3	46
Percent	2.2	6.5	30.4	54.4	6.5	100

A Chi-square (χ^2) test of significance between the independent and non-independent service repairers for the responses in Table 6.23 gives a value of 2.1 giving a probability value under the null hypothesis of 0.72 which is not statistically significant at the 0.05 level.

6.3.6.4 The responsiveness of the manufacturers in providing technical assistance

The numerous colour television service centres in South Africa are so small that they seldom

make provision for technical training. The onus lies with the manufacturers in establishing technical training courses which technicians may attend as well as providing service manuals. These manuals should provide well designed aids for diagnosis and repair, including exploded views showing the structure of the product, parts lists and detailed instructions for repair.

In question 6 (Part three) the respondents are asked to estimate the responsiveness or willingness of the manufacturers in providing components, service diagrams and technical assistance which is summarised in Table 6.24.

From these results, TVMANA, TVMANB, TVMAND, TVMANE and TVMANC all provide above average technical assistance for the service repair centres whereas TVMANF, TVMANG and TVMANH are the only manufacturers providing below average technical assistance.

Table 6.24: The responsiveness or willingness of the manufacturers

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	187	3.5401	A		
TVMANB	187	3.3904	A		B
TVMAND	180	3.2000	C		B
TVMANE	131	3.1298	C		B
TVMANC	186	3.0806	C		
TVMANF	124	2.6452	D		
TVMANG	130	2.5769	D		
TVMANH	69	2.2609	E		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	163.15	23.31	20.1	.0001
Error	1186	1373.76	1.15		
Corrected	1193	1536.91			

From Table 6.24, the manufacturers differ significantly with regard to providing technical assistance. TVMANF, TVMANG and TVMANH are rated significantly lower to TVMANA, TVMANB, TVMAND, TVMANE and TVMANC. It is noteworthy that TVMANH provides significantly inferior technical assistance compared to all the manufacturers.

These results show that 62.5% of the manufacturers are providing an above average level of technical assistance to the service repairers.

6.3.6.5 The quality of technical information provided by the manufacturers

In question 7 (Part three) the respondents are asked to estimate the quality of service manuals and technical information provided by the manufacturers to the service repairers which is summarised in Table 6.25.

Table 6.25: A comparison between the manufacturers on technical information

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	188	3.7394	A		
TVMANB	188	3.5213	A	B	
TVMANE	132	3.1591	C	B	
TVMANC	187	3.1497	C	B	
TVMAND	180	3.1333	C		
TVMANG	132	2.6439	D		
TVMANF	125	2.6400	D		
TVMANH	70	2.2857	E		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	209.76	29.97	22.9	.0001
Error	1194	1562.76	1.31		
Corrected	1201	1772.52			

The mean rating and Duncan grouping shown in Table 6.25 indicates that the manufacturers differ significantly with regard to providing quality technical information. TVMANG, TVMANF and TVMANH are rated significantly lower than TVMANA, TVMANB, TVMANE, TVMANC and TVMAND. From these results, TVMANA, TVMANB, TVMANE, TVMANC and TVMAND all provide above average quality service manuals and technical information for the service repair centres whereas TVMANG, TVMANF and TVMANH are the only manufacturers providing below average quality service manuals and technical information. It is noteworthy that TVMANH provides significantly inferior quality service manuals and technical information compared to all the manufacturers.

6.3.6.6 The reliability of service provided by the manufacturers

The provision of reliable service to the service repairers requires the participation and action from all the manufacturers' major departments which includes engineering, purchasing, production, service and quality control. The growing complexity of colour television receivers requires service repair manuals, parts lists and "exploded" views for improving the skills and competence of repairers. As soon as a new model goes on sale the supply of spare parts should be available. However, the discontinuance of a model does not abolish the need for spare parts, requiring the manufacturers to keep stock of spare parts for many years.

In question 8 (Part three) the respondents are asked to estimate the reliability of the manufacturers in providing components, service diagrams and technical assistance which is summarised in Table 6.26.

The mean rating and Duncan grouping shown in Table 6.26 indicates that the manufacturers differ significantly with regard to providing reliable technical assistance. TVMANF, TVMANG and TVMANH are rated significantly lower than TVMANA, TVMANB, TVMAND, TVMANC and TVMANE. From these results, TVMANA, TVMANB, TVMAND, and TVMANC provide an average to good level of technical assistance for the service repair centres whereas TVMANE, TVMANF, TVMANG and TVMANH provide

poor assistance.

Table 6.26: A comparison between the manufacturers in providing reliable service

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	187	3.6631	A		
TVMANB	187	3.3850	B		
TVMAND	179	3.2067	B		C
TVMANC	186	3.0054	D		C
TVMANE	129	2.8915	D		
TVMANF	121	2.6033	E		
TVMANG	129	2.4186	E		F
TVMANH	68	2.2647			F
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	216.67	30.95	27.5	.0001
Error	1178	1328.47	1.12		
Corrected	1185	1545.14			

6.3.6.7 The credibility and competence of the manufacturers

The service repairers have extensive need for competent assistance and correct information from the manufacturers. In some cases the technological ignorance of the service repairer requires that qualified manufacturing specialists be available to diagnose problems and in other cases the need is mainly for explanation.

In question 9 (Part three) the respondents are asked to estimate the credibility and competence of the manufacturers in providing correct information and parts required for repairs to colour television receivers which is summarised in Table 6.27.

The mean rating and Duncan grouping shown in Table 6.27 indicates that the manufacturers differ significantly with regard to competent technical assistance. TVMANF, TVMANG and TVMANH are rated significantly lower than TVMANA, TVMANB, TVMAND, TVMANC and TVMANE. From these results, TVMANA, TVMANB, TVMAND, TVMANC and TVMANE are sufficiently competent in providing technical assistance to the service repair centres whereas TVMANF, TVMANG and TVMANH all provide poor assistance.

These results show that 62.5% of the manufacturers are sufficiently competent in providing parts and technical information to the service repairers.

Table 6.27: A comparison between the manufacturers on credibility and competence

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	187	3.9358	A		
TVMANB	187	3.6898	B		
TVMAND	179	3.4413	C		
TVMANC	186	3.3441	C		
TVMANE	129	3.2901	C		
TVMANF	121	2.7073	D		
TVMANG	129	2.6231	D		
TVMANH	68	2.5571	D		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	249.27	35.61	38.9	.0001
Error	1185	1083.59	0.91		
Corrected	1192	1332.87			

6.3.6.8 Empathy displayed by the manufacturers

A further dimension of service quality is consumer empathy. It is important for the

manufacturers to create an "atmosphere" which meets the needs of the service repairers. By designing into their plan of consumer relations the manufacturers can enforce a feeling of importance, courtesy and respect when dealing with the service repairers.

In question 10 (Part three) the respondents are asked to estimate the ability of the manufacturers to communicate and understand the requirements of the service repairers which is summarised in Table 6.28.

Table 6.28: A comparison between the manufacturers on empathy displayed

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	187	3.8075	A		
TVMANB	187	3.6364	A		
TVMANC	186	3.3763	B		
TVMAND	179	3.3352	B		
TVMANE	130	3.0615	C		
TVMANG	130	2.7538	D		
TVMANF	121	2.6694	D		
TVMANH	73	2.5068	D		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	7	208.02	29.72	25.9	.0001
Error	1185	1356.54	1.14		
Corrected	1192	1564.56			

The mean rating and Duncan grouping shown in Table 6.28 indicates that the manufacturers differ significantly with regard to empathy. TVMANG, TVMANF and TVMANH are rated significantly lower than TVMANA, TVMANB, TVMANC, TVMAND and TVMANE. From these results, TVMANA, TVMANB, TVMANC, TVMAND and TVMANE are sufficiently empathetic when providing technical assistance to the service repair centres

whereas TVMANG, TVMANF and TVMANH are less empathetic.

These results show that 62.5% of the manufacturers are sufficiently empathetic when providing assistance to the service repairers.

6.4 SUMMARY

The service questionnaire has revealed that TVMANA and TVMANB are regarded by the service repairers as the most preferred of the colour television manufacturers which concurs with the opinions of the retailers (see Section 5.4).

The service repairers indicated that the quality of South African colour television receivers is not below world standards and consider the quality of SABS mark bearing sets to be on par with non-mark bearing sets.

No significant agreement on a definition for colour television receiver quality was found and therefore quality is not a singular characteristic, but consists rather of many characteristics or dimensions.

No manufacturer is considered to have a very low frequency of repair to their products and therefore it may be concluded that product reliability has not been optimised and that opportunities for improvement exist.

In examining the service repairers' opinions on repair time, design, workmanship, components, packaging, soldering, assembly, alignment and testing, it was established that:

- TVMANA and TVMANB were rated average to good and were assessed consistently higher than the other manufacturers. In most circumstances a statistically significant difference was found between TVMANA and TVMANB and the remaining manufacturers

-
- no statistical significant difference was found on the time required to repair the various manufacturer's products. This indicates that all colour television receivers are repaired in approximately the same time. However, a repair time of 2.75 hours appears to be unacceptable. The work force, skills, technical data, test equipment and support facilities in the colour television industry are probable factors contributing to poor repair time
 - TVMANG, being the only manufacturer to undertake local design, was rated significantly lower (poor) on design performance
 - the main problems responsible for field failures are product testing, faulty components, assembly and alignment with workmanship and soldering impacting to a lesser extent.

These results are indicative of a deficiency existing in the planning and management of quality in the colour television industry supporting the hypothesis that there is a need to improve the quality control procedures employed by the colour television manufacturers. A lack of understanding of the importance and timely response to newly discovered field problems has perhaps been the primary reason for the large number of failures in the colour television industry. Fast, automatic response to help a company's personnel prevent poor quality is the life blood of the quality control department.

The ranking of colour television quality dimensions indicated that a manufacturing company choosing to compete on the basis of quality, would probably single out reliability, maintainability, durability and conformance for special attention. In doing so, high reliability will require special attention to design with conformance to requirements necessitating precision testing to ensure specifications are met, whereas durability will require the use of long-lived components and exceptional maintainability requiring a strong customer service department.

The ranking of service quality dimensions indicates that a manufacturing company would probably single out reliability, responsiveness and assurance for special attention when conducting repairs to defective colour television receivers.

In examining the service quality provided by the manufacturers to the service repairers, the opinions of the service repairers on responsiveness, tangibles, reliability, assurance and empathy indicate that:

- TVMANA and TVMANB were rated consistently higher on all the service quality dimensions
- of the newer manufacturers, TVMANE shows a consistently higher rating on all the service quality dimensions
- with the exception of TVMANA and TVMANB the remaining manufacturers manifest a sufficient or mediocre level of service quality. This mediocrity will impact negatively on the service quality that the service repairers will be expected to deliver to the consumers thus supporting the hypothesis that there is a need by the **consumers** for service repair organisations to improve their service quality.

CHAPTER 7**THE CONSUMER QUESTIONNAIRE****7.1 INTRODUCTION**

Deming (1986:5) considers the consumer to be the most important part of the production line with quality requiring to be directed at the needs of the consumer, present and future. This implies that without someone to purchase a product, the manufacturer might as well shut down the factory. Deming (1986:175) advocates the application of two principles in consumer research. The first is to study the needs of the consumer and then design a product and service that will provide better living in the future. The second is that no one can guess the future loss of business from a dissatisfied consumer. Profit in business comes from repeat consumers, consumers that boast about the manufacturer's product and service (Deming 1986:141).

The purpose of the consumer questionnaire is to test the validity of the hypotheses mentioned in Chapter 1, Section 1.4, that there is a need for the manufacturers to improve the quality of colour television receivers, for the service repair organisations to improve their service quality and for the manufacturers to improve their quality control procedures. In order to achieve this the following is ascertained:

- what the overall response is to each question in the questionnaire;
- whether any significant difference in service and product quality exists between the manufacturers; and

-
- what the consumers agree on in respect of service and product quality dimensions.

7.2 THE SURVEY SAMPLE

The Bureau for Statistical and Survey Methodology (STATOMET) at the University of Pretoria was approached to determine a proportionate consumer sample for the Gauteng area. The data from the All Media Product Survey (AMPS) for October 1994 was used for this purpose. A matrix, profiling specific criteria was developed indicating the sample structure. The matrix criteria included:

- population number of households owning a colour television receiver
- population sectors by race (Black, Asian, Coloured and White)
- by geographic area (Pretoria, Johannesburg, East Rand, West Rand, Soweto and Vaal triangle including Sebokeng).

Table 7.1: Proportionate consumer sample size by area

Population group	Pretoria	Johannesburg	East Rand	West Rand	Soweto	Vaal Triangle	Total
White	40	42	41	14	0	11	147
Black	17	7	21	3	27	10	85
Coloured	0	7	2	1	0	0	11
Asians	1	4	2	0	0	0	7
Total	58	60	66	18	27	21	250

From this matrix an allocation table was constructed indicating the number of interviews to be conducted in the specific geographic areas (see Table 4.1 and Table 7.1).

The consumer questionnaire was answered by colour television owners living in the province of Gauteng in the Republic of South Africa. Two-hundred and fifty persons were interviewed (see Table 7.1).

7.3 THE STATISTICAL RESULTS

The consumer questionnaire consists of sixty two questions covering three parts: general information (eleven questions); product quality (seven questions); and service quality (forty four questions of which the first twenty-two cover expectations and the remainder perceptions). An example of this questionnaire is given in Appendix C.

Part one of the questionnaire identifies the manufacturer of the respondent's colour television receiver, their preferences and whether they have experienced any failures, their perception of quality and their ranking of product and service quality dimensions. The questions in part two of the questionnaire endeavour to ascertain the respondents' ratings of their colour television receivers in respect of product quality dimensions using a five point scale. The questions in part three establish the perceptions and expectations of those respondents who have experienced repairs to their colour television receivers using a seven point scale.

7.3.1 The consumer sample in terms of the number of colour television receivers

In question 1 (Part one) the respondents were asked to indicate the number of colour television receivers owned or rented next to the name of the South African manufacturer and which manufacturer their last purchase was made from. Table 7.2 summarises these responses. It is interesting to note that only four manufacturers (TVMANB, TVMAND, TVMANA and TVMANC) make up 86.2% of the total sales to the population. These results were not entirely unexpected. TVMANB, TVMAND, TVMANA and TVMANC were

initially established to provide locally manufactured colour television receivers during the mid 1970's. It was only during the late 1980's that new entrants (TVMANF, TVMANG, TVMANE and TVMANH) were allowed to compete.

Table 7.2: A breakdown of the sample in terms of colour television receivers

Manufacturer	Number purchased	Percentage purchased	Number of sets last purchased	Percentage of sets last purchased
TVMANB	83	26.2	65	26.6
TVMAND	76	24.0	61	25.0
TVMANA	64	20.2	48	19.7
TVMANC	50	15.8	34	13.9
TVMANF	12	3.8	9	3.7
TVMANE	10	3.2	10	4.1
TVMANG	8	2.5	4	1.6
TVMANH	2	0.6	3	1.2
OTHER	12	3.8	10	4.1
Total	317	100.0	244	100.0

The percentage of sets last purchased shows that the new manufacturers have not yet made a significant impact on market share (see Table 7.2). This is also not entirely unexpected due to the short time period in which the new manufacturers have been trading.

Twenty-two percent of the respondents indicated that they owned or rented more than one colour television receiver of which only 34.5% repurchased from the same manufacturer. It is noteworthy that an analysis of these repurchases confirm that no significant preference of manufacturer was observed.

Table 7.3: Percentage composition of the sample in terms of product age and manufacturer

Manufacturer	Age in months					Total %
	0-12	13-24	25-48	49-120	> 120	
TVMANA	5.0	3.6	5.6	5.6	0.7	20.5
TVMANB	5.0	5.9	5.3	6.6	2.0	24.8
TVMANC	2.0	1.3	4.6	6.9	1.3	16.2
TVMAND	4.3	4.3	4.3	6.9	2.3	22.1
TVMANF	1.0	1.0	1.0	0.0	0.3	3.3
TVMANG	0.3	0.3	0.7	0.7	0.0	2.0
TVMANE	1.0	0.7	1.3	0.3	0.0	3.3
TVMANH	0.3	0.0	0.0	0.3	0.0	0.7
OTHER	3.3	1.3	1.3	1.0	0.3	7.3
Total	22.1	18.5	24.1	28.4	6.9	100.0

In question 5 (Part one) the respondents were asked to indicate the name of the manufacturer and the age (in months) of their receivers. The request to indicate whether they purchased remote control or manual colour television receivers was not analysed due to the fact that all newly manufactured colour television receivers are now remote control operated.

Table 7.3 summarises the ages of the colour television receivers obtained in the sample of which 64.7% are less than four years old with only 6.9% being older than ten years.

7.3.2 Consumer preference of manufacturer

In question 2 (Part one) the respondents were asked to indicate their preference of manufacturer by indicating which brand of colour television receiver they would purchase

should they require a new television receiver. Table 7.4 summarises these responses.

Table 7.4: Consumer preference of manufacturer's product

Manufacturer	Frequency	Percent	Cumulative frequency	Cumulative percent
TVMANB	75	32.5	75	32.5
TVMANA	63	27.3	138	59.8
TVMAND	46	19.9	184	79.7
TVMANC	34	14.7	218	94.4
TVMANE	6	2.6	224	97.0
TVMANF	2	0.9	226	97.9
Other	5	2.1	231	100.0

From these results, four manufacturers have dominated the selection by totalling 94.4% of the respondents' decisions. In comparing Table 7.2 with Table 7.4 it is clear that TVMAND has lost favour to TVMANB and TVMANA with TVMANC having lost marginally. These results indicate that TVMAND products appear to have deteriorated in their value resulting in consumers switching their preference of manufacturer. It is noteworthy that the new manufacturers have not yet made an impact.

7.3.3 The importance of price, quality and after sales service

Deming (1986:32) maintains that price has no meaning without a measure of the quality being purchased which may result in the risk of low product prices being associated with low quality and high costs.

The importance of consumer insistence on acceptable after sales service, product quality and price are investigated in order to establish whether consumers have any significant preferences

which the manufacturers, retailers and service repair organisations may not discern.

Table 7.5: Comparison between price, quality and after sales service

Category	Ranking			
	One	Two	Three	Percent
PRICE	61	116	70	32.6
QUALITY	173	60	14	43.9
SERVICE	15	71	161	23.4

In question 3 (Part one) the respondents are asked to rank price, quality and after sales service. In order to establish consumer preference between price, quality and after sales service a weight of 3 is multiplied with the first ranking score followed by a weight of 2 for the second ranking score and a weight of 1 for the third ranking score. By expressing each category's weighted total ranking score as a percentage of the total weighted scores for all the categories, the overall preference is obtained from the percentage column in Table 7.5.

Although the price slip is easy to read and that an understanding of quality requires knowledge and education, it is clear from these results that quality is seen by the consumers to be the most important variable, with price second and after sales service third.

7.3.4 The consumer's definition of colour television receiver quality

In question 4 (Part one) the consumers are asked to rank the quality definitions espoused by the quality theorists (Demming, Crosby, Juran and Feigenbaum) in order to obtain insight into what consumers understand by the meaning of "colour television receiver quality". In order to establish the most preferred definition of quality, the weighted ranking score method

is used. The ranking for each dimension is shown in Table 7.6.

Although the consumer's first preference is the definition "zero defects", these results indicate that there is no significant agreement on a definition for colour television receiver quality and that the key lies in understanding that quality is not a singular characteristic. Rather, many characteristics or dimensions may contribute to the meaning of quality in the eyes of the consumer. These results support Garvin's five-pronged approach in defining quality, thus avoiding a reliance on a single definition of quality which is a frequent source of problems (Garvin 1984b:29).

Table 7.6: Ranking of product quality definitions by the consumers

Definitions of quality	Ranking					
	One	Two	Three	Four	Five	%
Zero defects	87	65	28	29	31	24.06
Pride of workmanship	50	46	43	55	45	19.91
Meeting customer expectations	37	56	51	42	54	19.41
Fitness for use	48	37	55	46	52	19.32
Conformance to requirements	23	37	58	65	57	17.30

7.3.5 The ranking of product quality dimensions

In question 8 (Part one) the respondents are asked to rank all eight quality dimensions in respect of their importance to colour television receivers. In order to establish the most preferred dimension the weighted ranking score method is used. The overall preference of dimension is obtained from the percentage column in Table 7.7

From Table 7.7 the overall ranking of colour television receiver quality dimensions from the perspective of the consumers indicates that reliability (16.3%), performance (15.0%) and durability (13.0%) have substantial representation in the sample.

From these results, a manufacturing company choosing to compete on the basis of quality, would probably single out reliability, performance and durability for special attention. In doing so, high performance and reliability will require, for example, careful attention to design whereas durability will require the use of long-lived components.

Table 7.7: Ranking of product quality dimensions

Quality dimensions	Ranking								
	One	Two	Three	Four	Five	Six	Seven	Eight	%
Reliability	77	39	40	25	21	23	14	6	16.3
Performance	52	40	40	30	30	28	13	13	15.0
Durability	29	43	37	28	26	25	18	37	13.0
Features	24	28	31	36	31	36	36	24	12.2
Perceived quality	32	27	30	31	26	24	51	23	12.2
Conformance	20	25	18	28	53	41	28	31	11.4
Maintainability	8	24	27	34	30	48	46	26	10.7
Aesthetics	6	22	22	32	28	17	35	83	9.2

It is interesting that consumers do not rank maintainability as high as the retailers and the service repairers which is probably due to the fact that their experience in repair service is limited to those who have experienced failures (see Tables 5.13 and 6.20).

It is clear that the different dimensions of quality require different forms of expertise and it is unlikely that manufacturers will prosper by trying to succeed on all dimensions at once

7.3.6 Failures during the first year of warranty

In question 9 (Part one) the respondents are asked to enter the number of times repairs or service calls were required on their colour television receivers during the first year of warranty. In Table 7.8 the percentage failing during the first year warranty for each manufacturer is shown under the "Warranty fail rate" column.

Table 7.8: First year warranty failures by manufacturer

Manufacturer	Warranty failure rate (%)	Percentage of total warranty repairs				
		One Repair	Two Repairs	Three Repairs	Four Repairs	> Four Repairs
TVMANA	12.5	11.1	1.9	0.0	1.9	0.0
TVMANB	11.0	11.1	1.9	1.9	1.9	0.0
TVMANC	22.0	14.8	7.4	0.0	0.0	0.0
TVMAND	22.7	20.4	3.7	3.7	0.0	3.7
TVMANF	0.0	0.0	0.0	0.0	0.0	0.0
TVMANG	42.9	1.9	3.7	0.0	0.0	0.0
TVMANE	33.3	3.7	0.0	0.0	1.9	0.0
TVMANH	50.0	1.9	0.0	0.0	0.0	0.0
Total	17.6	64.8	18.5	7.4	5.6	3.7

It is clear from these results that a high failure rate is being experienced. The overall failure rate for all the manufacturers, as an industry, is 17.6%. Ignoring the new manufacturers (TVMANF, TVMANG, TVMANE and TVMANH) to the colour television manufacturing industry of which only a small number were selected in the sample, the remaining more established manufacturers manifest a failure rate ranging from 11% to 22.7%. These high failure rates may result as a consequence of the fact that the colour television industry is

subject to long delays between date of manufacture and date of sale to the end consumer, creating the risk that numerous products contain potential problems unknown to the manufacturer. It would seem that early warning signals, to detect these conditions, appear to be lacking.

It is interesting that the retail sales persons and the results taken from the consumers with regard to failures during the warranty period concur. In question 3 (Part three) in the retail questionnaire (see Section 5.3.16) the sales persons indicate that 17.5% of all the colour television receivers sold are either exchanged or require a single service call during the warranty period.

In Table 7.8 it can be seen that 35.2% of all warranty failures required more than one repair. This indicates that either poorly executed repairs and/or substandard products were manufactured.

7.3.7 Service quality dimensions

The meaning of colour television repair service quality, as with product quality, is established by finding out which dimensions can be singled out for special attention. In question 10 (Part one) the respondents are asked to rank all five service quality dimensions in respect of their importance to colour television receiver repairs.

In order to establish the most preferred dimension of service quality, the weighted ranking score method is used. The overall preference of service quality dimensions for colour television repair service quality is obtained from the percentage column in Table 7.9.

From Table 7.9 the overall ranking of the repair service quality dimensions, from the perspective of the consumers, indicates that reliability (24.6%), responsiveness (24.1%) and assurance (20.3%) have substantial representation in the sample.

Table 7.9: Ranking of service quality dimensions

Quality dimensions	Ranking					
	One	Two	Three	Four	Five	%
Reliability	90	64	34	39	16	24.6
Responsiveness	88	49	60	25	21	24.1
Assurance	32	69	57	51	35	20.3
Empathy	19	36	38	59	93	15.7
Tangibles	19	36	38	59	93	15.4

From these results, a manufacturing company would probably single out reliability, responsiveness and assurance for special attention when conducting repairs to defective colour television receivers. It is interesting that the consumer's rankings are similar to those of the retailers and service repairers (see Table 5.20 and Table 6.20 respectively).

The reliability of a repair requires the diagnosing and repair of the **cause** of the fault and not only the symptom. Assurance entails approachability, politeness, respect, consideration and friendliness. Responsiveness involves timeliness of service, for example, by initiating repairs quickly and calling the consumer back promptly about the status of the repair. Although the dimensions of tangibles and empathy are not as important, they should be applied appropriately.

7.3.8 Average time to repair

In establishing the average time to repair a colour television receiver a number of variables must be taken into account. Some of these variables are availability of manpower, spare parts, design for easy access, special tools and transport.

Table 7.10: Average time to repair by manufacturer (days)

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANB	26	5.962	A		
TVMAND	32	4.531	A		
TVMANC	18	3.118	A		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	2	94.17	47.08	1.09	.3411
Error	73	3148.93	43.13		
Corrected	75	3243.11			

In question 11 (Part one) the respondents, who experienced failures on their products, are asked to indicate the average time (in days) that it took to repair their colour television receivers. From Table 7.10 it can be seen that only three manufacturers were analysed having a sample size in excess of 15, giving an average time to repair of 4.69 days with no statistical significant differences existing between the manufacturers.

These results indicate that colour television receivers are not easily restored to service after failure. From the service questionnaire, see Section 6.3.6.2, it was established that the average time to repair, excluding travelling and administration time, is 3 hours. From these results travelling and administration time appear to be the main factors contributing to delays in restoring defective colour television receivers to service.

7.3.9 Product quality

7.3.9.1 A comparison between the manufacturers on picture and sound quality

Performance refers to the **primary** operating characteristics of a product. For a colour television receiver these would include clarity of **sound** (power output and distortion) and

picture (brightness, contrast, colour purity and tuner sensitivity). From these attributes comparisons against competing products are made. In question 1 (Part two) the respondents are asked to rate the performance of their colour television receivers by referring to the clarity of sound and picture. A five-point scale is used ranging from 1 ("very low") to 5 ("very high").

From Table 7.11 it can be seen that only 4 manufacturers have substantial representation in the consumer sample (the remaining manufacturers were not meaningfully represented having sample sizes of less than 15). It is noteworthy that a statistically significant difference between the four manufacturers exists with TVMAND being the only manufacturer manifesting a significant difference from the other manufacturers. These results indicate that the picture quality of the various brands is considered by the majority of the consumers to be of a high quality (a mean rating of 4.12 for the four manufacturers is obtained from Table 7.11).

Table 7.11: Picture performance by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	65	4.2615	A		
TVMANC	53	4.1698	A		
TVMANB	81	4.1975	A		
TVMAND	76	3.8947	B		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	3	5.77	1.92	3.03	0.029
Error	271	172.02	0.63		
Corrected	274	177.79			

In Table 7.12 a similar result to Table 7.11 is obtained with none of the manufacturer's brands being rated below average for sound quality performance. The Duncan grouping and F value indicate that no statistically significant difference exists between the manufacturers in respect of sound quality.

With majority of the manufacturers brands manifesting a high rating for the primary operating characteristics of picture and sound quality it is concluded that the colour television industry is satisfying consumers to a large extent in regard to these characteristics.

Table 7.12: Sound performance by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANB	81	4.2099	A		
TVMANA	65	4.2000	A		
TVMAND	75	3.9733	A		
TVMANC	53	3.9245	A		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	3	4.42	1.47	2.22	0.086
Error	270	179.47	0.66		
Corrected	273	183.89			

7.3.9.2 A comparison between the manufacturers on product features

Features are those secondary characteristics that supplement the product's basic functioning. Some examples employed on colour television receivers are: remote control operation, simulcast operation, headphone facilities, teletext facilities, audio/video input and output operation, automatic tuning, stereo audio operation, child lock facilities and multi-system operation. In question 2 (Part two) the respondents are asked to rate the features provided

on their colour television receivers. A five-point scale is used ranging from 1 ("very low") to 5 ("very high").

Table 7.13: Product features by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	62	3.9194	A		
TVMANB	80	3.7875	A		B
TVMANC	53	3.4151			B
TVMAND	75	3.4133			B
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	3	13.11	4.37	3.84	0.010
Error	266	303.03	1.13		
Corrected	269	316.15			

From Table 7.13 it can be seen that only 4 manufacturers have substantial representation in the consumer sample (the remaining manufacturers were not meaningfully represented having sample sizes of less than 15).

It is noteworthy from Table 7.13 that statistically significant differences between the manufacturers' exists with TVMANA and TVMANB brands satisfying consumer needs to a large extent. However, the mean ratings indicate that the basic functioning of the various brands is considered, by the majority of the consumers, to be more than sufficiently supplemented with various features. It is interesting that none of the manufacturers were rated below average for features provided on their products.

With the manufacturers manifesting an above average rating for features supplied on their products it is concluded that the colour television industry is satisfying consumers to a large extent in this regard.

7.3.9.3 A comparison between the manufacturers on product reliability

A reliable product is one that will perform its intended function over its period of use. Reliability is a quality characteristic that represents one of today's principal consumer demands. Consumers who once concentrated their purchases on products that were innovative are now concentrating on products which operate reliably (Feigenbaum 1986:570).

In question 3 (Part two) the respondents are asked to rate the reliability of their colour television receivers using a five-point scale ranging from 1 ("very low") to 5 ("very high").

Table 7.14: Product reliability by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANB	73	4.3014	A		
TVMAND	70	4.2714	A		
TVMANA	60	4.2500	A		
TVMANC	49	4.2653	A		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	3	0.09	0.03	0.04	0.991
Error	248	210.01	0.85		
Corrected	251	210.10			

From Table 7.14 it can be seen that only 4 manufacturers have substantial representation in the consumer sample (the remaining manufacturers were not meaningfully represented having sample sizes of less than 15).

In Table 7.14 it can be seen that no statistically significant difference exists with all the manufacturers manifesting a score above 4 implying a high rating for reliability.

7.3.9.4 A comparison between the manufacturers on time to failure

Much of reliability analysis has been founded on statistical studies using the parameter "mean time to failure" (MTTF) and therefore in an attempt to quantify reliability the consumers were asked to indicate, in question 3 (Part two), the approximate time to failure in months if their colour television receiver experienced a failure.

From Table 7.15 it can be seen that only 4 manufacturers have substantial representation in the consumer sample (the remaining manufacturers were not meaningfully represented having sample sizes of less than 15).

In Table 7.15 it can be seen that no statistically significant differences between the manufacturers exist. From these results the MTTF for the colour television industry is 46.92 months.

In comparing the consumer rating for reliability in Section 7.3.9.3 and the MTTF obtained above it appears that consensus exists in that an acceptable failure rate is occurring on colour television receivers.

Feigenbaum (1986:576) indicates that the behaviour of the failure rate with time can decrease, remain constant or increase with time. The decreasing failure rate, or "infant mortality" region of the failure rate-life characteristic curve is where most manufacturing and warranty failures occur and therefore cognisance must be taken of this when assessing reliability. In question 9 (Part one) the consumers indicated the number of repairs or service calls required during the first year of warranty to be 17.6% (see Section 7.3.6) which is considered to be high. These findings support the view that the initial failures during the warranty period are not considered to be important by the consumers when assessing reliability.

Table 7.15: Time to failure by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	15	70.93	A		
TVMAND	32	50.22	A		
TVMANB	24	40.21	A		
TVMANC	17	29.00	A		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	3	14951.59	4983.86	1.30	0.281
Error	83	319028.35	3843.71		
Corrected	86	333979.95			

7.3.9.5 A comparison between the manufacturers on product maintainability

Maintainability is an inherent part of product design. Failure of proper consideration to maintainability will result in a high cost of maintenance during a product's life (Juran *et al.* 1979:8-41). Factors affecting maintainability are workforce skills, technical data, test equipment and support facilities.

In question 5 (Part two) the respondents who experienced repairs are asked to rate the maintainability of their colour television receivers using a five-point scale ranging from 1 ("very low") to 5 ("very high").

From Table 7.16 it can be seen that only 4 manufacturers have substantial representation in the consumer sample (the remaining manufacturers were not meaningfully represented having sample sizes of less than 15).

In Table 7.16 it can be seen that the Duncan grouping indicates that no statistically significant differences between the manufacturers exists. The manufacturers are rated above average to

high, indicating that the maintainability on colour television receivers is generally acceptable.

Table 7.16: Product maintainability by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANB	36	4.1111	A		
TVMAND	40	3.9750	A		
TVMANC	20	3.9500	A		
TVMANA	23	3.6957	A		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	3	2.43	0.81	0.93	0.427
Error	115	100.35	0.87		
Corrected	118	102.78			

7.3.9.6 A comparison between the manufacturers on product aesthetics

Aesthetics is a subjective dimension of product quality and refers to how a product looks, feels and sounds and is clearly a matter of personal judgement. In question 6 (Part two) the respondents were asked to rate the aesthetics of their colour television receivers using a five-point scale ranging from 1 ("very low") to 5 ("very high").

From Table 7.17 it can be seen that only 4 manufacturers have substantial representation in the consumer sample (the remaining manufacturers were not meaningfully represented having sample sizes of less than 15).

In Table 7.17 it can be seen that although statistically significant differences between the manufacturers' brands exists none of the manufacturers were rated below 3 indicating that colour television receivers are generally acceptable in terms of their shape and finish.

Table 7.17: Product aesthetics by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	63	4.0317	A		
TVMANB	82	3.9756	A		
TVMANC	53	3.7358	A		B
TVMAND	75	3.5600			B
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	3	10.23	3.41	3.91	0.009
Error	269	234.66	0.87		
Corrected	272	244.90			

7.3.9.7 A comparison between the manufacturers on perceived quality

This dimension of product quality can be as subjective as the assessments of aesthetics with consumers often relying on advertising or the retailer's reputation and image (Garvin 1984b:32). In question 7 (Part two) the respondents were asked to rate the perceived quality of their colour television receivers using a five-point scale ranging from 1 ("very low") to 5 ("very high").

From Table 7.18 it can be seen that only 4 manufacturers have substantial representation in the consumer sample (the remaining manufacturers were not meaningfully represented having sample sizes of less than 15).

In Table 7.18 it can be seen that statistically significant differences between the manufacturers' brands exists and that none of the manufacturers were rated below 3 indicating that the perceived quality of the colour television receivers are rated average to high by the consumers.

Table 7.18: Perceived quality by manufacturer

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANB	81	4.3704	A		
TVMANA	63	4.1746	A		B
TVMANC	53	4.0000			B
TVMAND	73	4.9863			B
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	3	7.11	2.37	3.45	0.017
Error	266	182.95	0.68		
Corrected	269	190.07			

7.3.10 Service quality

7.3.10.1 General

The framework used in this section of the research is centred around the Parasuraman *et al.* (1984:15) conceptual model of service quality. This model is used to identify and improve comprehension of service quality management in the colour television service repair industry using the **SERVQUAL** instrument. Only 90 consumers (36%) having experienced a repair to their colour television receiver, as indicated in Question 11 (Part one), were required to complete the **SERVQUAL** instrument (see Part three in the consumer questionnaire).

The **SERVQUAL** instrument consists of a questionnaire using a 7-point Likert-type scale anchored on "Strongly disagree" (1) through to "Strongly agree" (7) with some statements positively and others negatively worded. The service quality index (Q) is defined as the discrepancy between the consumer's perceptions (P) of the actual quality of service received, and his or her expectations (E) of that service, where $Q = E - P$ and E and P are the ratings on the corresponding expectation and perception statements respectively.

To a certain extent the methodology used in this section follows that of Parasuraman *et al.* (1984:15). An average between each corresponding expectation and perception is calculated with all positive scores indicating that the service repairers did not live up to the expectations of the consumers. An assessment along each of the five service dimensions by averaging the difference scores on items making up the dimension is determined with an average score across all five dimensions providing an overall measure of service quality.

A comparative analysis using analysis of variance and Duncan grouping, between the manufacturers, employing the requirements indicated in the above paragraph, is conducted to indicate the absence or otherwise of statistical significance for the service quality dimensions. These results highlight areas requiring managerial action.

Of the eight manufacturers only TVMANA, TVMANB, TVMAND and TVMANC were analysed. The remaining four manufacturers of TVMANF, TVMANE, TVMANG and TVMANH were not analysed due to the small number of repairs on their brands found in the sample.

7.3.10.2 Analysis of consumers' expectations against their perception of service quality delivered

The dimension of **tangibles** is measured by the first four statements under the expectation and perception sections of Part 3 of the consumer questionnaire. These questions addressed issues relating to whether the service repairers used up-to-date equipment (P3QUAL1), whether their facilities were visually appealing (P3QUAL2), whether the service employees dressed well and appeared neat (P3QUAL3) and whether their physical facilities are in keeping with the type of service provided (P3QUAL4).

From Table 7.19 only TVMANC exceeded expectations relating to up to date equipment (see P3QUAL1). All the manufacturers exceeded expectations relating to visually appealing physical facilities (see P3QUAL2). Only TVMANC and TVMAND employees are well

dressed and appear neat (see P3QUAL3). All the manufacturer's service facilities are not in keeping with the type of service provided (see P3QUAL4). Only TVMANC exceeded overall expectations on the dimension of tangibles.

Table 7.19: A service quality index comparison between the manufacturers on questions relating to the dimension of tangibles

Question	Manufacturer (No. of responses)			
	TVMANA (14)	TVMANB (27)	TVMANC (17)	TVMAND (32)
P3QUAL1	0.78571	0.59259	-0.05882	0.65625
P3QUAL2	-0.42857	-0.03704	-0.03704	-0.47059
P3QUAL3	1.00000	0.11111	-0.41176	-0.37500
P3QUAL4	0.64286	0.22222	0.05882	0.21875
Tangibles	0.50000	0.22222	-0.22059	0.10938

Table 7.20: A comparison between the manufacturers on the dimension of tangibles

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANA	14	0.5000	A		
TVMANB	27	0.2222	A		
TVMAND	32	0.1094	A		
TVMANC	17	-0.2206	A		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	3	4.23	1.41	0.52	0.672
Error	86	234.89	2.73		
Corrected	89	239.13			

From Table 7.20 it can be seen that none of the manufacturers differed significantly indicating that the manufacturer's service departments are under performing with regard to the dimension of tangibles.

The **reliability** dimension is covered by statements five to nine under the expectation and perception sections of Part 3 of the consumer questionnaire. These questions addressed issues relating to whether the service repairers keep promises (P3QUAL5), are sympathetic (P3QUAL6), dependable (P3QUAL7), provide on time service (P3QUAL8) and keep records (P3QUAL9) accurately. This involves the ability of the service repairer to perform the promised service dependably and accurately at the designated time.

Table 7.21: A service quality index comparison between the manufacturers on questions relating to the reliability dimension

Question	Manufacturer (No. of responses)			
	TVMANA (14)	TVMANB (27)	TVMANC (17)	TVMAND (32)
P3QUAL5	0.71429	1.48148	0.41176	1.34375
P3QUAL6	0.71429	1.25926	0.47059	1.28125
P3QUAL7	0.57143	1.40741	0.76471	1.18750
P3QUAL8	0.42857	1.85185	1.00000	1.34375
P3QUAL9	0.00000	0.96296	-0.17647	0.53125
Reliability	0.48571	1.39259	0.49412	1.13750

From Table 7.21 it is clear that all the manufacturers' service departments are not exceeding the consumers' expectations. Only one negative value was obtained in that TVMANC's record keeping (P3QUAL9) exceeds the expectations of the consumers.

Table 7.22: A comparison between the manufacturers on the reliability dimension

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANB	27	1.3926	A		
TVMAND	32	1.1375	A		
TVMANC	17	0.4941	A		
TVMANA	14	0.4857	A		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	3	12.81	4.27	2.01	0.119
Error	86	182.94	2.13		
Corrected	89	195.75			

From Table 7.22 it can be seen that none of the manufacturers differed significantly indicating that the manufacturers' service departments are under performing with regard to the reliability dimension.

The **responsiveness** dimension is measured by statements ten to thirteen under the expectation and perception sections of Part 3 of the consumer questionnaire. These questions addressed issues relating to whether the service repairers tell their customers exactly when services will be performed (P3QUAL10), whether it is realistic to expect prompt service (P3QUAL11), are willing to help their customers (P3QUAL12) and to respond to requests promptly (P3QUAL13). Responsiveness concerns the willingness or readiness of the service repairer's employees to provide service. It involves timeliness of service by initiating repairs quickly and calling the consumer back promptly about the status of the repair.

From Table 7.23 all the manufacturers' service departments are exceeding consumers' expectations and that only TVMANC differs significantly from the group of manufacturers (see Table 7.24).

Table 7.23: A service quality index comparison between the manufacturers on questions relating to the responsiveness dimension

Question	Manufacturer (No. of responses)			
	TVMANA (14)	TVMANB (27)	TVMANC (17)	TVMAND (32)
P3QUAL10	-2.21429	-1.00000	-0.29412	-1.31250
P3QUAL11	-1.78571	-1.25926	-0.41176	-1.09375
P3QUAL12	-1.71429	-1.18519	-0.41176	-1.40625
P3QUAL13	-0.78571	-1.00000	-0.88235	-0.90625
Responsiveness	-1.62500	-1.11111	-0.50000	-1.17969

Table 7.24: A comparison between the manufacturers on the responsiveness dimension

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANC	17	-0.5000	A		
TVMANB	27	-1.1111	A		B
TVMAND	32	-1.1797	A		B
TVMANA	14	-1.6250			B
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	3	10.19	3.39	1.30	0.278
Error	86	223.79	2.60		
Corrected	89	233.98			

The **assurance** dimension is measured by statements fourteen to seventeen under the expectation and perception sections of Part 3 of the consumer questionnaire. These questions addressed issues relating to whether the consumers should be able to trust (P3QUAL14) and

feel safe (P3QUAL15) in their transactions with the service employees. Politeness (P3QUAL16) and support (P3QUAL17) of the service employees are also assessed. The dimension of assurance, according to Zeithaml *et al.* (1990:25), may be equated to courtesy, competence, credibility and security.

Table 7.25: A service quality index comparison between the manufacturers on questions relating to the assurance dimension

Question	Manufacturer (No. of responses)			
	TVMANA (14)	TVMANB (27)	TVMANC (17)	TVMAND (32)
P3QUAL14	1.21429	1.25926	1.00000	1.21875
P3QUAL15	0.28571	1.00000	0.47059	1.03125
P3QUAL16	0.78571	0.74074	0.64706	0.87500
P3QUAL17	0.57143	0.85185	0.70588	1.00000
Assurance	0.71429	0.96296	0.70588	1.03125

Table 7.26: A comparison between the manufacturers on the assurance dimension

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMAND	32	1.0313	A		
TVMANB	27	0.9630	A		
TVMANA	14	0.7143	A		
TVMANC	17	0.7059	A		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	3	1.78	0.59	0.30	0.822
Error	86	167.82	1.95		
Corrected	89	169.60			

From Table 7.25 it is clear that all the manufacturers' service departments are not exceeding the consumers' expectations.

From Table 7.26 it can be seen that none of the manufacturers differed significantly indicating that all the manufacturers' service departments are under performing with regard to the assurance dimension.

The **empathy** dimension is measured by statements eighteen to twenty-two under the expectation and perception sections of Part 3 of the consumer questionnaire. These questions addressed issues relating to whether the consumers should be given individual (P3QUAL18) and personal (P3QUAL19) attention in their transactions with the service employees. Customer needs (P3QUAL20) and interests (P3QUAL21) as well as having operating hours convenient (P3QUAL22) to all the consumers are also assessed. Empathy also implies politeness, respect, consideration and friendliness of contact personnel.

From Table 7.27 it is clear that all the manufacturers' service departments are not exceeding the consumers' expectations.

Table 7.27: A service quality index comparison between the manufacturers on questions relating to the empathy dimension

Question	Manufacturer (No. of responses)			
	TVMANA (14)	TVMANB (27)	TVMANC (17)	TVMAND (32)
P3QUAL18	-1.28571	-1.14815	-0.07058	-0.75000
P3QUAL19	-0.92857	-1.48148	-1.23529	-1.15625
P3QUAL20	-0.91857	-1.25926	-0.41176	-0.62500
P3QUAL21	-1.14286	-1.25926	-1.00000	-1.75000
P3QUAL22	-1.21429	-0.40741	-1.76471	-0.03125
Empathy	-0.94286	-1.03704	-0.76471	-0.86875

From Table 7.28 it can be seen that none of the manufacturers differed significantly indicating that all the manufacturers' service departments are under performing with regard to the empathy dimension.

Table 7.28: A comparison between the manufacturers on the empathy dimension

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANC	17	-0.7647	A		
TVMAND	32	-0.8688	A		
TVMANA	14	-0.9429	A		
TVMANB	27	-1.0370	A		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	3	0.86	0.29	016	0.923
Error	86	155.54	1.81		
Corrected	89	156.41			

7.3.10.3 Overall service quality

The relative importance of the five service quality dimensions espoused by Parasuraman *et al.* (1991:16) in Table 3.1 and the findings of this research, obtained from Table 7.9, are compared to one another in Table 7.30. This comparison shows that the relative importance of the service quality dimensions for the South African colour television repair industry has manifested an expected result. Consequently, the overall service quality performance for the colour television repair industry is determined by weighting the service quality findings for each dimension, as given in Section 7.3.10.2, by the relative importance of the quality dimensions (see Table 7.29).

The overall service quality index of +0.051, in Table 7.30, shows that gap 5 (see Section 3.2.2) in the Parasuraman *et al.* model (1984) exists, proving that consumers' expectations

of repair service differs from their perceptions of repair service thus supporting the hypothesis that the service repair organisations need to improve their service quality.

Table 7.29: The relative importance of the service quality dimensions in the colour television repair industry

Dimension	Percentage from Table 3.1 (Expected findings)	Percentages from Table 7.9 (Research findings)
Reliability	32.0	24.6
Responsiveness	22.0	24.1
Assurance	19.0	20.3
Empathy	16.0	15.7
Tangibles	11.0	15.4
Total	100.0	100.0

It is interesting that the service repairers are under-performing on the dimensions of reliability, assurance and tangibles while over-performing on the dimensions of responsiveness and empathy. A lack of technical competence caused by the skills shortage in the South African market may be contributing to the dimensions of reliability and assurance not meeting consumer expectations. Another factor which could contribute to the lack of technical competence is the use of service agents which are smaller companies and hence no real career path is available to highly competent staff. An inability to find the right staff may therefore result in repairs not being undertaken properly.

It appears that the manufacturers understand consumers' needs and respond effectively. This may be explained by the fact that all quality complaints are received by the manufacturers who in turn allocate service according to the availability of the various service agents, including their own service departments. This gives the manufacturers flexibility in responding quickly and the opportunity to control the empathy dimension with properly

trained service call takers.

Table 7.30: Weighted scores for the service quality dimensions

Dimension	Reliability	Responsiveness	Assurance	Empathy	Tangibles	Total
Gap Score	0.99806	-1.09466	0.88592	-0.84466	0.14563	0.005
Weight	0.24600	0.24100	0.20300	0.15700	0.15400	1.000
Total	0.24550	-0.26380	0.17980	-0.13260	0.02240	0.051

Table 7.31: A comparison between the manufacturers on overall service quality

Manufacturer	No. of responses	Mean rating	Duncan grouping		
TVMANB	27	0.0774	A		
TVMAND	32	0.0554	A		
TVMANC	17	-0.1230	A		
TVMANA	14	-0.2143	A		
Source	Degrees of freedom	Sum of squares	Mean square	F	Pr > F
Model	3	1.14	0.38	089	0.452
Error	86	37.02	0.43		
Corrected	89	38.15			

From Table 7.31 it can be seen that none of the manufacturers differed significantly on overall service quality. It is interesting that TVMANB and TVMAND obtained positive scores (performing below expectations) with TVMANA and TVMANC obtaining negative scores (exceeding expectations).

7.4 SUMMARY

From the consumer sample it was established that TVMAND, TVMANB, TVMANA and TVMANC were responsible for 86.2% of the total sales of colour television receivers. Twenty-two percent of the respondents indicated that they owned or rented more than one colour television receiver of which 34.5% repurchased from the same manufacturer. Consumer product preference indicated that TVMAND had lost favour to TVMANB and TVMANA with TVMANC having lost marginally. These results indicate that TVMAND products appear to have deteriorated in their value and perhaps their quality or their advertising was less effective resulting in consumers switching their brand preference.

Although quality requires knowledge and education, the consumer research has shown that quality is seen to be the most important variable followed by price and after sales service respectively.

The consumers indicated **"zero defects"** to be their first preference of a definition for colour television receiver quality, although no significant agreement on a definition was established. Possibly many characteristics or dimensions are contributing to the meaning of quality in the eyes of the consumer.

The ranking of product quality dimensions revealed that a manufacturing company choosing to compete on the basis of quality, would single out reliability, performance, durability and features for special attention. In doing so, high performance, features and reliability will require, for example, careful attention to design whereas durability will require the use of long-lived components. It is interesting that consumers do not rank maintainability as high as the retailers and the service repairers which is probably due to the fact that their experience in service repairs is limited to those who have experienced failures.

With all the manufacturers manifesting an above average rating for the primary operating characteristics, features, aesthetics and perceived quality for their products it is concluded that

the colour television industry is satisfying consumers with regard to these product quality dimensions.

The first year warranty failure rate was found to be 17.6%. This high failure rate may result as a consequence of the fact that the colour television industry is subject to long delays between date of manufacture and date of sale to the end consumer, creating the risk that numerous products, held in stock, contain potential problems unknown to the manufacturer resulting in delayed feedback on corrective action. It would seem that early warning signals to detect these conditions appear to be lacking. It appears that the decreasing failure rate, or "infant mortality" region of the failure rate-life characteristic curve, is where most manufacturing and warranty failures occur. These findings strongly supports the hypothesis that there is a need from the **consumers** for the South African manufacturers to improve the quality of colour television receivers. This also suggests that there is a need to improve the quality control procedures employed by the colour television manufacturers.

An analysis of warranty failures showed that 35.2% of all failures required more than one repair. This indicates that either poorly executed repairs and/or substandard products were manufactured.

The ranking of service quality dimensions revealed that a manufacturing company would single out reliability, responsiveness and assurance for special attention.

The average time to repair a colour television receiver was found to be 4.69 days with no statistically significant difference existing between the manufacturers. These results indicate that colour television receivers are not easily restored to service after failure with travelling and administration time being the main contributing factors. These findings support the hypothesis that the service quality of colour television repairers needs improvement.

The overall service quality of colour television repairs was measured giving a gap of +0.051. This indicates that gap 5 in the Parasuraman *et al.* model (1984) exists proving that

consumers' expectations of repair service differs from their perceptions of repair service thus supporting the hypothesis that the service repair organisations need to improve their service repair quality.

It is interesting that the service repairers are under-performing on the dimensions of reliability, assurance and tangibles while over-performing on the dimensions of responsiveness and empathy. A lack of technical competence caused by the skills shortage in the South African market may be contributing to the dimensions of reliability and assurance not meeting consumer expectations. Another factor which could contribute to the lack of technical competence is the use of service agents which are smaller companies and hence no real career path is available to highly competent staff. An inability to find the right staff may therefore result in repairs not being undertaken properly.

It appears that the manufacturers understand consumers' needs and respond effectively. This may be explained by the fact that all quality complaints are received by the manufacturers who in turn allocate service according to the availability of the various service agents, including their own service departments. This gives the manufacturers flexibility in responding quickly and the opportunity to control the empathy dimension with properly trained service call takers.

CHAPTER 8**THE MANUFACTURING QUESTIONNAIRE****8.1 INTRODUCTION**

Colour television receivers are assembled from numerous parts, progressing through a series of operations which may include machine component insertion, hand component insertion, flow soldering, chassis assembly and final assembly. The major quality aspects include planning preceding production, the quality of materials and parts, detailed specifications and strict process control with inspection and tests conducted at many intermediate stations culminating in consumer acceptance of the final product.

In general, manufacturing has often been publicised for its technical aspects with the human relations activity often being played down or minimised. According to Feigenbaum (1986:737) without high plant morale and motivation the more technical control methods can have few lasting results. This implies that a companywide commitment to quality, taking both technological and human influences into account is required.

The purpose of the manufacturing questionnaire is to test the validity of the hypotheses mentioned in Chapter 1, Section 1.4, that there is a need for the manufacturers to improve the quality of colour television receivers including their quality control procedures. In order to achieve this the following is ascertained:

- what the overall response is to each question in the questionnaire;

- whether any significant difference in quality performance, policies and attitudes exists between the manufacturers, and
- what the manufacturers agree on in respect of service and product quality dimensions.

8.2 THE SURVEY SAMPLE

Two questionnaires are used. The **supervisor/technical questionnaire** was answered by supervisors and technicians involved with the day-to-day activities of various manufacturing functions because of their good insight into the causes of quality problems during manufacture. The **senior management questionnaire** was answered by each manufacturer's managing director or general manager in order to obtain information relating to performance, policies and strategies.

One senior management questionnaire and 15 supervisor questionnaires were posted to all eight manufacturers. Unfortunately TVMANH declined to participate and TVMANG was liquidated during the survey and did not return any questionnaires. Sixty-two supervisor questionnaires were returned giving a response rate of 68.9% of which 6.5% did not indicate their manufacturing responsibility. A detailed breakdown of the supervisor sample is shown in Tables 8.1 to 8.4 in terms of manufacturing responsibility, manufacturing experience, level of responsibility and education level respectively.

In Table 8.1 the manufacturing responsibility is cross-tabulated with the manufacturers indicating that only three manufacturing responsibilities have any substantial representation in the supervisor sample, namely chassis assembly, final assembly and quality control. It is interesting that TVMANB, TVMANC and TVMANE do not have any representation from their chassis assembly area with TVMANA and TVMANC having no representation from their final assembly area - these two areas represent the main thrust of television assembly operations.

Table 8.1: Composition of the supervisor sample (n = 62) in terms of manufacturing responsibility (a percentage breakdown)

Manufacturer	Area of responsibility						
	Machine insertion	Hand insertion	Chassis	Final	Quality control	Material control	Total
TVMANA	0.0	1.7	1.7	0.0	8.6	3.4	15.4
TVMANB	1.7	3.4	0.0	3.4	1.7	0.0	10.3
TVMANC	0.0	0.0	0.0	0.0	10.3	3.4	13.6
TVMAND	3.4	0.0	5.2	3.4	8.6	1.7	22.3
TVMANF	1.7	3.4	10.3	1.7	5.2	1.7	23.9
TVMANE	0.0	1.7	0.0	12.1	0.0	0.0	13.8
Total	6.8	10.2	17.2	20.6	34.4	10.2	100.0

Table 8.2: Manufacturing experience of the supervisor sample

Manufacturer	Sample size	Mean experience in Years	Kruskal-Wallis P-Value
TVMANA	8	10.89	0.0288
TVMANB	9	10.89	
TVMANC	9	7.13	
TVMAND	14	14.14	
TVMANF	14	10.21	
TVMANE	8	10.25	

Table 8.2 expresses the experience of the supervisor sample by manufacturer indicating that the level of experience between the manufacturers is significantly different from each other with TVMAND having the most experience and TVMANC the least experience. The mean experience and standard deviation of the supervisor group is 10.21 years and 7.94 respectively, indicating that a reasonably high level of experienced personnel participated in the survey.

In Table 8.3 responsibility is cross-tabulated with the manufacturers indicating that four levels of manufacturing responsibility have substantial representation in the sample, namely supervisors, managers, technicians and inspectors.

In Table 8.4 the level of education is cross-tabulated with the manufacturers indicating that 67.8% of the respondents have at least a tertiary qualification.

Table 8.3: Composition of the supervisor sample in terms of responsibility (a percentage breakdown)

Manufacturer	Level of responsibility					
	Inspector	Fault finder	Technician	Supervisor	Superintendent	Manager
TVMANA	1.6	1.6	0.0	6.5	0.0	4.8
TVMANB	6.5	0.0	0.0	3.2	0.0	3.2
TVMANC	3.2	0.0	3.2	4.8	1.6	1.6
TVMAND	1.6	3.2	0.0	6.5	0.0	9.7
TVMANF	3.2	1.6	6.5	4.8	0.0	6.5
TVMANE	0.0	1.6	4.8	0.0	0.0	8.1
Total	16.1	8.1	14.5	25.8	1.6	33.9

Table 8.4: The level of education of the supervisor sample (a percentage breakdown)

Manufacturer	Level of education				
	University degree	Diploma	Certificate	Matric	< Matric
TVMANA	0.0	4.8	6.5	3.2	0.0
TVMANB	0.0	3.2	4.8	1.6	3.2
TVMANC	0.0	4.8	3.2	3.2	1.6
TVMAND	1.6	9.7	3.2	6.5	1.6
TVMANF	1.6	8.1	4.8	6.5	1.6
TVMANE	0.0	1.6	9.7	3.2	0.0
Total	3.2	32.3	32.3	24.2	8.1

8.3 THE STATISTICAL RESULTS

The **supervisor/technical questionnaire** consists of thirty questions covering five parts: general information (five questions), quality performance (six questions), management policies and attitudes (ten questions), quality policies (seven questions), and work force attitudes (two questions). An example of this questionnaire is given in Appendix D.

The **senior management questionnaire** consists of forty-one questions covering seven parts: general information (nine questions), labour force (four questions), quality performance (seven questions), quality policies and strategies (seven questions), supplier quality (one question), quality systems (seven questions), and service quality (six questions). An example of this questionnaire is given in Appendix E.

8.3.1 The supervisor questionnaire

The supervisors are asked to rank and measure, on an arbitrary scale, the various dimensions

and characteristics of product quality in order to establish their meaning and experience of colour television receiver quality. The internal quality performance is investigated by asking questions relating to the reasons for quality problems occurring during manufacture, to what extent is quality performance measured and whether feedback mechanisms are used. Management policies and attitudes are also investigated to establish the acceptance and commitment of quality improvement of processes and practices. This information is evaluated and compared between the different manufacturers to establish the validity of the hypothesis that there is a need for the manufacturers to improve their quality control procedures.

8.3.1.1 Product quality dimensions

In question 5 (Part one) the respondents are asked to rank all eight quality dimensions in respect of their importance to colour television receivers. In order to quantify the preferences the weighted ranking score method is used. The overall preference of dimension is obtained from the percentage column in Table 8.5.

From Table 8.5, the overall ranking of the first three colour television receiver quality dimensions in order of preference are: reliability (18.3%), performance (14.4%), and durability (13.6%). These results indicate that the manufacturers agree on the importance of reliability, performance and durability with the consumers (see Table 7.7) and the retailers (see Table 5.13). The service repairers expectedly ranked maintainability higher but agree also on the importance of reliability and durability (see Table 6.20). It is interesting that the manufacturers rank maintainability very low even though their companies are required to support their products in the field for a number of years.

Table 8.5: Ranking of product quality dimensions

Quality dimensions	Ranking								
	One	Two	Three	Four	Five	Six	Seven	Eight	%
Reliability	27	14	4	4	2	1	1	4	18.3
Performance	8	11	13	6	3	7	4	6	14.4
Durability	5	10	11	7	7	7	9	2	13.6
Perceived quality	9	6	4	10	6	14	3	4	12.9
Conformance	5	5	10	8	7	7	9	5	12.0
Features	2	8	7	9	9	4	8	10	11.4
Maintainability	0	3	4	9	15	6	9	10	9.6
Aesthetics	0	1	6	3	7	10	14	17	7.8

Table 8.6: A comparison between the manufacturers on product quality dimensions

Quality dimensions	Manufacturer						
	TV-MANA	TV-MANB	TV-MAND	TV-MANC	TV-MANF	TV-MANE	%
Reliability	20.5	20.0	21.0	13.1	17.9	20.4	18.3
Performance	15.3	12.9	5.9	13.9	12.7	18.0	14.4
Durability	14.2	14.5	15.5	10.7	14.1	15.5	13.6
Perceived	13.5	11.0	13.9	15.9	12.9	12.7	12.9
Conformance	12.5	12.5	13.2	10.7	13.1	11.4	12.0
Features	12.2	9.0	11.6	17.1	10.7	10.2	11.4
Maintainability	6.6	13.3	10.0	10.3	9.5	10.2	9.6
Aesthetics	5.2	6.7	8.7	8.3	9.1	11.0	7.8

In Table 8.6 a summary of the manufacturers' weighted total percentage for each dimension is given. From these results it is clear that reliability is ranked by the majority of manufacturers as their most preferred dimension. Only TVMANC did not rank reliability as their most preferred dimension and ranked features first. It is noteworthy that aesthetics was ranked by four of the manufacturers as their most least preferred dimension.

8.3.1.2 Product quality performance

In question 1 (Part two) the respondents are asked to rate the quality of their company's colour television receivers in relation to their competitors, using a scale ranging from 1 ("much worse") to 5 ("much better"). The results in Table 8.7 show that approximately 75% indicated that their company was better, with TVMANF being the only manufacturer to rate themselves worse than their competitors.

Although self-appraisal could result in a biased opinion it must be emphasised that the company is considered not capable of performing and not the individual respondent.

Table 8.7: Self-appraisal of quality performance (a frequency breakdown)

Manufacturer	Response category					
	Much worse	Little worse	The same	Little better	Much better	%
TVMANA	-	-	-	-	9	14.8
TVMANB	-	-	-	2	6	13.1
TVMANC	-	-	3	3	1	11.5
TVMAND	-	-	-	5	9	23.0
TVMANF	-	5	7	1	1	23.0
TVMANE	-	-	-	2	7	14.8
Total	-	5	10	13	33	100.0

In question 2 (Part two) the respondents are asked to indicate what stage their company has reached in solving quality problems. A scale ranging 1 "we have no idea" to 5 "we know why they occur" is used. The results show that 51% of the respondents indicated that their company knows why quality problems are occurring and 37% know "most of the time". Only 11% indicated that their company knows "some of the time", the reasons for quality problems occurring. It is clear from these responses that the colour television manufacturers have identified and know the reasons for quality problems occurring during manufacture.

In question 5 (Part two) the respondents are asked to break down the causes of quality problems into 7 areas by assigning a ranking score between 1 ("highest") and 7 ("lowest").

In order to establish the most serious problem areas the weighted ranking score method is used. The most serious problem areas are obtained from the percentage column in Table 8.8.

Table 8.8: A ranking of quality problem areas in the colour television industry

Problem areas	Ranking							%
	One	Two	Three	Four	Five	Six	Seven	
Workmanship	27	5	6	4	4	6	4	18.6
Materials	5	18	11	7	3	9	3	16.2
Product Design	10	8	3	9	13	5	9	14.4
Systems	4	7	8	15	10	4	9	13.7
Management	8	6	10	6	5	11	11	13.6
Equipment	1	6	13	4	12	11	9	12.1
Maintenance	1	7	5	12	9	10	12	11.5

From Table 8.8 workmanship errors and faulty materials have substantial representation in the sample and are therefore the main quality problem areas occurring in the colour television industry. Workmanship errors can take several forms. For example, some operators exhibit no interest in quality or even work which is evidenced by high error rates, lack of response for corrective action and absenteeism. Some operators conceal defects by not reporting scrap and they falsify records. Other operators devise ways to increase production at the expense of quality so as to give themselves more leisure time on the job. In some situations good operator performance creates problems with fellow workers or the trade union to which the operator has loyalty.

These problems may be caused by monotonous jobs often found in colour television assembly operations which is a highly repetitive flow-type production system. Subjectiveness in product evaluation caused by vague standards and inadequate information as well as failure to resolve personal grievances are possible defences for operator errors. For workmanship-initiated errors, the major remedy is through motivation. Through quality planning by specialists, critical aspects of a job can be given to operators whose motivation level is higher, thereby removing offending operators from jobs giving rise to a high incidence of defects. Provision of clear traceability to operators through identity stamps is another remedy that may be used to reduce workmanship errors.

Due to the fact that the colour television manufacturing industry imports components and materials in kit form (see Section 8.3.2.1) from overseas suppliers the emphasis on reducing faulty materials should lie with the development of good vendor relations and not the management of an incoming inspection department.

In Table 8.9 the quality problem areas are cross tabulated with the manufacturers in order to establish whether any common patterns of causation exist. These results indicate that four of the six manufacturers rate workmanship errors as their main quality problem area with two manufacturers indicating faulty materials as their highest concern. It is noteworthy that inadequate maintenance and poor production equipment are the least areas of concern

indicating that the facilities in the colour television industry are probably reliable.

In question 6 (Part two) the respondents are asked to rank the reasons for quality problems occurring on their products during manufacture by giving a ranking factor against a given list of probable reasons. The list of areas (discussed previously) and the list of reasons for possible quality problems are marginally different in so far as "too many models", "insufficient workforce instructions" and "attitudes towards quality" were added to the list of areas to make up the list of reasons with "management errors" changed to "supervision". This was done in order to assess whether supervision has any impact and whether the generally accepted excuses of "too many models", "attitudes towards quality" and "insufficient instructions" are significant factors.

Table 8.9: A comparison between the manufacturers on quality problem areas

Problem areas	Manufacturer						
	TV-MANA	TV-MANB	TV-MAND	TV-MANC	TV-MANF	TV-MANE	%
Workmanship	21.0	18.3	15.5	17.9	20.7	19.7	18.6
Materials	19.6	14.7	16.0	15.3	13.3	22.3	16.2
Product design	8.5	15.2	14.1	13.8	17.6	11.7	14.4
Systems	12.1	13.6	15.2	13.8	13.8	14.4	13.7
Management	12.9	15.7	15.7	16.3	11.5	10.1	13.6
Equipment	14.3	10.5	10.4	14.8	10.5	12.8	12.1
Maintenance	11.6	12.0	13.1	8.2	12.8	9.0	11.5

In order to establish the most important reasons the weighted ranking score method is used. The most important reasons are obtained from the percentage column in Table 8.10.

From Table 8.10 workmanship is ranked first followed by faulty components, poor supervision and quality attitudes. It is noteworthy that supervision is ranked equally second with faulty components given that approximately 26% of the respondents are supervisors and 35% are managers (see Table 8.3). The aim of supervision is to improve the performance of man and machine, to improve quality and to increase output. More specifically the aim of supervision is to remove the causes of failure and to help operators to work smarter and achieve greater consistency of performance. It follows therefore that motivation and training that are quality-problem-centered is probably lacking in the industry. Training that is built around assisting supervisors to do a better quality job is implied rather than the dissemination of broad, general theories regarding quality practices. It is interesting that quality attitudes were ranked fourth. According to Feigenbaum (1986:205) quality attitudes are historically shaped by a broad process of quality education which involves not only formal quality control courses but, to a much larger extent, many informal quality influences. Another technique to improve quality attitudes is to involve employees in actions for improvement of operations.

Table 8.10: A ranking of reasons for poor quality in the colour television industry

Reasons for poor quality	Ranking										
	1	2	3	4	5	6	7	8	9	10	%
Workmanship	18	4	6	8	6	2	2	2	7	1	12.7
Faulty components	1	10	13	5	6	6	4	2	5	4	10.9
Supervision	4	10	7	7	6	5	5	4	3	5	10.9
Quality attitudes	10	8	2	7	5	4	1	9	4	6	10.6
Poor instructions	4	4	8	4	10	6	5	5	7	4	10.0
Too many models	5	8	5	5	5	4	7	3	5	11	9.8
Product design	11	2	3	6	4	3	3	7	6	13	9.3
Systems and controls	1	1	7	9	5	10	6	9	4	5	9.0
Maintenance	3	5	4	6	3	5	12	8	8	2	9.0
Design of equipment	0	4	2	1	6	11	11	9	7	5	7.7

In question 3 (Part two) the respondents are asked how the quality of their work is evaluated. All of the manufacturers indicated that various measures are used. The most popular measures being "reject rates" (37%) followed by "amount of rework" (20%) and "scrap costs" (17%). None of the manufacturers indicated that "no measures" were being undertaken. It is clear, therefore, that quality performance measurements are in place indicating that quality characteristics are being quantified. It is a generally accepted fact that the quantification of quality performance receives more attention from management than vague objectives since there is less room for debate on what has actually happened allowing the establishment of cause and effect relationships. Finding remedies is generally easier than discovering causes and therefore the information required to improve products and processes appears to be available.

In question 4 (Part two) approximately 56% the respondents indicated that the only acceptable level of defects is zero whereas 32% did not agree with the balance indicating a neutral position. These results indicate that a "zero defect" motivational program may be effective in certain situations for certain companies. According to Feigenbaum (1986:213) participative approaches to the fostering of quality commitment in many companies have proved their value over the years. The key is an employee involvement programme which genuinely meets the needs and conditions of the specific company.

8.3.1.3 Management policies and attitudes

All organisations have either in mind or writing, a set of principles, creeds and beliefs (policies) which represent their broad guidelines to managerial conduct. There are no "right" policies, other than the obvious, because each company is unique with policies structured to fit it. With this in mind, Part 3 of the questionnaire was structured to investigate in what manner management policies and attitudes may be affecting the management of quality in the colour television industry.

In question 7 (Part three) the respondents were asked to rank their manufacturing objectives

by giving a ranking factor against a given list of manufacturing objectives. Although there are many reasons why manufacturing companies create objectives the more usual have been selected for investigation.

In order to establish the most important objectives the weighted ranking score method is used. The most important objectives are obtained from the percentage column in Table 8.11.

The results in Table 8.11 indicate that "meeting the production schedule" and "producing high quality products" are the two main manufacturing objectives having significant representation in the sample. "Meeting the production schedule" implies that numerical quotas may be in use as work standards. For example, a production schedule might require that 500 products be produced per day implying that one product per minute must be completed. Deming (1986:71) explains that quotas work against improvement of quality and productivity because numerical goals are usually an attempt to manage without knowledge of what to do (management by numbers). It is noteworthy that "improving worker productivity" is ranked the lowest in importance. Experience has demonstrated that by improving quality one decreases costs and inevitably productivity improves (Deming 1986:2). This is because productivity depends not merely on more output per minute but on more **useable** output that will provide customer satisfaction

Table 8.11: Ranking of manufacturing objectives

Manufacturing objectives	Ranking				
	One	Two	Three	Four	%
Meeting the production schedule	25	14	13	9	29.4
High quality products	23	14	12	11	28.0
Low cost production	9	20	10	21	22.7
Improving productivity	4	12	25	18	19.9

In Table 8.12 the manufacturers are cross-tabulated with the manufacturing objectives. It is interesting that three of the six manufacturers rank "meeting the production schedule" as the main objective. TVMAND is the only manufacturer showing a significantly high commitment to producing high quality products with TVMANF the lowest.

Table 8.12: A comparison between the manufacturers on objectives

Manufacturing objectives	Manufacturer					
	TV-MANA	TV-MANB	TV-MANE	TV-MANF	TV-MANC	TV-MAND
High quality products	30.0	29.0	29.9	19.3	21.3	40.5
Production schedule	27.8	31.0	27.3	33.6	33.8	26.2
Low cost production	20.0	22.5	22.1	27.1	25.0	20.6
Improving productivity	22.2	17.5	20.8	20.0	20.0	12.7

In questions 1, 4 and 6 (Part three) the respondents are asked to rate the amount of pressure being applied to increase quality, the importance of producing defect free products, and how much attention to quality is given by their respective companies using a scale ranging from 1 ("very little") to 5 ("too much").

The results in Table 8.13 show that the manufacturers were rated on average between 3 and 4 and in some instances above 4 implying that a lot of pressure is been applied to increase quality with no statistically significant differences existing between the manufacturers. However, statistically significant differences between the manufacturers on the importance of producing defect free products and the attention given to quality were found. It is interesting that TVMANC is the only manufacturer providing little to mediocre attention to quality and producing defect free products by their management.

Table 8.13: A comparison between the manufacturers on quality attitudes

Quality attitudes	Manufacturer (No. of responses)						Kruskal Wallis P-Value
	TV-MANA (9)	TV-MANB (8)	TV-MANE (9)	TV-MANF (14)	TV-MANC (8)	TV-MAND (14)	
Increase quality	3.4	4.1	3.9	4.2	3.4	3.5	0.1772
Defect free products	4.1	3.5	4.3	3.9	2.8	4.3	0.0009
Attention to quality	4.4	3.6	4.1	3.4	1.9	4.1	0.0001

In questions 2, 3 and 5 (Part three) the respondents are asked to rate the importance given to low cost production, meeting production schedules and worker productivity by their respective companies using a scale ranging from 1 ("very little") to 5 ("too much"). The results in Table 8.14 show that all of the six manufacturers were rated on average between 3 and 4 and in some instances above 4, implying a lot of attention and importance are being given to these issues with no statistically significant differences existing between the manufacturers at the 0.05 level.

Although these results show that a lot of importance is given to productivity, it is considered by the majority of the manufacturers to be the lowest priority of the four objectives (see Table 8.12 and Table 8.14). Similarly low cost production commands a lot of importance, but is prioritised less than the need to produce high quality products and meeting production schedules (see Table 8.12 and Table 8.14).

Table 8.14: A comparison between the manufacturers on their attitudes regarding the importance of productivity, low cost and production volumes

Attitudes	Manufacturer (No. of responses)						Kruskal Wallis P-Value
	TV-MANA (9)	TV-MANB (8)	TV-MANE (9)	TV-MANF (14)	TV-MANC (8)	TV-MAND (14)	
Low cost production	4.0	3.1	3.8	3.8	4.1	3.6	0.5611
Production volumes	4.2	4.0	4.3	4.2	4.3	4.4	0.9199
Productivity	4.0	3.6	4.4	4.2	4.3	4.2	0.4149

In questions 8, 9 and 10 the respondents are asked to rate their company on whether employees are discouraged from demonstrating initiative, whether participative management is the predominant management style, and if there is commitment to the ongoing training of the workforce. A scale ranging from 1 ("strongly disagree") to 5 ("strongly agree") is used.

Table 8.15: A comparison between the manufacturers on employee initiative, participative management and training

Attitudes	Manufacturer (No. of responses)						Kruskal Wallis P-Value
	TV-MANA (9)	TV-MANB (8)	TV-MANE (9)	TV-MANF (14)	TV-MANC (8)	TV-MAND (14)	
Employee initiative	2.6	3.0	1.4	2.6	3.4	2.9	0.1014
Participation	2.9	3.3	3.3	3.2	2.6	3.6	0.0469
Training	3.1	3.4	4.1	2.6	2.8	4.0	0.0035

The results in Table 8.15 indicate that the manufacturer's workforces may not be highly motivated to produce quality even though employees are not actively discouraged from demonstrating initiative. It is noteworthy that no statistically significant differences exist between the manufacturers on discouraging employee initiative. It has been shown that employee participation and training, in most companies, are prime sources of motivation (Juran *et al.* 1979:18-20). Table 8.15 shows that a participative management style is not being forcefully employed by all the manufacturers. It is noteworthy that statistically significant differences exist with TVMANC manifesting a particularly low rating for participative management style. Training of the workforce is being strongly applied by TVMAND and TVMANE. TVMANF is the only manufacturer found to be significantly different from TVMAND and TVMANE in their commitment to training their workforce.

8.3.1.4 Quality policies

The most common form of quality policy is a brief statement giving guidelines for conduct in respect of providing products and services of a quality that meets the needs and expectations of customers, and in so doing, to be a leader in quality reputation. To be useful, quality policies should provide specific guidelines for action on important matters to help both employees and outsiders as to what to expect from management.

In question 1 (Part 4) the respondents are asked if they have seen a formal quality statement of their company. From Table 8.16 it is significant that none of the manufacturers participating in the survey obtained a 100% "yes" response from their supervisors. These results indicate that a formal quality statement is probably in existence for each of the manufacturers. However, the communication of quality policy appears to be lacking at the supervisor level.

No one quality policy can encompass all company activities which is normally solved by creating several levels of quality policy. In order to ensure that all these quality policies are adhered to, procedures and work instructions are developed into a quality manual which

includes formal plans, definitions, corrective action, process control, inspection and test including feedback. In order to assess the existence of various levels of quality policy, the respondents are asked in questions 2, 4 and 7 (Part 4) whether such activities are being carried out.

The results in Table 8.16 indicate that a system of feedback and inspection on processed work is in existence for each of the manufacturers. TVMANC, however, appear to either have an informal system or are inconsistent with their policy of feedback whereas the remaining manufacturers are probably using a formal feedback system.

Table 8.16: Responses by the manufacturers on the existence of quality policies (a percentage analysis)

Questions relating to the existence of quality policies	Manufacturer (No. of responses)					
	TV-MANA (9)	TV-MANB (8)	TV-MANE (9)	TV-MANF (14)	TV-MANC (8)	TV-MAND (14)
Have you seen a policy statement?	77.8	83.3	92.9	21.4	55.6	25.0
Are rejects feedback?	88.9	100.0	92.9	100.0	87.5	62.5
Is inspection carried out on processed work?	100.0	100.0	92.9	100.0	100.0	87.5
Is SPC used?	100.0	100.0	92.9	78.6	88.9	37.5

In question 7 (Part four) the respondents are asked whether statistical process control (SPC) techniques are being used in managing quality in their area of work. According to Deming (1986:354) the improvement of quality and economy of production can only commence once statistical control is established.

The results in Table 8.16 indicate that statistical quality control is in existence in most areas of manufacturing for the majority of the manufacturers. The existence of statistical quality control, however, does not imply that the advantages of stability or statistical control are being accomplished. The propensity to improve performance is only probable if processes are in statistical control.

Deming (1986:54) supports the view that management is not supervision, but rather leadership, and that management must work on the sources of improvement by identifying possible causes. In questions 3 and 6 (Part four) the respondents are asked to indicate whether leadership has played a key role in improving quality and whether a continual emphasis on quality improvement of processes and practices is in existence, respectively. A scale ranging from 1 ("strongly disagree") to 5 ("strongly agree") is used.

Table 8.17: A comparison between the manufacturers on leadership and quality improvement

Quality policy	Manufacturer (No. of responses)						Kruskal Wallis P-Value
	TV-MANA (9)	TV-MANB (8)	TV-MANE (9)	TV-MANF (14)	TV-MANC (8)	TV-MAND (14)	
Leadership	3.8	4.4	4.3	3.4	2.9	4.1	0.0030
Quality	3.8	4.1	4.3	3.6	3.5	4.2	0.1441

The results in Table 8.17 show that the majority of the manufacturers were rated on average between 3 and 4 and in some instances above 4 implying that leadership has played a key role in improving processes and practices in the colour television manufacturing industry. It is noteworthy that no statistically significant differences exist between the manufacturers on emphasising quality improvement. However, the leadership at TVMANC, in demonstrating commitment to quality, is significantly different from TVMANB, TVMANE and TVMAND.

In question 5 (Part four) the respondents are asked to prioritise their perception of colour television receiver quality by ranking the quality definitions espoused by the quality theorists (Demming, Crosby, Juran and Feigenbaum) in order to obtain insight into the meaning of colour television receiver quality from a manufacturing perspective.

In order to establish the most preferred definition of quality the weighted ranking score method is used. The overall preference of a definition for colour television receiver quality is obtained from the percentage column in Table 8.18.

Table 8.18: Ranking of quality definitions

Quality definitions	Ranking					
	One	Two	Three	Four	Five	%
Meeting customer expectations	20	19	7	5	4	24.8
Zero defects	21	12	10	7	10	24.3
Pride of workmanship	4	8	21	14	10	18.0
Conformance to requirements	4	11	12	14	16	16.9
Fitness for use	5	10	8	16	16	16.1

From Table 8.18, the first two definitions of colour television receiver quality in order of preference, are "meeting customer expectations" (24.8%) and "zero defects" (24.3%) which have substantial representation in the sample. These results indicate that there is no significant agreement on a definition for colour television receiver quality and that the key lies in understanding that quality is not a singular characteristic.

In Table 8.19 a comparison between the manufacturers for each definition shows that there is substantial agreement on "meeting customer expectations" and "zero defects" as the two most preferred definitions.

Table 8.19 Ranking of product quality definitions by manufacturer

Quality definitions	Ranking					
	TV-MAN A	TV-MAN B	TV-MAN D	TV-MAN F	TV-MAN E	TV-MAN C
Meeting customer expectations	25.5	30.5	23.6	26.1	21.2	24.8
Fitness for use	18.2	9.5	23.6	20.3	11.0	21.0
Pride of workmanship	13.9	21.9	13.4	14.0	22.9	18.1
Conformance to requirements	17.5	15.2	13.0	19.3	14.4	18.1
Zero defects	24.8	22.9	26.4	20.3	30.5	18.1

8.3.1.5 Work force attitudes

The individual operator is the key to the production of products of satisfactory quality. It is generally recognised that in most instances, the operator wants to do a good job. However, the correct "climate" must be provided by management for this accomplishment (Feigenbaum 1986:205). A quality system is designed around the operator incorporating a technological program which must be supplemented by a human climate which motivates the operator to produce good quality.

Question 1 (Part five) is designed to establish whether the attitude of the workforce is a significant cause of quality problems occurring in the colour television manufacturing industry. In question 1 (Part five) the respondents are asked to rate their work force on the amount of care they give to product quality using a scale ranging from 1 ("do not care") to 5 ("care too much"). In question 2 the respondents are asked to indicate whether quality (fewer defects) can be improved upon by providing monetary awards.

Table 8.20: A comparison between the manufacturers on work force attitudes

Attitudes	Manufacturers						Kruskal-Wallis p Value
	TV-MANA (9)	TV-MANB (8)	TV-MANE (9)	TV-MANF (14)	TV-MANC (8)	TV-MAND (14)	
Product quality	3.7	4.0	4.2	3.0	2.8	3.1	0.0057
Monetary awards (yes %)	100.0	100.0	66.7	85.7	71.4	100.0	

The results shown in Table 8.20 indicate that the workforces of the majority of manufacturers care more than sufficiently about product quality with TVMANE obtaining the highest rating. TVMANC and TVMANF manifest a mediocre rating which is significantly different to TVMANE. It is noteworthy that there is a high agreement amongst the manufacturers in providing monetary awards to improve quality which may indicate the existence of poor supervision. Deming (1986:72) criticises incentive pay or monetary awards as a manifestation of an inability to understand and provide appropriate supervision.

8.3.2 Senior management questionnaire

General information regarding each manufacturer is requested in order to establish whether different levels of production, models, experience and localisation programs have any significant impact on the product and repair service quality.

The senior managers are asked to provide their internal and external failure rates in order to establish quality performance levels. Questions relating to the reasons for quality problems occurring during manufacture are explored. Quality systems, policies and attitudes are also investigated to establish the acceptance and commitment of quality improvement of processes

and practices. Labour matters are analysed to establish its significance relating to achieving quality during manufacture. All these issues are evaluated and compared between the different manufacturers to establish the validity of the hypothesis that there is need for the manufacturers to improve their quality control procedures.

8.3.2.1 General information

In question 1 (Part one) the respondents are asked to indicate the output of their factory during 1993 in respect of 71cm, 51cm and 37cm screen size colour television receivers. From Table 8.21 it can be seen that all the manufacturers produced comparatively similar volumes for the three standard screen sizes which allows more meaningful comparisons to be made between the manufacturers.

Table 8.21: A comparison between the manufacturers on general information

Manufacturer	No. of television receivers ('000)			Experience	Models	SABS
	71 cm	51 cm	37 cm	Years	Quantity	Mark
TVMANA	< 10	> 40	< 10	20	4	Yes
TVMANB	11-15	31-35	11-15	20	6	Yes
TVMAND	16-20	> 40	11-15	20	9	Yes
TVMANF	< 10	31-35	< 10	3	7	No
TVMANE	< 10	31-35	11-15	7	7	No
TVMANC	< 10	26-30	< 10	20	7	Yes

It is interesting to note that TVMANA, TVMANB, TVMANC and TVMAND, who have been in existence since the inception of television in South Africa, have implemented an ISO 9000 quality management system evidenced by the fact that the SABS mark is displayed on their products (see Table 8.21).

It is noteworthy that some manufacturers are producing as few as 4 and others as many as 9 significantly different models. The fewer model approach, for example TVMANA, utilises the principle of commonality during production which has the advantage of less change over, similar specifications, parallel operations and similar process variables thereby providing higher efficiencies of scale and improved quality.

In questions 5 and 6 (Part one) the respondents are asked to specify whether kits used in the manufacture of colour television receivers are imported in completely knocked down (CKD) form or whether local design and manufacture is used. From Table 8.22 all the manufacturers indicate that imported CKD kits are used, with as much as 20% and as little as 3% local content. It is interesting that the majority of the older manufacturers have more local content than the new manufacturers.

In question 2 (Part one) the respondents are asked to indicate the number of managers, supervisors, direct labour and indirect labour employed during 1993. By observing Tables 8.21, 8.22 and 8.23 it is noticeable that TVMAND, being the higher volume producer with the most number of different models and having more local content is also the manufacturer having the highest number of employees which is 32.1% of the total number of employees for the six manufacturers. The high complement of TVMAND employees would only make sense if the cost advantages of the local content program is economically viable.

The ratio of labourers to supervisors for the industry is 17 which appears to be reasonable. It is significant that TVMANB and TVMANE have labourer/supervisor ratios of 34 and 43 respectively. These ratios appear to be very high which may impact on their ability to supervise quality issues due to the wide span of control being applied over employees directly involved with generating quality characteristics. With all manufacturers using one shift it appears that additional capacity is available should the market demand increase substantially.

Table 8.22: A comparison between the manufacturers on kit compilation

Manufacturer	Local content (%)			Completely knocked down kits	
	71 cm	51 cm	37 cm	Imported	Local design
TVMANA	20	20	14	Yes	No
TVMANB	8	8	8	Yes	No
TVMAND	18	31	29	Yes	No
TVMANF	3	3	3	Yes	No
TVMANE	10	10	10	Yes	No
TVMANC	6	20	3	Yes	No

Table 8.23: A comparison between the manufacturers on employees utilised

Manufacturer	Number of employees utilised				Number of shifts
	Managers	Supervisors	Direct labour	Indirect labour	
TVMANA	8	15	150	69	1
TVMANB	7	4	100	37	1
TVMAND	8	27	270	93	1
TVMANF	7	8	108	20	1
TVMANE	5	4	150	20	1
TVMANC	2	7	100	20	1
Total	37	65	878	259	-

In question 8 (Part one) the respondents are asked to prioritise their perception of colour television receiver quality by ranking the quality definitions espoused by the quality theorists in order to obtain insight into the meaning of colour television receiver quality from a senior management perspective and to compare this with the perceptions of the supervisors.

In order to establish the most preferred definition of quality the weighted ranking score method is used. The overall preference of a definition for colour television receiver quality is obtained from the percentage column in Table 8.24.

From Table 8.24 the most important definitions of colour television receiver quality in order of preference, are: "meeting customer expectations" (26.7%), "zero defects" (22.2%) and "fitness for use" (22.2%) which have substantial representation in the sample.

Table 8.24 Ranking of product quality definitions by senior management

Quality definitions	Ranking						
	TV-MAN A	TV-MAN B	TV-MAN D	TV-MAN F	TV-MAN E	TV-MAN C	%
Meeting customer expectations	3	1	1	2	3	2	26.7
Fitness for use	4	3	2	5	1	1	22.2
Zero defects	1	2	3	3	2	5	22.2
Pride of workmanship	2	4	4	1	4	4	18.9
Conformance to requirements	5	5	5	4	5	3	10.0

It is interesting that the supervisors also selected "meeting customer expectations" and "zero defects" as their most preferred definitions of colour television receiver quality indicating that there is general agreement within the management structure of the manufacturers. In question 9 (Part one) the respondents are asked to rank all eight quality dimensions in respect of their importance to colour television receivers. In order to establish the most preferred dimension the weighted ranking score method is used. The overall preference of dimension is obtained from the percentage column in Table 8.25.

From Table 8.25 the overall ranking of the first three colour television receiver quality dimensions, in order of preference, are: reliability (21.3%), perceived quality (16.2%) and performance (15.7%)

Table 8.25: A comparison between the manufacturers on product quality dimensions

Quality dimensions	Manufacturers						%
	TV-MAN A	TV-MAN B	TV-MAN D	TV-MAN C	TV-MAN F	TV-MAN E	
Reliability	1	2	2	1	1	1	21.3
Perceived quality	4	1	1	3	2	8	16.2
Performance	3	3	4	2	6	2	15.7
Durability	2	8	8	5	3	3	11.6
Conformance	7	6	5	4	4	4	11.1
Aesthetics	6	5	3	6	7	7	9.3
Features	5	4	7	7	8	5	8.3
Maintainability	8	7	6	8	5	6	6.5

These results indicate that the supervisors (see Tables 8.5 and 8.6) agree on the importance of reliability and performance with senior management. It is noteworthy that senior management gives a high priority to perceived quality whereas supervisors consider durability to be more important.

8.3.2.2 Labour

In Part two of the questionnaire the respondents are asked to indicate the percentage absenteeism (based on shifts or days), the percentage labour turnover (excluding retrenchments) and whether their workforce is represented by a labour union. The results of

these questions are summarised in Table 8.26. Absenteeism for the colour television manufacturing industry appears to average around 5% and labour turnover 2.3% with union representation found in all factories.

A 5% absenteeism figure implies that operators need to be more widely skilled and flexible in their job assignments thereby allowing vacant positions as a consequence of absenteeism, to be filled with competence.

Table 8.26: A comparison between the manufacturers on labour issues

Manufacturer	Percentage absenteeism of direct labour						Union presence	Percentage labour turnover
	0-1	2-3	4-5	6-7	8-9	>10		
TVMANA			■				■	0.5
TVMANB			■				■	1.0
TVMAND			■				■	5.0
TVMANF		■					■	4.0
TVMANE		■					■	1.0
TVMANC					■		■	2.0

8.3.2.3 Quality performance

To identify quality performance two dimensions namely **external failure rates**, measured by the rate of service calls for units under first year of warranty excluding customer instruction calls, and **internal failure rates**, measured by defect rates occurring at chassis test and final test were requested from the respondents in questions 1, 4 and 5 (Part three). These results are summarised in Table 8.27 and indicate that 71cm screen sizes on average fail more frequently under warranty than the smaller screen sizes. The first year warranty failures average between 0 and 15 percent with TVMANF manifesting the highest failure rate. The

chassis fail rate averages between 10 and 15 percent with final test fail rate averaging between 0 and 5 percent.

Table 8.27: A comparison between the manufacturers on quality performance

Manufacturer	External failure rates (%)			Internal failure rates (%)	
	First year warranty			Chassis	Final
	71 cm	51 cm	37 cm		
TVMANA	0-5	0-5	0-5	1	3
TVMANB	11-15	6-10	6-10	18	1
TVMAND	6-10	6-10	0-5	20	15
TVMANF	16-20	11-15	11-15	20	5
TVMANE	0-5	0-5	0-5	8	1
TVMANC	0-5	0-5	0-5	10	5

The large differences in quality performance figures, shown in Table 8.27, may be explained by the fact that some manufacturers differ in how they define and record defects. For example, some manufacturers may be recording every single product defect and others may be interested in only major flaws. Unit prices of more expensive products, such as a 71cm screen size colour television receiver, are known to influence the service call rate (Juran *et al.* 1979:15-15).

In question 7 (Part three) the respondents are asked to rank the main reasons for quality problems occurring during the warranty period. The results in Table 8.28 are determined by the weighted ranking score method. The main reasons for warranty failures are obtained from the percentage column in Table 8.28.

Table 8.28: Ranking of product failure categories during the warranty period

Failure categories	Ranking						
	TV-MAN A	TV-MAN B	TV-MAN D	TV-MAN F	TV-MAN E	TV-MAN C	%
Customer education	1	2	1	1	1	2	31.1
Faulty components	3	4	3	2	3	1	22.2
Poor installation	2	5	2	5	2	5	16.7
Poor product design	5	1	4	4	5	3	15.6
Poor workmanship	4	3	5	3	4	4	14.4

It is clear from these results that customer education service calls have substantial representation with all the manufacturers. These calls, for instance, arise as a result of consumer ignorance of product knowledge. Due to the operational complexity of modern electronic products and the centralised role of the colour television receiver in home entertainment needs, it is not surprising that such complaints are extensive. Service calls due to faulty components are the main manufacturing controllable defect occurring during the warranty period. Poor product design is only ranked high by one manufacturer with the balance indicating that few problems result from design flaws. The importation of kits implies that all the products manufactured in South Africa are designed overseas (see Table 8.22).

In question 6 (Part three) the respondents are asked to rank the reasons for quality problems occurring during manufacture. The results in Table 8.29 are determined by the weighted ranking score method. The main reasons for failure during manufacture are obtained from the percentage column in Table 8.29.

Table 8.29: A ranking of reasons for poor quality during manufacture

Reasons for poor quality	Manufacturer						%
	TV-MAN A	TV-MAN B	TV-MAN D	TV-MAN C	TV-MAN F	TV-MAN E	
Workmanship	4	2	3	2	3	1	15.5
Faulty components	2	9	2	1	5	2	13.6
Supervision	5	3	1	4	4	5	13.3
Quality attitudes	3	1	4	3	10	8	11.2
Too many models	1	6	10	7	1	7	10.3
Product design	8	5	5	9	2	9	8.5
Equipment design	7	4	7	8	7	6	8.2
Poor instructions	9	10	8	6	6	4	7.0
Maintenance	6	8	6	5	9	10	6.7
Systems / controls	10	7	9	10	8	3	5.8

The results given in Table 8.29 indicate that workmanship, faulty components, supervision and quality attitudes are the main reasons given for failures occurring during manufacture. It is interesting that these results are identical to those obtained from the supervisors (see Table 8.10).

8.3.2.4 Quality policies and strategies

In questions 1 to 7 (Part four) the respondents are asked to indicate their policy on various principles and strategies relating to quality assurance (QA). A fundamental responsibility of the quality assurance department is to help general management and various departmental

heads to meet their own quality responsibilities through which the necessary business quality results may be achieved. To exercise these authorities a principal responsibility to stop production is normally given to the quality assurance department if production output does not meet quality standards. As expected, the majority of the manufacturers have empowered the quality assurance department to stop production if quality standards are not met (see Table 8.30).

To practise quality assurance in a way consistent with the best and most up-to-date methodology is becoming increasingly more important as industry expands on a far more internationally oriented basis. With all the manufacturers indicating that they export locally manufactured colour television receivers, it is significant that quality assurance principles and techniques have recently become more important to the majority of the manufacturers (see Table 8.30). At present only exports to Africa are taking place (obtained from question 4, Part four). As the export horizons expand, the importance of these principles and techniques will become even more important.

It is interesting that the results in Table 8.16 and Table 8.30 are not in complete agreement with each other in respect of the existence of formal quality policies. These results confirm that quality policies are not being communicated properly by all the manufacturers to their respective employees.

In question 6 (Part four) the respondents are asked to indicate whether line managers and supervisors are formally evaluated on the quality of their output. The results in Table 8.30 indicate that only half of the manufacturers evaluate their management on matters relating to quality responsibilities. It is therefore noteworthy that some of the manufacturers are not practising modern quality policies and strategies. In today's times quality responsibilities represent a far bigger job than the quality assurance function of the past whose work was usually limited to some form of technical responsibility.

Table 8.30: Quality policies and strategies by manufacturer

Questions	Manufacturer					
	TV-MAN A	TV-MAN B	TV-MAN D	TV-MAN C	TV-MAN F	TV-MAN E
Does QA have the power to stop production if quality standards are not met?	Yes	Yes	Yes	No	Yes	Yes
Have QA principles become more important or less important during the past 5 years?	More	More	More	Same	More	More
Does your company have a formal QA policy?	Yes	Yes	Yes	No	Yes	Yes
Are managers evaluated on QA performance?	Yes	No	Yes	No	No	Yes
What is the average burn-in time in hours ?	2	1	2	2	4	2

"Infant mortality" failures occurring during the warranty period, as a result of workmanship errors, design errors or faulty components, are used to determine the amount of testing (burn-in) required to achieve desirable reliability goals. In question 7 (Part four) the respondents are asked to indicate the burn-in time given to their products during manufacture prior to shipment. These results confirm that all manufacturers are employing burn-in procedures on their products during manufacture which varies between 1 and 4 hours.

8.3.2.5 Quality systems

The systems approach to quality begins with the principle that customer satisfaction cannot be achieved by concentrating upon one area of a factory or company alone. A Total Quality Control (TQC) system provides technical and managerial procedures that act as guidelines for

the coordination of the work force, equipment and information of a company to assure customer quality satisfaction in an economical way (Feigenbaum 1986:78). In questions 1 to 7 (Part six) the respondents are asked to indicate whether their company employs a Total Quality Control system (ISO 9000) and various related issues in order to assess whether fundamental quality control principles are being applied.

The results in Table 8.31 indicate that a Total Quality system is not being employed by all the manufacturers. However, a separate department for quality assurance, with a designated quality manager, is utilised by all. It is interesting that the majority of manufacturers does not employ a quality cost system. The mistaken notion that the achievement of better quality requires much higher costs may prevent investments in quality systems and programs in those manufacturers who have indicated an absence of a quality cost system.

Table 8.31: Quality systems employed by the manufacturers

Questions	Manufacturer					
	TV-MAN A	TV-MAN B	TV-MAN D	TV-MAN C	TV-MAN F	TV-MAN E
Does your company employ a TQC system?	Yes	No	Yes	No	No	Yes
Does your company have a separate QA department?	Yes	Yes	Yes	Yes	Yes	Yes
Does your company employ a quality cost system?	Yes	No	No	No	No	Yes
Does your company have a designated QA manager?	Yes	Yes	Yes	Yes	Yes	Yes
Does your QA audit finished goods?	Yes	Yes	Yes	Yes	Yes	Yes

Although there is no generally recognised organisational rule as to the optimum reporting structure for the quality assurance function, a high enough reporting level is required so that quality assurance systems can be implemented. In question 7 (Part six) the majority of respondents indicated that quality assurance managers reported to either the managing director or the manufacturing director. Only TVMANB indicated a lower reporting level for the quality assurance manager (factory manager).

8.3.2.6 Repair service quality

Repair service is one of the most important consumer service activities intimately involved with the field quality performance of the final product. The principal activities of the colour television repair service centres include the administration of product warranties, maintenance contracts, spares sales, and independent repair service agents throughout the Republic of South Africa. In questions 1 and 3 (Part seven) the respondents are asked to indicate the composition of own and independent service centres and the percentage of warranty service calls carried out by these independent service centres respectively.

From Table 8.32 it is clear that all the manufacturers make use of independent service repairers at varying orders of magnitude. It is significant that the new manufacturers consisting of TVMANF and TVMANE make exclusive use of independent service repairers while the older manufacturers use mainly their own service repair centres. These results seem to indicate that manufacturer-owned service repair centres covering the entire country are too costly to manage and that a trend towards independent service repair centres may be evolving. In South Africa many small towns and suburbs have one or two television service repairers comprising of personnel who are personally known to the community and are, therefore, preferred to the larger manufacturer-owned service centres who operate from locations further away. Thus, the appointment of independent service repairers as agents for the colour television manufacturers may be on the increase for reasons such as credibility, availability and cost.

Table 8.32: Warranty service calls carried out by independent repair service centres

Manufacturer	TV-MAN A	TV-MAN B	TV-MAN D	TV-MAN C	TV-MAN F	TV-MAN E
Percentage of calls carried out by independent service agents	5	10	15	5	100	100

In questions 4 to 6 (Part seven) the respondents are asked to rate their company's repair service in relation to their competitors, the amount of pressure required to increase their repair service quality and how much attention is given by their company to repair service quality using a scale ranging from 1 to 5.

The results in Table 8.33 show that all the manufacturers rate themselves better than their competitors. Little to sufficient pressure to increase repair service quality is being felt by the majority of manufacturers. The attention given to repair service quality varies substantially with only two manufacturers indicating that too little attention is being given.

Table 8.33: Repair service quality assessment by senior management

Service quality questions (4, 5 and 6)	Manufacturer					
	TV-MAN A	TV-MAN B	TV-MAN E	TV-MAN F	TV-MAN C	TV-MAN D
Rating of repair service in relation to competitors	5	5	5	4	4	5
Rating of pressure to increase repair service quality	3	3	2	3	1	3
Rating of attention given to repair service quality by own company	4	2	4	2	3	4

The overall results from these questions indicate that repair service quality is seen to be satisfactory from the perspective of senior management.

The meaning of colour television repair service quality is established by finding out which dimensions can be singled out for special attention. In question 2 (Part seven), the respondents are asked to rank all five service quality dimensions in respect of their importance to colour television receiver repairs.

In order to establish the most preferred dimension of service quality the weighted ranking score method is used. The overall preference of service quality dimensions for colour television repair service quality is obtained from the percentage column in Table 8.34.

From Table 8.34 responsiveness and reliability have substantial representation from the perspective of senior management. These results indicate that senior management of the colour television manufacturers agree on the importance of the service quality dimensions of reliability and responsiveness with the retailers, service repairers and consumers. As a result, the manufacturing companies should single out reliability and responsiveness for special attention particularly with the independent service repairers.

Table 8.34: Ranking of service quality dimensions

Quality dimensions	Ranking						
	TV-MAN A	TV-MAN B	TV-MAN E	TV-MAN F	TV-MAN C	TV-MAN D	%
Responsiveness	1	3	1	2	1	1	30.0
Reliability	2	2	2	1	2	2	27.8
Assurance	4	1	3	3	3	3	21.1
Empathy	5	4	4	4	4	4	12.2
Tangibles	3	5	5	5	5	5	8.9

8.4 SUMMARY

With only two manufacturers not participating in the manufacturing survey, adequate representation of the perceptions and experiences of the local colour television manufacturing industry was acquired from the remaining six manufacturers. All these manufacturers produced comparatively similar volumes which allowed meaningful comparisons to be made.

The ranking of colour television quality dimensions revealed that reliability and performance obtained substantial representation by both supervisors and senior management. Senior management, however, ranked perceived quality second in importance, probably because of their concern that consumers do not always possess complete information about their products.

Quality performance was measured by the incidence of internal and of external failures. The external failure results suggest that 71cm screen sizes fail more frequently under warranty than the smaller screen sizes, probably, because more expensive products give rise to higher levels of performance expectation (Juran *et al.* 1979:15-15). The first year warranty failures average between 0 and 10 percent with one manufacturer manifesting a failure rate between 11 and 15 percent. The internal failures average between 10 and 15 percent at chassis test with final test averaging between 1 and 5 percent. Although the external failure rates do not appear to be very high, a failure rate of less than 5 percent would indicate satisfactory reliability performance. Internal failures are high which is indicative of poor process control. These results are consistent with the hypothesis that there is a need for the manufacturers to improve the quality of their colour television receivers.

Faulty components, poor supervision and quality attitudes are the three main causes of internal failures. These results indicate that quality procedures related to process and workforce issues are contributing to quality problems. Customer education was found to be the main reason for warranty service calls. Service calls due to faulty components were established as the main manufacturing controllable defect occurring during the warranty

period. These results indicate that burn-in procedures, which vary between 1 and 4 hours are not reducing the incidence of component failures and that perhaps unreliable components are being used or that anti-static control procedures are not being properly employed.

Meeting the production schedule and producing high quality (defect free) products were established as the two main manufacturing objectives. The high priority given to meeting the production schedule may imply that numerical quotas are being used as work standards which, according to Deming (1986:71), work against improvement of quality and productivity. Experience has demonstrated that by improving quality, one decreases costs and inevitably productivity improves. This is because productivity depends not merely on more output per minute but on more **useable** output that will provide customer satisfaction.

The communication of a formal quality policy was shown to be lacking at the supervisor level for the majority of the manufacturers. However, lower level policies such as feedback, inspection and statistical quality control are in existence in most areas of manufacturing for the majority of the manufacturers. Notwithstanding the fact that the majority of the manufacturers has empowered their respective quality assurance departments to stop production if quality standards are not met. It is noteworthy that some of the manufacturers are not practising modern quality policies and strategies. For example, a Total Quality Control system (ISO 9000) is not being employed by all the manufacturers. It is interesting that the majority of manufacturers do not employ a quality cost system which may prevent investments in quality systems and programs in those manufacturers who have indicated an absence of a quality cost system. In today's times quality responsibilities represent a far bigger job than the quality assurance function of the past whose work was usually limited to some form of technical responsibility. These results are consistent with the hypothesis that there is a need for the manufacturers to improve their quality control procedures.

The results obtained indicate that the manufacturers' workforces may not be highly motivated to produce quality even though the supervisors indicate an opposing view to be supported by monetary incentives. A participative management style is not being forcefully employed by

all the manufacturers and that training of the workforce is being strongly applied by only two manufacturers. It has been shown that employee participation and training, in most companies, are prime sources of motivation (Juran *et al.* 1979:18-20).

Although no significant agreement on a definition for colour television receiver quality was found, both supervisors and senior management agreed that "meeting customer expectations" and "zero defects" are the most preferred definitions. Reliability and responsiveness were established as the most important service quality dimensions requiring special attention by the independent service repairers.

Senior management indicated that the appointment of independent service repairers may be on the increase for reasons such as credibility, availability and cost. The overall results indicate that repair service quality is satisfactory from the perspective of senior management.

CHAPTER 9

FINAL CONCLUSIONS AND RECOMMENDATIONS

9.1 INTRODUCTION

This thesis was structured around the need for South African enterprises to improve their product and repair service quality in order to compete against imported products and overseas markets. The colour television industry was selected because it offers relatively standardised products and services, which facilitates intercompany comparisons, and employs a simple flow type assembly line process that is representative of other mass production industries. The international revolution in quality that has taken place during South Africa's economic isolation and the reduction of duties on imported products, provided for in GATT, were advanced as the main contributing factors to this competition.

The literature study showed that the integration of products and services into a synthesised quality management approach is a key requirement for any manufacturing industry to remain competitive. The methodology employed was largely determined from the literature study resulting in empirical data being obtained from the retailers, service repairers, consumers and the manufacturers to address the research hypotheses.

The final conclusions and recommendations resulting from this research are structured to support the hypotheses mentioned in Chapter 1 (Section 1.4). Chapter 9 consists of the following sections:

- product and repair service quality requirements from the perspective of the colour

television retailers

- product and service quality requirements from the perspective of the television service repair organisations
- product and repair service quality requirements from the perspective of the colour television consumers
- the relevance of the quality control procedures employed by the colour television manufacturers
- recommendations for future research.

The first four sections include the final conclusions and recommendations based on the most important findings of the research.

9.2 PRODUCT AND REPAIR SERVICE QUALITY REQUIREMENTS FROM THE PERSPECTIVE OF THE COLOUR TELEVISION RETAILERS

In the Republic of South Africa there is a need from the retail trade for the colour television manufacturers to improve both product and repair service quality. In order to validate these hypotheses it is necessary to compare the empirical research findings of Chapters 5, 6, 7 and 8 (see Section 9.2.1).

The retail questionnaire was answered by salespersons, sales managers and store managers directly involved with colour television retail sales in the province of Gauteng in the Republic of South Africa. The retail sample comprises 200 respondents having a mean level of experience of 6.13 years. Approximately 86 percent of the respondents were television sales persons with retail management constituting the difference.

9.2.1 Final conclusions

To validate the hypotheses the following statements are analysed and comparisons between the four different samples where applicable are made.

- ***Warranty failure rates on colour television receivers are too high.*** This is confirmed by the retailers who indicated that approximately 17.5 percent of all colour television receivers sold require at least one repair or an exchange for a new product during the warranty period. In the consumer questionnaire it was established that a first year warranty failure rate of 17.6 percent exists. The manufacturers indicated that their first year warranty failure rates range from between 0 and 15 percent. Although these discrepancies may be explained by the application of different warranty periods, these findings confirm that there is an underlying problem with product reliability.
- ***The responsiveness of the manufacturers to solving newly discovered consumer problems is mediocre.*** A mediocre response by the manufacturers to solving newly discovered consumer problems in the field was confirmed by the retailers with a rating ranging from 2.8 to 3.8 on a five point scale. These findings were found to correspond with the service repairers' responses to the same question. A rating in excess of 4 would indicate that the manufacturers are committed to reducing their quality costs and gaining the confidence of the consumers in their efforts to improving quality. These results confirm that the manufacturers are not responding timeously enough. The analysis and feedback of quality complaints from the field to the manufacturer's quality department, for corrective action, is a vital component of any quality management system. A lack of understanding of the importance and timely response to newly discovered field problems may be the primary reason for the large number of failures occurring during the warranty period.

- ***Colour television receivers are not easily restored to service after failure.***

According to the retailers, the average time to restore a colour television receiver to service, after failure, is approximately 10 days. It is noteworthy that no statistically significant differences between the manufacturers' service departments was found. From the consumer survey, an average time to restore a defective colour television receiver to service was calculated at 4.69 days. The discrepancy between the retail and consumer restoration times might be explained by the fact that repairs handed in to the retailers by consumers takes approximately five days longer. These results indicate that all colour television receivers are not easily restored to service after failure. The service repairers indicate that the average time to repair a colour television receiver, excluding travelling and administration time, varies from 2.51 hours to 3.25 hours, with no statistically significant differences existing between the manufacturers' brands. The maintainability of colour television receivers is therefore principally influenced by travelling and administration time and to a lesser degree by product design. The inability of the manufacturers' service departments and appointed agents to provide satisfactory repair service quality is clearly evident.
- ***The majority of the manufacturers do not produce colour television receivers of significantly high quality.***

Only colour television receivers manufactured by TVMANA and TVMANB are rated superior in overall quality by the retailers. From a more technical point of view, the service repairers rated only TVMANA products superior in overall quality. The first year warranty failure rates for TVMANA and TVMANB, obtained from the consumer survey, supports these findings. These results confirm that there is an opportunity for the majority of the colour television manufacturers to improve their product quality.
- ***The majority of the manufacturers do not experience product design related quality problems.***

TVMANG was the only manufacturer to receive an above average to high rating for quality complaints, relating to design flaws, from the perspective of the retailers.

It is interesting that the service repairers rated TVMANG significantly lower than all the manufacturers for product design. The manufacturing survey indicated that completely knocked down kits are imported for the manufacture of colour television receivers which implies that product design activities, conducted by overseas suppliers, are not contributing significantly to quality problems. It is interesting that TVMANG is the only colour television manufacturer undertaking original product design.

- ***The standard of repair service quality offered by independent service agents/repairers is inferior to that of the manufacturer's service departments.*** According to the retailers, the manufacturers differ significantly with regard to repair service quality. TVMANE, TVMANF, TVMANG and TVMANH are significantly different to TVMANA, TVMANB and TVMANC. It is interesting that the older manufacturers consisting of TVMANA, TVMANB, TVMANC and TVMAND are providing a higher level of repair service quality than the newer manufacturers of TVMANE, TVMANF, TVMANG and TVMANH, who make extensive and almost exclusive use of appointed service agents. It is noteworthy that TVMAND, using a higher proportion of independent service agents, is rated lower than TVMANA, TVMANB and TVMANC on repair service quality. These results indicate that manufacturers' service departments are preferred by the retailers.
- ***The majority of the manufacturers are providing mediocre repair service quality.*** The retailers indicated reliability to be the most critical of the service quality dimensions followed by responsiveness, assurance, tangibles and empathy. It is significant that only TVMANA and TVMANB are providing a high to very high level of performance on all the service quality dimensions. The remaining manufacturers' performances range from low to mediocre with TVMAND and TVMANC performing marginally better than TVMANE, TVMANF, TVMANG and TVMANH. With the exception of the dimension of empathy, statistically significant differences between TVMANA and TVMANB and the remaining manufacturers were found.

Based on the above findings, there is a need from the perspective of the retailers for the manufacturers to improve their product and repair service quality. Hence, the hypotheses are accepted.

9.2.2 Recommendations

The final impact on retail satisfaction by a manufacturer is a function of both product and repair service quality. This research has shown that an underlying problem exists with the reliability of locally manufactured colour television receivers with the majority of the manufacturers providing mediocre repair service quality.

Without specific and timely information on defects and field failures, improvements in quality and reliability are seldom possible. Studies in the United States of America and Japan (Garvin 1983:70) have shown that there is a close correlation between those companies who report extensively on warranty service calls and high quality performance. It is recommended that each manufacturer establishes a retail committee to which retailers are chosen, on a rotational basis, to become members. The main purpose of the committee is to assist in collecting warranty failure information in order that more precision in warranty failure reporting is achieved. With the knowledge that poor product design is not a significant factor, the committees should initially concentrate their activities on obtaining information regarding failure symptoms that can be linked to local assembly and testing deficiencies. The quantification of failure data may then be linked to serial numbers, model numbers, demographic locations, weather patterns, time to failure, date of manufacture and other pertinent issues. By developing a closer working relationship with the retailers on quality matters, an understanding of the importance and timely response to newly discovered field problems will develop and assist in reducing the warranty field failures.

The establishment of manufacturer-owned service departments, covering the entire country, cannot be justified unless minimal volumes of work are available to amortise investment in facilities, vehicles and equipment. For areas not extensively covered by the manufacturer's

product, independent service operations must be resorted to. The improvement in restoring a defective colour television receiver to service must begin with the establishment of maintainability goals. This research has shown that the support facilities consisting of travelling and administration are the main contributing factors to poor down-time. By quantifying the impact that each of these factors are having on actual down-time will provide opportunities for the manufacturers to improve their maintainability performance.

9.3 PRODUCT AND SERVICE QUALITY REQUIREMENTS FROM THE PERSPECTIVE OF THE TELEVISION SERVICE REPAIR ORGANISATIONS.

In the Republic of South Africa there is a need from the service repair organisations for the colour television manufacturers to improve both product and service quality. In order to validate these hypotheses it is necessary to compare the empirical research findings of Chapters 5, 6, 7 and 8 (see Section 9.3.1).

The service questionnaire was answered by 191 persons represented by technicians, foremen, service managers and business owners directly involved with colour television repairs in the province of Gauteng in the Republic of South Africa. The mean level of experience of the respondents in the service sample is 7.9 years.

9.3.1 Final conclusions

To validate the hypotheses the following statements are analysed and comparisons between the four different samples where applicable are made.

- ***The reliability of locally manufactured colour television receivers has not been optimised.*** It is noteworthy that no manufacturer was considered to have a very low frequency of repair to their products and therefore it may be concluded that the reliability of colour television receivers has not been optimised and that opportunities

for improvement exist. It is interesting that the retailers rate the frequency of repair marginally higher than the service repairers. These results are confirmed by the consumers who indicated a first year warranty failure rate of 17.6 percent.

- ***The main reasons for field failures are manufacturing related.*** The responses by the service repairers confirmed that only TVMANA and TVMANB are highly rated on their workmanship and soldering quality with TVMANA being the only manufacturer to be highly rated for product testing. In order of significance, product testing, faulty components, alignment and assembly are the main factors giving rise to colour television defects in the field.
- ***Colour television receivers are not easily repaired.*** An average repair time of approximately 2.75 hours implies that less than four colour television receivers are being repaired on average by one service technician each day. The consumer survey revealed that restoration times, on defective colour television receivers, average at 4.69 days. These results indicate that an accumulation of defective colour television receivers is probably being experienced in the repairers' workshops, thereby impacting negatively on the reliability dimension of service repair quality.
- ***Significant internal and external pressure is being applied for the service repairers to improve their repair service quality.*** Although 72 percent of the service repairers rated their repair service quality to be more superior than their competitors, consumers and service management indicated that the service repairer's performance was not compatible with the needs of consumers. This is confirmed by approximately 60 percent of the service repairers who indicated that they feel a lot of pressure to improve their repair service quality. Notwithstanding the pressure for improvement, 67 percent of the service repairers indicated that above average attention to repair service quality was being given by their firms.

- ***The performance of the majority of the manufacturers, in providing technical assistance, is poor to mediocre.*** TVMANA and TVMANB are considered by the service repairers to be significantly superior to the other manufacturers in providing technical assistance. A rating ranging from 2.2 to 3.2 on a five point scale for the repair service quality dimensions of reliability, responsiveness, assurance, empathy and tangibles in respect of technical assistance to the manufacturers, excluding TVMANA and TVMANB, is indicative of a general mediocre performance. It is noteworthy that none of the manufactures obtained a rating of good to excellent for technical assistance. These results confirm that repair service quality to the consumers and retailers, by the service repairers, can be improved upon if the manufacturers improve their service quality to the repair service industry.

Based on the above findings, there is a need for the manufacturers to improve their product and service quality from the perspective of the service repairers. Hence, the hypotheses are accepted.

9.3.2 Recommendations

Faults due to poor product testing, component failure and alignment indicate that processing equipment, in some factories, may need improving in order to increase the number of variables that can be controlled and to improve in controlling those variables. The narrowing of tolerances and reduced variability will require measuring systems to become more precise. This will tend to decrease the variability of colour television receivers being manufactured and at the same time improve reliability by eliminating the high frequency of failure. The use of computer-controlled test equipment will expand and permit better collection and analysis of data with a consequent improvement in corrective action. Television manufacturing which is not automated, using computer-controlled equipment, requires many operators to perform important operations that can affect product quality thus requiring more emphasis to the human dimension of managing quality. In these circumstances employee responsibility for, and interest in product quality will require management to adopt employee

motivational programmes that overcome the boring repetitive nature of production flow-type systems often found in colour television manufacturing operations.

Service repair time may be improved upon by considering modularisation. Modular design requires added design and production costs but reduces the time required for diagnosis and remedy in the field. The fault is localised to the modular level, after which the defective module is replaced. For some modules, the cost of field repair exceeds the cost of manufacturing new units in the factory and in such cases design for throw away is a viable option. Another example is to minimise complexity. By populating the printed circuit board with components on one side increases material and production costs, but decreases the time required for diagnosis and repair. By improving the contributors to poor down-time responsiveness, reliability and assurance will automatically improve.

The numerous independent service repairers involved with colour television repairs and the increasing trend in their use by the manufacturers requires that special service manuals be provided for their use to improve technical assistance. These manuals must provide well designed aids for diagnosis and repair, including exploded views and diagrams to show the structure of the product; parts lists used for various models; detailed instructions for repair including equipment to be used and manuals in various languages.

The independent service repairers are small and cannot make provision for training which the manufacturers must undertake. Technical training courses must be targeted to provide the technicians with new technology and product information before the launch of new products.

9.4 PRODUCT AND REPAIR SERVICE QUALITY REQUIREMENTS FROM THE PERSPECTIVE OF THE COLOUR TELEVISION CONSUMERS.

In the Republic of South Africa there is a need from the consumers for the colour television manufacturers to improve both product and repair service quality. In order to validate these hypotheses it is necessary to compare the empirical research findings of Chapters 5, 6, 7 and

8 (see Section 9.4.1).

The consumer questionnaire was answered by a sample of 250 persons represented by a proportionate number of households portraying the various race sectors owning colour television receivers in the Pretoria, Johannesburg, East Rand, West Rand, Soweto and Vaal triangle areas of the province of Gauteng in the Republic of South Africa.

9.4.1 Final conclusions

To validate the hypotheses, the following statements are analysed and comparisons between the four different samples where applicable are made.

- ***The majority of consumers do not repurchase the same brand of colour television receiver.*** Twenty-two percent of the consumers indicated that they owned or rented more than one colour television receiver with approximately 65 percent of the repurchases constituting brands of a different manufacturer. It is noteworthy that an analysis of these repurchases confirmed that no significant preference of manufacturer was observed.

With the knowledge that quality is regarded by the consumers to be more important than price and after sales service the of consumers appear to switch brands for reasons pertaining to product quality.

- ***Failures during the first year of warranty are high.*** A first year warranty failure rate of 17.6 percent, obtained from the consumer questionnaire, appears to be high. An analysis of the more established manufacturers consisting of TVMANA, TVMANB, TVMANC and TVMAND manifest a failure rate ranging from 11 to 22.7 percent indicating that even the more experienced manufacturers are experiencing high warranty failure rates. The high consumer ratings for reliability appear to support the notion that the initial failures during the warranty period are expected to occur and are

therefore not considered an important factor when assessing reliability.

- ***Colour television receivers are not easily restored to service after failure.*** Although the maintainability performance by the manufacturers is rated average to high by the consumers, a restoration to service of 5.1 days appears to be excessive. TVMANG was the only manufacturer found to be significantly different, obtaining a low rating for maintainability.
- ***Warranty failures often require more than one repair.*** Approximately 35 percent of all warranty failures required more than one repair, 17 percent required more than two repairs and 9 percent required more than three repairs. This suggests that either poorly executed repairs and/or substandard products are being manufactured.
- ***The reliability dimension of repair service quality needs improvement.*** The consumer expectations exceeded their perceptions resulting in a substantial shortcoming or gap of +0.99. It is noteworthy that no statistical significant difference between the manufacturers was found. The gap confirms that the manufacturers' service departments are under performing with regard to the reliability dimension which is considered by the consumers to be their highest priority.
- ***The assurance dimension of repair service quality needs improvement.*** The consumer expectations exceeded their perceptions, resulting in a substantial shortcoming or gap of +0.88. It is noteworthy that no statistical significant difference between the manufacturers was found. The gap confirms that the manufacturers' service departments are under performing with regard to the assurance dimension which is considered by the consumers to be their third highest priority.
- ***The tangibles dimension of repair service quality needs improvement.*** The consumer expectations exceeded their perceptions, resulting in a marginal shortcoming or gap of +0.14. It is noteworthy that no statistical significant difference between

the manufacturers was found. The gap confirms that the manufacturers' service departments are under performing with regard to the tangible dimension which is considered by the consumers to be their lowest priority.

Based on the above findings there is a need from the consumers for the colour television manufacturers to improve both product and repair service quality. Hence, the hypotheses are accepted.

9.4.2 Recommendations

A well organised data system appears to be lacking in the various manufacturers' quality departments which is evidenced by the high warranty failure rate occurring in the industry. Such a system will assist in identifying repetitive failures in order of costliness. In many cases, a sampling of field failure data is quite adequate for identifying the main problem areas. Efforts to secure all failure data may be self defeating because too many sources are unreliable and hence reduce the quality of the data. The frequency and cost of failure must be used to judge which failures to analyse in depth. Isolated complaints, as a result of inadvertent mistakes or carelessness, are difficult to solve but much can be done to assist with motivation by returning the failed sample to the responsible area.

Although no statistically significant differences in repair service quality were found to exist between the manufacturers it is noteworthy that TVMANB and TVMAND are performing below expectations with TVMANA and TVMANC exceeding expectations. It is recommended that the manufacturers measure their repair service quality performance at regular intervals and trend the results to determine whether corrective action has had any desirable results.

Poor repair service reliability was also confirmed by the high number of warranty calls requiring more than one repair. A lack of technical competence caused by the skills shortage in the South African market may be contributing to the dimensions of reliability and

assurance not meeting consumer expectations. Another factor which could contribute to the lack of technical competence is the use of service agents and small workshops in which no real career path is available to highly competent staff. An inability to find the right staff may therefore result in repairs not being undertaken properly. A possible solution is the use of franchise agreements where standards for adequate repair service can be imposed by using audits. This will allow the improvement of the inherent effectiveness of the service repairers' workshops through improved engineering and management whereby diagnostic instruments, tools, spare parts inventories and training can be implemented.

9.5 THE RELEVANCE OF THE QUALITY CONTROL PROCEDURES EMPLOYED BY THE COLOUR TELEVISION MANUFACTURERS.

In the Republic of South Africa there is a need to improve the quality control procedures employed by the colour television manufacturers. In order to validate this hypothesis it is necessary to compare the empirical research findings of Chapters 5, 6, 7 and 8 (see Section 9.5.1).

Two manufacturers did not participate in the manufacturing survey. TVMANH declined to participate and TVMANG was liquidated during the survey and did not return any questionnaires.

Sixty-two supervisor questionnaires were returned, giving a response rate of 68.9 percent and six senior management questionnaires were completed by each manufacturer's appropriate executive.

9.5.1 Final conclusions

To validate the hypotheses the following statements are analysed and comparisons between the four different samples where applicable are made.

- ***The quality performance of the manufacturers needs improvement.*** The external quality performance obtained by the first year warranty failures average between 0 and 15 percent with TVMANF manifesting the highest failure rate ranging from 11 to 20 percent. These failure rates appear to be high which concurs with the findings obtained from the retailers and consumers (see Sections 9.2 and 9.3 respectively). The internal quality performance obtained by the chassis fail rate averages between 10 and 15 percent with the final test fail rate averaging between 1 and 5 percent. Defects are not free. Money is paid to make defects, as well as to correct them. By improving quality (reducing failures) the waste of man-hours and of machine time will be transferred into the manufacture of good product.
- ***The main reasons for poor quality performance are manufacturing related.*** Workmanship errors, faulty materials, poor supervision and quality attitudes were found to be the main reasons given by the supervisors and senior management for failures occurring during manufacture. Warranty service calls due to faulty components is the main manufacturing controllable defect occurring during the warranty period. The service repairers indicated that product testing, faulty components, alignment and assembly are the main factors giving rise to colour television defects in the field.
- ***Modern quality policies and strategies are not being practised by all the manufacturers.*** Although the majority of the manufacturers have empowered the quality assurance department to stop production if quality standards are not met, some of the manufacturers are not practising modern quality policies and strategies. In today's times, quality responsibilities represent a far bigger job than the quality assurance function of the past, whose work was usually limited to some form of technical responsibility. The senior management survey confirmed that a Total Quality Control system is not being employed by all the manufacturers. However, a separate department for quality assurance with a designated quality manager is utilised by all.

Experience has shown that one of the major obstacles to the establishment of stronger quality programs was the mistaken notion that the achievement of better quality requires higher costs. It is noteworthy that the majority of the manufacturers do not employ a quality cost system which allows management to invest in cost effective quality programs.

- ***The majority of the manufacturers do not show a significantly high commitment to producing high quality products.*** Only one manufacturer confirmed that their company was forcefully committed to producing high quality products. This was supported by the fact that the majority of the manufacturers considers improvement in worker productivity to be the lowest priority of the more generally accepted manufacturing objectives. Meeting the production schedule is considered by the manufacturers to be more important than productivity and low cost production. Experience has demonstrated that by improving quality one decreases costs and inevitably productivity improves. It is significant that a participative management style is not being forcefully employed by all the manufacturers. Only two manufacturers indicated that the training of the workforce is being strongly applied.
- ***Quality policies are not properly communicated.*** It was established that a formal quality statement or policy is probably in existence for each of the manufacturers. However, the responses by the supervisors confirmed that communication of quality policy appears to be lacking.

Based on the above findings, there is a need to improve the quality control procedures employed by the colour television manufacturers. Hence, the hypotheses are accepted.

9.5.2 Recommendations

In larger companies, such as the colour television manufacturers, personal contact by the chief executive officer to determine the quality needs by personal observation and by direct

contact with people is not feasible. As an alternative to the personal leadership of the chief executive, a medium to large company can create interdepartmental mechanisms to identify objectives. The lack of awareness of company policies may arise from a belief that only top management can approve company policies and therefore only top management can venture on such ground. Inputs from quality specialists can provide potential improvement projects, for example, reducing failure rates which can be reviewed at progressively higher organisational levels until the corporate level is reached. Managers together with their supervisors and staff must be given the opportunity to participate in setting objectives and developing policies and procedures thereby ensuring the proper communication and commitment to these issues. The approach is to enhance employee participation in actions for improvement of operations. More attention to the human dimension, rather than the technical dimension of the quality function, is advocated.

Once quality projects have been identified, quantified objectives must be established so that internal and external performances can be improved upon. The establishment of quality costing will involve the identification of the quality cost items, the structure of the quality cost reporting, including analysis and control and its maintenance to ensure that objectives of higher quality at lower cost are being met. Quantified objectives usually receive more attention than vague objectives since there is less room for debate on what has actually happened, thus increasing the likelihood that they will be met.

To exercise leadership of the quality function requires that top management first creates the tools which make this participation possible. This consists of developing an annual program that establishes active participation in establishing quality policies, quality objectives and plans for meeting these objectives, creating an organisation structure providing commitment to quality, training of the management team in understanding the nature of the quality function, and in their respective roles, for achieving objectives and motivation of all levels to give the quality function the priority required.

9.6 RECOMMENDATIONS FOR FUTURE RESEARCH

It is recommended that future research be extended to include imported colour television receivers. The data obtained could then be used to serve as a basis for a comparative study between local and international manufacturers. Using quality as a strategic weapon should be assessed in terms of the overall level of profitability for the local colour television industry.

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APPENDIX A

RETAIL QUESTIONNAIRE

PART 1: GENERAL INFORMATION

1. Tick (✓) the block that nearest describes the retail category for your company.

Chain Store

<input type="checkbox"/>
<input type="checkbox"/>

Independent Store

2. Tick (✓) the appropriate block concerning your present position in the company.

Salesperson

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

Sales Manager/ess

Store Manager/ess

3. Please indicate how much experience you have in colour television retailing (in years).

Years

<input type="checkbox"/>

4. How much attention is given to the **SABS** mark by consumers purchasing colour television sets? Please tick (✓) the appropriate category.

Very Little	Little	Medium	High	Very High
1	2	3	4	5

5. Do you think that the quality of South African manufactured colour television sets are below world standards? Please tick (✓) the appropriate category.

YES	NO	DON'T KNOW
-----	----	------------

6. If you answered "yes" to question 5 how can the South African colour television manufacturers improve?

7. Based on **enquiries** that you have received, please **rank** the importance of the criteria given below when consumers purchase colour television sets. Rank (1) = First or main concern; (2) = Second; (3) = Third or last concern.

Price

Quality

After Sales Service

8. If you were to recommend a **colour television set** to a customer, your preference of manufacturer would be ranked as indicated below. Please **rank** your preference of colour television manufacturer with Rank (1) = First choice; (2) = Second; and so on to (8) = Eighth or last choice.

**Television
Manufacturer**

National

Etron

Triad

Phillips

**Television
Manufacturer**

Tek

Kenzo

Rowa

Tedelex

9. Prioritise your perception of **colour television set** quality by ranking the following definitions. Rank: (1) = First choice; (2) = Second choice; (3) = Third choice; (4) Fourth choice; (5) Fifth or last choice.

Fitness for use (serving the purpose of the user)

Conformance to requirements (specifications)

Pride of workmanship (quality built in)

Meeting customer expectations

Zero defects (defect free products)

10. Rate **each manufacturer** on how frequently their brand(s) require repairs, commands the lowest price, has the highest demand and most effective advertising by using the following scale.

<i>Very Low</i>	<i>Low</i>	<i>Medium</i>	<i>High</i>	<i>Very High</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>

Example:

<i>Television Manufacturer</i>	<i>Frequency of Repairs</i>	<i>Lowest Price</i>	<i>Highest Demand</i>	<i>Most Effective Advertising</i>
XXXXXXXX	3	2	4	4

Television Manufacturer	Frequency of Repairs	Lowest Price	Highest Demand	Most Effective Advertising
National				
Phillips				
Etron				
Kenzo				
Tedelex				
Tek				
Rowa				
Triad				

PART 2: PRODUCT QUALITY

1. Please rank the following **product quality dimensions**, in respect of their importance to your perception of colour television receivers by giving a rating evaluation against each dimension in the blocks provided. Rank the following by allocating a (1) to the highest or most important; a (2) for the second highest; a (3) for the third highest, and so on and; a (8) to the lowest.

Performance (eg. ability to receive distant stations)	
Features (eg. stereo sound)	
Reliability (eg. failure rate or frequency of failure)	
Conformance (eg. meets specifications)	
Durability (eg. time until replacement of a new set becomes necessary)	
Maintainability (eg. easy to repair)	
Perceived quality (eg. reputation and image)	
Aesthetics (eg. styling and finish)	

Evaluate Questions (2) to (7) in this section using the following scale:

<i>Very Low</i>	<i>Low</i>	<i>Medium</i>	<i>High</i>	<i>Very High</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>

2. Rate **each manufacturer** according to **best overall quality** (use the product quality dimensions in the previous question as a guide)

**Television
Manufacturer**

**Your
Estimate**

**Television
Manufacturer**

**Your
Estimate**

National

Etron

Triad

Phillips

Tek

Kenzo

Rowa

Tedelex

SCALE:

<i>Very Low</i>	<i>Low</i>	<i>Medium</i>	<i>High</i>	<i>Very High</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>

3. Based on colour television quality complaints that you have received, indicate to what extent is *product design* the possible cause. A repetition of similar complaints will indicate that product design flaws exist.

Television
Manufacturer

Your
Estimate

National

Etron

Triad

Phillips

Television
Manufacturer

Tek

Kenzo

Rowa

Tedelex

Your
Estimate

4. Based on the colour television quality complaints that you have received, indicate to what extent is *workmanship* the possible cause. The external finish and assembly of the product will indicate workmanship excellence.

Television
Manufacturer

Your
Estimate

National

Etron

Triad

Phillips

Television
Manufacturer

Tek

Kenzo

Rowa

Tedelex

Your
Estimate

5. Based on the colour television quality complaints that you have received, indicate to what extent *packaging* is the possible cause.

Television
Manufacturer

Your
Estimate

National

Etron

Triad

Phillips

Television
Manufacturer

Tek

Kenzo

Rowa

Tedelex

Your
Estimate

SCALE:

<i>Very Low</i>	<i>Low</i>	<i>Medium</i>	<i>High</i>	<i>Very High</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>

6. Based on complaints that you have received, indicate to what extent is the television **installation** at the consumer's premises the possible cause.

**Television
Manufacturer**

**Your
Estimate**

**Television
Manufacturer**

**Your
Estimate**

National

Tek

Etron

Kenzo

Triad

Rowa

Phillips

Tedelex

7. Indicate your estimate of the **responsiveness** of each manufacturer to solving newly discovered consumer problems.

**Television
Manufacturer**

**Your
Estimate**

**Television
Manufacturer**

**Your
Estimate**

National

Tek

Etron

Kenzo

Triad

Rowa

Phillips

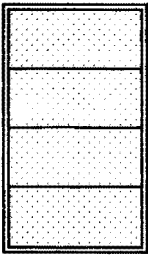
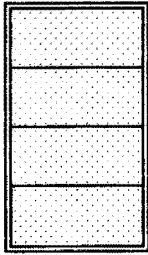
Tedelex

PART 3: SERVICE QUALITY

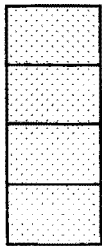
1. Please rank the following **service quality dimensions**, in respect of their importance to you should a colour television require service/repair by allocating a (1) to the highest or most important; a (2) for the second highest; a (3) for the third highest and, so on and; a (5) to the lowest in the blocks provided.

Tangibles (eg. service facilities- equipment and buildings)	
Responsiveness (eg. willingness to provide service)	
Reliability (eg. repeat calls, performing the promised service)	
Assurance (credibility, competence)	
Empathy (eg. communication, understanding/knowning the consumer)	

2. Enter the **average time to repair** a defective colour television set in **days** for each television manufacturer's service department (ie. from the time the complaint is reported until the consumer receives the repaired set) .

Television Manufacturer	Your Estimate	Television Manufacturer	Your Estimate
National		Tek	
Etron		Kenzo	
Triad		Rowa	
Phillips		Tedelex	

3. Based on the number of colour television sets you have sold, please **estimate** what **percentage** have required an exchange for a new product, a single service call, and what percentage have required more than one service call during the warranty period.

	%
Sets requiring exchange	
Sets requiring a single repair/service call	
Sets requiring two repairs/service calls	
Sets requiring three or more repairs/service calls	

4. How much attention to **repair service quality** does your firm give? Please tick (✓) the appropriate category.

Very Little	Little	Medium	High	Very High
1	2	3	4	5

5. How much attention is given by your company to **educate the consumer on product knowledge** once a colour television is sold? Please tick (✓) the appropriate category.

Very Little	Little	Medium	High	Very High
1	2	3	4	5

6. How much attention is given by your company to ensure that the consumer's colour television set is properly **installed**? Please tick (✓) the appropriate category.

Very Little	Little	Medium	High	Very High
1	2	3	4	5

7. How much attention is given by your company to **ensure that a complaint is valid or genuine** before placing a service call. Please tick (✓) the appropriate category.

Very Little	Little	Medium	High	Very High
1	2	3	4	5

Evaluate Questions (8) to (13) in this section using the following scale:

Very Low	Low	Medium	High	Very High
1	2	3	4	5

8. Indicate your estimate of the service quality provided by the following manufacturer's service organisations irrespective of whether their service is conducted in house or is subcontracted to service agents.

**Television
Manufacturer**

**Your
Estimate**

**Television
Manufacturer**

**Your
Estimate**

National

Tek

Etron

Kenzo

Triad

Rowa

Phillips

Tedelex

9. Based on the repair service that you and your customers have received from the manufacturer's service organisation, estimate a rating, for each manufacturer's service facilities.

**Television
Manufacturer**

**Your
Estimate**

**Television
Manufacturer**

**Your
Estimate**

National

Tek

Etron

Kenzo

Triad

Rowa

Phillips

Tedelex

SCALE:

<i>Very Low</i>	<i>Low</i>	<i>Medium</i>	<i>High</i>	<i>Very High</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>

10. Based on the repair service that you and your customers have received from the manufacturer's service organisation estimate a rating, for each manufacturer, of their **willingness to serve**.

**Television
Manufacturer**

**Your
Estimate**

**Television
Manufacturer**

**Your
Estimate**

National

Etron

Triad

Phillips

Tek

Kenzo

Rowa

Tedelex

11. Based on the repair service that you and your customers have received from the manufacturer's service organisation, estimate a rating, for each manufacturer, of their **ability to keep promises**.

**Television
Manufacturer**

**Your
Estimate**

**Television
Manufacturer**

**Your
Estimate**

National

Etron

Triad

Phillips

Tek

Kenzo

Rowa

Tedelex

SCALE:

<i>Very Low</i>	<i>Low</i>	<i>Medium</i>	<i>High</i>	<i>Very High</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>

12. Based on the repair service that you and your customers have received from the manufacturer's service organisation, estimate, for each manufacturer, a rating of their **competence and expertise**.

**Television
Manufacturer**

**Your
Estimate**

National

Etron

Triad

Phillips

**Television
Manufacturer**

**Your
Estimate**

Tek

Kenzo

Rowa

Tedelex

13. Based on the repair service that you and your customers have received from the manufacturer's service organisation, estimate a rating, for each manufacturer, of **empathy or sensitivity** shown.

**Television
Manufacturer**

**Your
Estimate**

National

Etron

Triad

Phillips

**Television
Manufacturer**

**Your
Estimate**

Tek

Kenzo

Rowa

Tedelex

APPENDIX B

SERVICE QUESTIONNAIRE

PART 1: GENERAL INFORMATION

1. Tick (✓) the block that nearest describes the service repair category for your company.

Maxicare Service Workshop or appointed Agent	<input type="checkbox"/>
Mastercare Service Branch	<input type="checkbox"/>
Early Bird Service Branch	<input type="checkbox"/>
Television Manufacturer's Service Department	<input type="checkbox"/>
Independent Service Repairer	<input type="checkbox"/>
Other (Specify)	<input type="checkbox"/>

2. Tick (✓) the block that nearest describes your present position in the service company.

Workshop Technician	<input type="checkbox"/>
Field Technician	<input type="checkbox"/>
Workshop and Field Technician	<input type="checkbox"/>
Service Manager	<input type="checkbox"/>
Business Owner	<input type="checkbox"/>
Foreman or Senior Technician	<input type="checkbox"/>

3. Indicate how much experience you have in colour television service/repairs (in years).

Years

4. Indicate your **highest** level of education obtained by ticking (✓) the appropriate block.

University degree	<input type="checkbox"/>
Technical diploma or certificate	<input type="checkbox"/>
Trade test in TV repairs	<input type="checkbox"/>
N3 or Matric and lower	<input type="checkbox"/>

5. If you were to recommend a **colour television set** to a customer, your preference of manufacturer would be ranked as indicated below. Please **rank** your preference of colour television manufacturer with Rank (1) = First choice; (2) = Second; and so on to (8) = Eighth or last choice.

**Television
Manufacturer**

National

Etron

Triad

Phillips

**Television
Manufacturer**

Tek

Kenzo

Rowa

Tedelex

6. Do you think that the quality of South African manufactured colour television receivers are below world standards? Please tick (✓) the appropriate block.

YES	NO	DON'T KNOW
-----	----	------------

7. If you answered "yes" to question 6 how **can** the South African colour television manufacturers improve? _____

8. Based on repairs that you have performed indicate by how much the **SABS** mark bearing colour television sets are superior in quality to those that are not. Please tick (✓) the appropriate category.

None	Little	Same	A Lot	Very Superior
1	2	3	4	5

9. Prioritise your perception of **colour television set** quality by ranking the following definitions. Rank: (1) = First choice; (2) = Second choice; (3) = Third choice; (4) Fourth choice; (5) Fifth or last choice.

Fitness for use (serving the purpose of the user)

Conformance to requirements (specifications)

Pride of workmanship (quality built in)

Meeting customer expectations

Zero defects (defect free products)

10. Please (✓) **one** of the categories below which **best describes** the geographical area in which you conduct repairs.

Western Cape	
Northern Cape	
Eastern Cape	
O.F.S	
P.W.V	
Kwazulu Natal	
Northern Transvaal	
Eastern Transvaal	
North West	

PART 2: PRODUCT QUALITY

Evaluate questions (1) to (5) using the scale provided:

SCALE:

<i>Very Low</i>	<i>Low</i>	<i>Medium</i>	<i>High</i>	<i>Very High</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>

1. Based on the repairs that you have performed please give your estimate, in the blocks provided, of how frequently each manufacturer's brand requires repair.

**Television
Manufacturer**

**Your
Estimate**

**Television
Manufacturer**

**Your
Estimate**

National

Etron

Triad

Phillips

Tek

Kenzo

Rowa

Tedelex

SCALE:

<i>Very Poor</i>	<i>Poor</i>	<i>Average</i>	<i>Good</i>	<i>Excellent</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>

2. Based on repairs that you have performed, please rate the manufacturers by assigning, to the blocks provided, a rating for each criteria.

For example:

<i>Television Manufacturer</i>	<i>Longest Product Life</i>	<i>Easiest to Repair</i>	<i>Best Design</i>	<i>Best Overall Quality</i>
<i>XXXXXXXX</i>	<i>5</i>	<i>1</i>	<i>3</i>	<i>3</i>

Television Manufacturer	Longest Product Life	Easiest to Repair	Best Design	Best Overall Quality
National				
Phillips				
Tedalex				
Tek				
Rowa				
Triad				
Etron				
Kenzo				

SCALE:

<i>Very Poor</i>	<i>Poor</i>	<i>Average</i>	<i>Good</i>	<i>Excellent</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>

3. Based on repairs that you have performed, please indicate the possible **causes** of colour television receiver quality problems by assigning a rating, to the blocks provided, for each **manufacturer**.

For example:

<i>Television Manufacturer</i>	<i>Work- manship</i>	<i>Com- ponents</i>	<i>Pack- aging</i>
XXXX	<u> 5 </u>	<u> 1 </u>	<u> 3 </u>

Television Manufacturer	Workmanship	Components	Packaging
National			
Phillips			
Tedalex			
Tek			
Rowa			
Triad			
Etron			
Kenzo			

SCALE:

<i>Very Poor</i>	<i>Poor</i>	<i>Average</i>	<i>Good</i>	<i>Excellent</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>

4. Based on the repairs that you have performed please indicate the possible **causes of poor workmanship** on colour television receivers by assigning a rating, to the blocks provided, for each manufacturer.

For example:

<i>Television Manufacturer</i>	<i>Soldering</i>	<i>Assembly</i>	<i>Alignment</i>	<i>Testing</i>
<i>XXXX</i>	<i>5</i>	<i>1</i>	<i>1</i>	<i>4</i>

Television Manufacturer	Soldering	Assembly	Alignment	Testing
National				
Phillips				
Tedalex				
Tek				
Rowa				
Triad				
Etron				
Kenzo				

SCALE:

<i>Very Poor</i>	<i>Poor</i>	<i>Average</i>	<i>Good</i>	<i>Excellent</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>

5. Please indicate, in the blocks provided, your estimate of the **responsiveness** of the manufacturers to solving newly discovered quality problems in the field.

**Television
Manufacturer**

**Your
Estimate**

**Television
Manufacturer**

**Your
Estimate**

National

Etron

Triad

Phillips

Tek

Kenzo

Rowa

Tedalex

6. Please rank the following **product quality dimensions**, in respect of their importance to your perception of colour television receivers by giving a rating evaluation against each dimension in the blocks provided. Rank the following by allocating a (1) to the highest or most important; a (2) for the second highest; a (3) for the third highest, and so on and; a (8) to the lowest.

Performance (eg. ability to receive distant stations)	
Features (eg. stereo sound)	
Reliability (eg. failure rate or frequency of failure)	
Conformance (eg. meets specifications)	
Durability (eg. time until replacement of a new set becomes necessary)	
Maintainability (eg. easy to repair)	
Perceived quality (eg. reputation and image)	
Aesthetics (eg. styling and finish)	

PART 3: SERVICE QUALITY

1. Please rank the following **service quality dimensions**, in respect of their importance to you should a colour television require service/repair by allocating a (1) to the highest or most important; a (2) for the second highest; a (3) for the third highest and, so on and; a (5) to the lowest in the blocks provided.

Tangibles (eg. service facilities- equipment and buildings)	
Responsiveness (eg. willingness to provide service)	
Reliability (eg. repeat calls, performing the promised service)	
Assurance (credibility, competence)	
Empathy (eg. communication, understanding/knowing the consumer)	

2. Please enter the **average time to repair** a defective colour television receiver (in **hours** excluding travelling and administration time) for each colour television manufacturer's products serviced by your company.

**Television
Manufacturer**

**Your
Estimate**

**Television
Manufacturer**

**Your
Estimate**

National

Tek

Etron

Kenzo

Triad

Rowa

Phillips

Tedelex

3. Please rate the quality of your firm's **colour television repair service** in relation to your competitors. Please tick (✓) the appropriate block.

Much Worse	Little Worse	The Same	A Little Better	Much Better
1	2	3	4	5

4. Do you feel pressure to increase the **service quality** of your firm's colour television repair service? Please tick (✓) the appropriate block.

None	Little	Sufficient	A Lot	Too Much
1	2	3	4	5

5. How much attention to **repair service quality** does your firm give? Please tick (✓) the appropriate block.

None	Little	Sufficient	A Lot	Too Much
1	2	3	4	5

Evaluate questions (6) to (10) using the following scale:

<i>Very Poor</i>	<i>Poor</i>	<i>Sufficient</i>	<i>Good</i>	<i>Excellent</i>
1	2	3	4	5

6. For each of the manufacturers of colour television receivers, that you service, please indicate your estimate of the **responsiveness or willingness** of that manufacturer in providing components, service diagrams and technical assistance.

**Television
Manufacturer**

**Your
Estimate**

**Television
Manufacturer**

**Your
Estimate**

National

Tek

Etron

Kenzo

Triad

Rowa

Phillips

Tedelex

7. For each of the manufacturers of colour television receivers, that you service, please indicate your estimate of the **quality of service manuals and technical information** provided by that manufacturer.

**Television
Manufacturer**

**Your
Estimate**

**Television
Manufacturer**

**Your
Estimate**

National

Tek

Etron

Kenzo

Triad

Rowa

Phillips

Tedelex

SCALE:

<i>Very Poor</i>	<i>Poor</i>	<i>Sufficient</i>	<i>Good</i>	<i>Excellent</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>

8. For each of the manufacturers of colour television receivers, that you service, please indicate your estimate of the ability of that manufacturer to **perform the promised service** in providing components, service diagrams and technical assistance.

**Television
Manufacturer**

**Your
Estimate**

**Television
Manufacturer**

**Your
Estimate**

National

Tek

Etron

Kenzo

Triad

Rowa

Phillips

Tedelex

9. For each of the manufacturers of colour television receivers, that you service, please indicate your estimate of the **credibility and competence** of that manufacturer in providing the correct information and components.

**Television
Manufacturer**

**Your
Estimate**

**Television
Manufacturer**

**Your
Estimate**

National

Tek

Etron

Kenzo

Triad

Rowa

Phillips

Tedelex

10. For each of the manufacturers of colour television receivers that you service, please indicate your estimate of the ability of that manufacturer to **communicate and understand** your requirements.

**Television
Manufacturer**

**Your
Estimate**

**Television
Manufacturer**

**Your
Estimate**

National

Tek

Etron

Kenzo

Triad

Rowa

Phillips

Tedelex

APPENDIX C

CONSUMER QUESTIONNAIRE

PART 1: GENERAL INFORMATION

1. Enter the number of **colour** television sets that you own or rent next to the name of the **South African** manufacturer for that model and indicate by means of tick (✓) the last purchased television set. Typical brand names, in brackets, have been provided next to the manufacturer's name to assist you. In many instances the manufacturer's name and the brand name are identical. If you are still not sure of the manufacturer's name please consult the rear cover label on your television set, the guarantee card, customer handbook or your dealer. The accuracy of this information is vital to the success of this research project.

Television Manufacturer	No. of sets	Last purchase (✓)
National (National, Panasonic, Quintrix)		
Phillips (Phillips, PYE)		
Tedalex (Tedalex, Sony, Blaupunt)		
Tek (Telefunken, Pioneer, JVC, Microtek)		
Rowa (Mercury, Technol, Supersonic, Maxam, Hitachi)		
Triad (Triad, Aim)		
Etron (Samsung, Goldstar, Dallas, Computron, Quintron, Logik)		
Kenzo (Astra, Univa)		
Giant (Giant)		
M.B.S. (Accent, Telestar, Orion)		
Other (please specify)		

2. Complete the following sentence. If I were to go out today and buy another **colour television set**, for my own use, it would be one manufactured by _____
(select one of the manufacturer's mentioned in question 1 above).
3. Rank the importance of the criteria given below when you purchase a colour television set. Rank (1) = First or main concern; (2) = Second; (3) = Third or last concern.

Price	
Quality	
After Sales Service	

4. Prioritise your perception of **colour television** quality by ranking the following definitions. Rank: (1) = First choice; (2) = Second choice; (3) = Third choice; (4) Fourth choice; (5) Fifth or last choice.

Fitness for use (serve the purpose of the user)	
Conformance to requirements (specifications)	
Pride of workmanship (quality built in)	
Meeting customer expectations	
Zero defects (defect free products)	

5. For each locally manufactured colour television set that you own or rent, please enter the name of the manufacturer, the number of months you have had your television set and (✓) whether it is manually or remote control operated. Use the manufacturer's name(s) you identified for your colour television set(s) from question 1.

Your Television Manufacturer's Name	The Number of Months	Manual Control Operation	Remote Control Operation

6. How much importance do you attach to colour television sets complying with the **SABS** mark? Please tick (✓) the appropriate block.

Very Little	Little	Medium	High	Very High
1	2	3	4	5

7. How much attention was given to **educating you on product knowledge** by the dealer when you purchased your last colour television set? Please tick (✓) the appropriate block.

Very Little	Little	Medium	High	Very High
1	2	3	4	5

8. **Rank the following product quality dimensions**, in respect of their importance to your knowledge and understanding of colour television sets. Rank by allocating a (1) to the highest or most important a (2) for the second highest a (3) for the third highest and so on and to (8) for the least important.

Performance (eg. ability to receive distant stations)	
Features (eg. stereo sound)	
Reliability (eg. failure rate)	
Conformance (eg. meets specification)	
Durability (eg. time until replacement of a new set becomes necessary)	
Maintainability (eg. easy to repair)	
Perceived quality (eg. reputation and image)	
Aesthetics (eg. styling and finish)	

9. For each locally manufactured colour television set that you own or rent, enter against the manufacturer of that television set the number of times repairs or service calls were required during the **first year of warranty**. Use the manufacturer's name(s) you identified for your colour television set(s) from question 1.

Your Television Manufacturer's Name	The Number of Service Calls

10. Please rank the following **service quality dimensions**, in respect of their importance to you should a colour television set require repair/service by allocating a (1) to the highest or most important; a (2) for the second highest; a (3) for the third highest, and so on; and a (5) to the lowest.

Tangibles (eg. service facilities- equipment and buildings)	
Responsiveness (eg. willingness to provide service)	
Reliability (eg. repeat calls, performing the promised service)	
Assurance (credibility, competence)	
Empathy (eg. communication, understanding/knowing the consumer)	

11. If you have experienced a repair(s) to your colour television set(s) please indicate the time it took, in days, to complete the repair (or the average time if more than one repair was experienced). If your colour television set has never required repairs then ignore this question.

Your Television Manufacturer's Name	Time to Repair in DAYS

PART 2: PRODUCT QUALITY

DIRECTIONS: Please evaluate all the statements in this section by using a five point scale with a (1) indicating very low and a (5) indicating very high. Select a number from (1) to (5) that best represents your rating of your colour television set and enter this alongside the name of the manufacturer of your product(s). Use the manufacturer's name(s) you identified for your colour television set(s) from question 1.

Evaluate questions (1) to (7) using the following scale:

<i>Very Low</i>	<i>Low</i>	<i>Medium</i>	<i>High</i>	<i>Very High</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>

1. Rate the performance of your colour television set(s). When we refer to the **performance** of a colour television set we allude to the clarity of the primary operating characteristics of sound and picture.

Your Television Manufacturer's Name	Your Rating of Picture Quality	Your Rating of Sound Quality

SCALE:

<i>Very Low</i>	<i>Low</i>	<i>Medium</i>	<i>High</i>	<i>Very High</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>

2. Rate the features of your colour television set(s). When we refer to the **features** of a colour television set we allude to attributes that supplement the basic functioning of the product. Examples include remote control functioning, headphone sockets, teletext, audio/video sockets, stereo operation, multi-system operation, on screen display, timers etc.

Your Television Manufacturer's Name	Your Rating of Features

3. Rate the reliability of your colour television set(s) and indicate the approximate time to failure or use in **months** (if never failed) after the date of installation. When we refer to the **reliability** of a colour television set we allude to the ability of the product to perform without failure.

Your Television Manufacturer's Name	Your Rating of Reliability	Time to Failure	Time of use (if never failed)

4. Indicate the durability of your colour television set(s) in years (if applicable). When we refer to the **durability** of a colour television set we allude to the amount of use one gets from a product before it physically deteriorates and replacement is considered as preferable to repair. If you have not replaced your colour television set due to deterioration then ignore this question.

Your Television Manufacturer's Name	Your Rating of Durability	Time to Replacement

SCALE:

<i>Very Low</i>	<i>Low</i>	<i>Medium</i>	<i>High</i>	<i>Very High</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>

5. Rate the maintainability of your colour television set(s). When we refer to the **maintainability** of a colour television set we allude to the time in which it takes a product to be restored to a satisfactory working condition after failure. If your colour television set has never required repairs then ignore this question.

Your Television Manufacturer's Name	Your Rating of Maintainability

6. Rate the aesthetics of your colour television set(s). When we refer to the **aesthetics** of a colour television set we allude to how a product looks and is finished off.

Your Television Manufacturer's Name	Your Rating of Aesthetics

7. Rate the perceived quality of your colour television set(s). When we refer to the **perceived quality** of a colour television set we allude to its reputation and image.

Your Television Manufacturer's Name	Your Rating of Perceived Quality

PART 3: SERVICE QUALITY

DIRECTIONS: This section deals with your **expectations** of Television repair services. Please show the extent to which you think firms offering television repair services should possess the features described by each statement. Do this by picking a number **between one and seven** and enter this in the space provided next to each statement. If you strongly agree that the service firm should possess a feature, enter the number 7. If you strongly disagree that these service firms should possess a feature, enter 1. If your feelings are not strong, enter one of the numbers in between. There are no right or wrong answers -- all we are interested in is a number that best shows your **expectations** about firms offering television repair services.

Expectation 1:	The television repair/service firm should have up-to-date equipment	
Expectation 2:	The physical facilities should be visually appealing.	
Expectation 3:	Their employees should be well dressed and appear neat	
Expectation 4:	The appearance of the physical facilities of these firms should be in keeping with the type of services provided.	
Expectation 5:	When these firms promise to do something by a certain time, they should do so.	
Expectation 6:	When customers have problems, these firms should be sympathetic and reassuring.	
Expectation 7:	These firms should be dependable.	
Expectation 8:	They should provide their services at a time they promise to do so.	
Expectation 9:	They should keep their records accurately.	
Expectation 10:	They should not be expected to tell customers exactly when services will be performed.	
Expectation 11:	It is not realistic for customers to expect prompt service from employees of these firms.	
Expectation 12:	Their employees do not always have to be willing to help customers.	
Expectation 13:	It is okay if they are too busy to respond to customer requests promptly.	
Expectation 14:	Customers should be able to trust employees of these firms.	
Expectation 15:	Customers should be able to feel safe in their transactions with these firm's employees.	
Expectation 16:	Their employees should be polite.	

Expectation 17:	Their employees should get adequate support from these firms to do their jobs well.	
Expectation 18:	These firms should not be expected to give customers individual attention.	
Expectation 19:	Employees of these firms cannot be expected to give customers personal attention.	
Expectation 20:	It is unrealistic to expect employees to know what the needs of their customers are.	
Expectation 21:	It is unrealistic to expect these firms to have their customer's best interests at heart.	
Expectation 22:	They should not be expected to have operating hours convenient to all their customers.	

DIRECTIONS: The following set of statements relate to your **perceptions** about your colour television manufacturer's service organisation or their appointed service agent. For each statement, please show the extent to which you believe the service organisation has the feature described by the statement. Once again, a seven (7) means that you strongly agree that the service organisation has the feature, and a one (1) means that you strongly disagree. You may use any number in between that show how strong your feelings are. There are no right or wrong answers -- all we are interested in is a number that best shows your **perceptions** about the service organisation.

Perception 1:	The service organisation has up-to-date equipment.	
Perception 2:	The service organisation's physical facilities are visually appealing.	
Perception 3:	The service organisation's employees are well dressed and appear neat.	
Perception 4:	The appearance of the physical facilities of the service organisation is in keeping with the type of service provided.	
Perception 5:	When the service organisation promises to do something by a certain time, it does so.	
Perception 6:	When you have problems, the service organisation, is sympathetic and reassuring.	
Perception 7:	The service organisation is dependable.	
Perception 8:	The service organisation provides its services at the time it promises to do so.	
Perception 9:	The service organisation keeps its records accurately.	

Perception 10:	The service organisation does not tell customers exactly when services will be performed.	
Perception 11:	Do you not receive prompt service from the service organisation' employees.	
Perception 12:	Employees of the service organisation are not always willing to help customers.	
Perception 13:	Employees of the service organisation are too busy to respond to customer requests promptly.	
Perception 14:	You can trust employees of the service organisation.	
Perception 15:	You feel safe in your transactions with the service organisation's employees.	
Perception 16:	Employees of the service organisation are polite.	
Perception 17:	Employees get adequate support from the service organisation to do their jobs well.	
Perception 18:	The service organisation does not give you individual attention.	
Perception 19:	Employees of the service organisation do not give you personal attention.	
Perception 20:	Employees of the service organisation do not know what your needs are.	
Perception 21:	The service organisation does not have your best interests at heart.	
Perception 22:	The service organisation does not have operating hours convenient to all their customers.	

APPENDIX D

MANUFACTURING QUESTIONNAIRE

SUPERVISORY/TECHNICAL QUESTIONNAIRE

PART 1: GENERAL INFORMATION

1. Indicate your **main area** of responsibility/work by ticking (✓) **one** of the blocks below that **nearest** describes your responsibility/work.

Machine insertion	Chassis insertion	Chassis assembly	Final assembly	Quality inspection	Material stores
----------------------	----------------------	---------------------	-------------------	-----------------------	--------------------

2. Indicate how much experience you have in colour television production activities (in years).

Years



3. Indicate your **level** of responsibility by ticking (✓) the appropriate block.

Inspector	Fault Finder	Technician	Supervisor	Superintendent	Manager
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4. Indicate your level of education by ticking (✓) the appropriate block.

University degree	Diploma	Certificate	Matric	Less than matric
-------------------	---------	-------------	--------	------------------

5. Rank the following **product quality dimensions**, in respect of colour television receivers, in order of their importance. Rank by allocating a (1) to the most important; a (2) to the second most important a (3) to the third most important and so on.

Performance (eg. ability to receive distant stations)

Features (eg. stereo sound)

Reliability (eg. failure rate or frequency of failure)

Conformity with specifications

Durability (eg. time until replacement is required)

Maintainability (eg. ease of repair)

Perceived quality (eg. reputation and image)

Aesthetics (eg. styling and finish)

PART 2: QUALITY PERFORMANCE

1. Rate the quality of your firm's colour television receivers in relation to your competitors. Please tick (✓) the appropriate block.

Much worse	A little worse	The same	A little better	Much better
------------	----------------	----------	-----------------	-------------

2. We are at the following stage in understanding our quality problems. Please tick (✓) the appropriate category.

We have no idea	We have a little idea	We know sometimes	We know most of the time	We know why they occur
-----------------	-----------------------	-------------------	--------------------------	------------------------

3. When the quality of my work performance is evaluated, I am held responsible in the areas of: You may tick (✓) more than one block.

The amount of rework/repairs required	Scrap costs	Reject rates	Other quality measures	No measures
---------------------------------------	-------------	--------------	------------------------	-------------

4. Do you believe that the only acceptable level of defects is zero? Please tick (✓) the appropriate block.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
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5. If you were to break the causes of your quality problems down into areas and then try to assign a rating to them, how would you rank them? Please rank the following by allocating a (1) to the highest a (2) to the second highest a (3) to the third highest and so on.

Workmanship errors

Faulty materials

Inadequate maintenance

Poor production equipment

Poor product design

Inadequate systems/controls

Management errors

6. Rank the following reasons for quality problems occurring with your colour television receivers, **during manufacture**, by giving a rating against each factor. Please rank them by allocating a (1) to the most frequent a (2) to the second most frequent a (3) to the third most frequent and so on.

Poor product design	
Faulty components	
Maintenance, equipment/process	
Poor supervision	
Poor workmanship	
Too many models	
Insufficient workforce instructions	
Poor design of equipment	
Inadequate systems and controls	
Attitudes towards quality	

PART 3: MANAGEMENT POLICIES AND ATTITUDES

1. Do you feel pressure to **increase the quality** of your firm's colour television receivers during manufacture? Please tick (✓) the appropriate block.

Very Little	Little	Medium	A Lot	Too Much
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2. The management of my company considers **low cost** colour television production to have the following importance. Please tick (✓) the appropriate block.

Very Little	Little	Medium	A Lot	Too Much
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3. The management of my company considers meeting the **production volumes** to have the following importance. Please tick (✓) the appropriate block.

Very Little	Little	Medium	A Lot	Too Much
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4. The management of my company considers producing **high quality (defect free)** products to have the following importance. Please tick (✓) the appropriate block.

Very Little	Little	Medium	A Lot	Too Much
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5. The management of my company considers worker productivity to have the following importance. Please tick (✓) the appropriate block.

Very Little	Little	Medium	A Lot	Too Much
-------------	--------	--------	-------	----------

6. How much attention to quality does your firm give?. Please tick (✓) the appropriate block.

Very Little	Little	Medium	A Lot	Too Much
-------------	--------	--------	-------	----------

7. If the management of my company were asked to rank its manufacturing objectives in order, I feel they would respond as follows: Please rank the following objectives by allocating a (1) to the highest a (2) to the second highest a (3) to the third highest and a (4) to the lowest.

Low cost production

Meeting the production schedule

Producing high quality (defect free) products

Improving worker productivity

8. Are employees actively discouraged from demonstrating initiative? Please tick (✓) the appropriate block.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
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9. Participative management is the predominant management style? Please tick (✓) the appropriate block.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
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10. Management is committed to the ongoing training of our workforce. Please tick (✓) the appropriate block.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
-------------------	----------	---------	-------	----------------

PART 4: QUALITY POLICIES

1. Have you seen a formal quality statement of your firm?. Please tick (✓) the appropriate block.

YES	NO
-----	----

2. Are rejects fed back to the operators? Please tick (✓) the appropriate category.

YES	NO
-----	----

3. In our company, leadership has played a key role in demonstrating commitment to improving quality. Please tick (✓) the appropriate block.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
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4. Do you inspect processed work at the end of each stage of production? Please tick (✓) the appropriate block.

YES	NO
-----	----

5. Prioritise your perception of **colour television receiver** quality by ranking the following definitions. Rank: (1) = First choice; (2) = Second choice; (3) = Third choice; (4) Fourth choice; (5) Fifth or last choice.

Fitness for use (serve the purpose of the user)

Conformity with specifications

Pride of workmanship (quality built in)

Meeting customer expectations

Zero defects (defect free products)

6. In your company, there is continual emphasis on quality improvement of processes and practices. Please tick (✓) the appropriate block.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
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7. Are statistical quality control techniques used in managing the quality in your area? Please tick (✓) the appropriate block.

YES	NO
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PART 5: WORK FORCE ATTITUDES

1. The production workers in my company: Please tick (✓) the appropriate block.

Do not care about product quality
Care little about product quality
Care sufficiently about product quality
Care a lot about product quality
Care too much about product quality

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

2. The production workers in my company think that quality can be improved (lower defects) by providing monetary awards. Please tick (✓) the appropriate block.

<input type="checkbox"/> YES	<input type="checkbox"/> NO
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APPENDIX E

MANUFACTURING QUESTIONNAIRE

SENIOR MANAGEMENT QUESTIONNAIRE

1.1 GENERAL INFORMATION

1. What was your factory's output of **colour television** receivers during 1993 (January to December)? Please tick (✓) only one block for **each category of screen size**.

<i>No. of sets ('000)</i>	< 10	11-15	16-20	21-25	26-30	31-35	> 40
Screen size +/- 71cm							
Screen size +/- 51cm							
Screen size +/- 37cm							

2. How many employees (on average) did your factory employ in respect of **colour television** manufacture during 1993 (January to December)?

Managers

Supervisors

Direct labour (eg. production operators)

Indirect labour (eg. stores, maintenance & supervisors)

3. How many years has your factory been producing colour television receivers?

In Years

--

4. How many **different** colour television receivers were produced by your factory during 1993? (Please do not count variations in styling or finish).

--

5. Please specify the kits used by your factory to manufacture colour television receivers? Please tick (✓) the appropriate block.

Completely knocked down (imported)	Completely knocked down (local design)
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1.2 LABOUR FORCE

1. Are your workers represented by a union? Please tick (✓) the appropriate block.

YES	SOME	NO
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2. What was the average absenteeism of the direct labour force between January and December 1993? Please tick (✓) the appropriate block.

0-1%	<input type="checkbox"/>	2-3%	<input type="checkbox"/>	4-5%	<input type="checkbox"/>	6-7%	<input type="checkbox"/>	8-9%	<input type="checkbox"/>	> 10%	<input type="checkbox"/>
------	--------------------------	------	--------------------------	------	--------------------------	------	--------------------------	------	--------------------------	-------	--------------------------

3. How many shifts does your factory normally run?

No of Shifts

4. What was your average labour turnover (excluding retrenchments) during 1993?

% of workers

1.3 QUALITY PERFORMANCE

1. What are your **approximate first year warranty failure rates** (as a percentage) for the following colour television receiver categories? Please exclude nuisance and customer education calls and tick (✓) the appropriate block.

Percentage (%)

For large screen sizes eg. 71cm

For medium screen sizes eg. 51cm

For small screen sizes eg. 37cm

< 5	6-10	11-15	16-20	> 20
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. Do you think that the warranty failure rates of your locally manufactured colour television receivers are below world standards? Please tick (✓) the appropriate block.

YES	NO	DON'T KNOW
-----	----	------------

3. If you answered "yes" to question 2 above how can your company improve the quality of your locally manufactured colour television receivers?

4. What is the **average failure rate** (as a percentage) when testing the main colour television chassis after the soldering process?

Chassis Failure Rate

5. What is the **average failure rate** (as a percentage) at final customer acceptance testing prior to packaging?

Failure Rate at Customer Acceptance

6. Rank the following reasons for quality problems occurring with your colour television receivers, **during manufacture**, by giving a rating against each factor. Please rank by allocating a (1) to the highest a (2) to the second highest a (3) to the third highest and so on.

Poor product design

Faulty components

Maintenance, equipment/process

Poor supervision

Poor workmanship

Too many models

Insufficient workforce instructions

Poor design of equipment

Inadequate systems and controls

Attitudes towards quality

7. Rank the following reasons for quality problems occurring with your colour television receivers, **during the warranty period**, by giving a rating against each factor. Please rank by allocating a (1) to the highest a (2) to the second highest a (3) to the third highest and so on.

Poor product design

Faulty components

Poor installation

Poor workmanship

Customer education

1.4 QUALITY POLICIES AND STRATEGIES

1. Is the quality assurance department empowered to stop production if output does not meet quality standards? Please tick (✓) the appropriate block.

YES	NO
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2. Do you feel that the utilisation of quality management principles and techniques has become more important or less important during the past five years? Please tick (✓) the appropriate block.

Less Important	Same	More Important
----------------	------	----------------

3. Do you export locally manufactured colour television receivers? Please tick (✓) the appropriate block.

YES	NO
-----	----

4. If you answered "yes" to question three above to which countries do you export to. You may tick (✓) more than one block.

Africa	
Europe	
N. America	
S. America	
Middle East	
Far East	
Australia/New Zealand	

5. Does your company have a formal, written statement of quality policy? Please tick (✓) the appropriate block.

YES	NO
-----	----

6. Are line managers and supervisors formally evaluated on the quality of their output? Please tick (✓) the appropriate block.

YES	NO
-----	----

7. What is the average burn-in (soak) time in hours given to your colour television receivers, during production, before final customer acceptance tests?

No of Hours

1.5 SUPPLIER QUALITY MANAGEMENT

1. What steps are taken to insure that suppliers provide high quality components? You may (✓) more than one category.

Supplier surveys and audits

Supplier rating systems

Supplier component qualification

Supplier corrective action systems

Supplier quality costs

Nothing (rely on supplier)

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

1.6 QUALITY SYSTEMS

1. Does your company employ a Total Quality Control System (eg. ISO 9000)? Please tick (✓) the appropriate block.

YES	NO
-----	----

2. Does your company have a separate department responsible for quality assurance? Please tick (✓) the appropriate block.

YES	NO
-----	----

3. Does your company employ a quality cost reporting system? Please tick (✓) the appropriate block.

YES	NO
-----	----

4. If you answered "yes" to question 3 above please rank the following **quality cost dimensions** by giving a percentage evaluation against each dimension. The total percentages given for all the dimensions below must add to 100%.

Prevention costs	
Appraisal costs	
Internal failure costs	
External failure costs	
Total quality costs	100%

5. Does your company have a designated manager responsible for quality? Please tick (✓) the appropriate block.

YES	NO
-----	----

6. Does your company perform a quality audit on a small sample of finished goods? Please tick (✓) the appropriate block.

YES	NO
-----	----

7. If you answered "yes" to question 5 above please indicate the management level to which the quality assurance manager reports to by ticking (✓) the block below that nearest describes his reporting line.

Managing director	
Manufacturing/Operations director	
Factory manager	
Production manager	
Other _____	

1.7 SERVICE QUALITY

1. What form of colour television field service does your company provide? Please tick (✓) only **one** of the relevant categories below.

Outside service organisations	In-house (company) service departments	A combination of outside and in-house service departments
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2. Please rank the following **service quality dimensions**, in respect of their importance to your company by allocating a (1) to the most important; a (2) to the second most important; a (3) to the third most important and, so on.

Tangibles (eg. service facilities- equipment and buildings)

Responsiveness (eg. swift reaction time)

Reliability (eg. no repeat calls, performing the promised service)

Assurance (credibility, competence)

Empathy (eg. communication, understanding/knowning the consumer)

3. What percentage of your warranty service calls are carried out by outside service organisations and In-house (company) service departments: Please ensure the total adds to 100%.

Outside service organisations

In-house (company) service departments

Total

100 %

4. Please rate the quality of your firm's **colour television repair service** in relation to your competitors. Please tick (✓) the appropriate block.

Much worse	A little worse	The same	A little better	Much better
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5. Do you feel pressure to increase the **service quality** of your firm's colour television repair service? Please tick (✓) the appropriate block.

No pressure	Little pressure	Sufficient pressure	A lot of pressure	Too much pressure
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6. How much attention to **repair service quality** does your firm give? Please tick (✓) the appropriate block.

Relatively little attention	Too little attention	Average attention	Above average attention	Too much attention
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