An Analysis of the Degree of Implementation of Total Quality and Technology Management Principles to Enhance the Competitive Status of a Cable Manufacturing Company.

By

NDUMISO WITNESS DE BOOI

Submitted in partial fulfilment of the requirements of the Magister in Business Administration (MBA) at the Nelson Mandela Metropolitan University

Promoter: Dr Shaun Krause
Submission Date: 30 November 2004
DECLARATION
This work has not been previously accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

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Date: __________________________

STATEMENT 1
This dissertation is being submitted in partial fulfilment of the requirements for the degree of Masters in Business Administration.

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STATEMENT 2
The dissertation is the result of my own independent work/investigation, except where otherwise stated. Other sources are acknowledged by giving explicit references. A bibliography is appended.

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DEDICATION

This research paper is dedicated to my wife, Thami, and my busy two year old daughter, “Her Daddy’s Teddy Bear”, Naomi.
ACKNOWLEDGEMENTS

• Jehovah, The One Who caused it to be, made it possible for this research paper to even exist through me. It is for this reason that all glory for this would rightfully be given to Him. Acknowledging that fact humbles me a great deal.

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ABSTRACT

The cable manufacturing industry may not be well known to some people, yet people’s very lives depend on products and services it produces. Today people live in a highly technological or digital world where most of the technology used by society has at least one electrical cable in it or is connected to a countrywide electrical or communications network through electrical cables in order to work.

Well trained and experienced corporate and business leaders recognize the importance of lean supply chain and of being closer to one’s business suppliers for efficient running of the business. Like in all other countries where these industries exist, it is vital that the cable manufacturing industry survives and prospers in South Africa, for the benefit of South African telecommunications, electricity suppliers, computer networks and many more industries.

However, today there are almost no boundaries in business owing to globalization which enhances free trade. The business environment is changing and there is fierce competition amongst international rivals. What happens then when customers are not happy with low quality products of one supplier? Would they not leave that supplier and look to the competition in order to get good quality products at reasonable prices? Of course they would. Consequently such a supplier would lose market share and ultimately be forced out of business.

This research investigates the shortcomings in terms of the implementation of the principles of total quality and technology management in the cable manufacturing industry. It identifies the internationally recognised principles in the fields of total quality management and technology management as a means of enhancing a competitive advantage. Training and development are identified as extremely important supporting mechanisms which should be done professionally for the best results in the implementation of total quality and technology management principles. Finally, suggestions and recommendations based on best management practice are made.
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CHAPTER 1

PROBLEM INTRODUCTION AND SETTING OF THE STUDY

1.1 INTRODUCTION AND BACKGROUND

The researcher has observed that the invention of electricity and its use has led to a further technological boom that made life easy for people worldwide in terms of the benefits provided by electrical supply, information technology and telecommunications industries. This invention resulted in the development of many other industries which have a great impact on the economy today.

One of those industries is the cable manufacturing industry which produces cables for transmission of electricity and electrical signals representing voice, data and video. In South Africa, Aberdare plays a huge part in the cable manufacturing industry. A brief profile of Aberdare has been outlined below. The group structure in figure 1 below indicates that Aberdare Cables Group is 70% owned by Powertech and 30% owned by a black empowerment Izingwe Consortium.

Figure 1: Altron Corporate Structure

Source: (www.aberdare.co.za)
1.1.1 Company Divisions

Aberdare Power Cables Division manufactures and markets a wide and diverse range of cables. These include paper cables, cross-linked polyethylene cables, rubber trailing cables, non-halogen cables, overhead line conductors, aerial bundle conductors, housewires, surfix, twin and earth cables, and a range of Electrodac cables. Manufacturing plants are located in Port Elizabeth, Cape Town, Pietermaritzburg, Johannesburg and Maputo in Mozambique (www.aberdare.co.za).

Aberdare has been actively involved in assisting local and national authorities in developing affordable cabling systems for low cost mass housing. A wide range of innovative new products, called the Electrodac range, has been developed and introduced to assist the drive to provide affordable electricity for all. However, the new range still performs to stringent control standards and absolutely no compromise on quality has been made. The range has aroused considerable interest in domestic and international markets (www.aberdare.co.za).

1.1.1.1 Telecommunication Cable Division

Aberdare Telecom Networks Division is a major manufacturer and supplier of telecommunication cables to Telkom, South Africa’s public telephone network operator, as well as to a large number of private network operators, both in the public and private sectors (www.aberdare.co.za).

The division also manufactures and supplies industrial telecommunication and instrumentation cables to a wide variety of industries, including the mining, transportation, petrochemical, manufacturing and general industries. The Aberdare range of telecommunication cabling provides unique advantages to users as a result of the constant development of new and innovative technologies (www.aberdare.co.za).

Manufacturing and development facilities, comparable with the best in the world, are situated in Port Elizabeth. The achievements of Aberdare Optical Fibre Systems are indicative of the high standards towards which the entire company
continually strives. Staffed by electrical engineers, the team is highly skilled in state-of-the-art optical digital data and voice communications, CATV, CCTV, and process control systems. The successful design, manufacture and commissioning of an optical fibre telecommunication system for deep level mining applications is recognized as a world first (www.aberdare.co.za).

1.1.1.2 Alcobre Conductores Electricos

Alcobre which is situated in Porto, Portugal, manufactures and distributes cable in domestic and EEC markets, and in addition maintains a high profile in export markets in other European and Middle Eastern countries. Alcobre's product range includes power and telecommunication cables, manufactured and supplied in line with Aberdare's reputation as a high quality service organisation (www.aberdare.co.za).

1.1.1.3 Cables De Comunicaciones

Cables de Comunicaciones, the Spanish manufacturer of metallic telecommunication cable, is a leading supplier of telecommunication products and services. The company has the expertise of more than thirty years of designing, manufacturing and supplying telecommunication products. Their technology has provided solutions for the development and implementation of networks in more than forty countries throughout Europe and the strength of their laboratories lies in transmission measurement in both copper and optical fibre cables, behaviour tests and trials on specific materials (www.aberdare.co.za).

1.1.2 Cable Accessories

Aberdare supports all its products by supplying a full range of accessories, designed for the jointing and terminating of both power and telecommunication cables (www.aberdare.co.za).

1.1.3 The Mission Statement
• To deliver a high quality, well-engineered product, supported by on-time delivery and excellent customer service.

• To provide the means and resources to promote equality, education and training programmes aimed at the development of Aberdare’s employees to attain their true potential in order to satisfy the future human resource needs of the organisation.

• To produce profit returns and growth factors commensurate with their shareholders' requirements, and necessary to secure the future of all their employees.

• To ensure equality in the workplace so that no individual shall be denied employment opportunities for reasons unrelated to ability (www.aberdare.co.za).

1.1.4 Aberdare Values

• To provide outstanding customer service.

• To ensure exceptional quality in the product, and pride in what Aberdare does.

• To develop a climate of trust and respect amongst all those who are employed at Aberdare (www.aberdare.co.za).

1.1.5 Aberdare Goals

• To achieve and maintain a customer satisfaction level that is a benchmark in their Industry.

• To motivate all the people of the Aberdare family by promoting a feeling of belonging to a winning team.

• To maintain and improve the leading position in the South African Cable Industry.

• To develop the best product in every sector of the market in which they compete.
To strive for goals which are recognised as rewarding and worthwhile to both the Company and the individual (www.aberdare.co.za).

1.1.6 Company’s Commitment

Aberdare employs approximately 3000 people at factories and branches throughout Southern Africa. This figure represents a full complement of key personnel necessary to sustain the growth of the operation. It includes electrical engineers, administration staff, sales staff, skilled and semi-skilled personnel (www.aberdare.co.za).

The factories follow a philosophy of participative management while overall development and strategy of the group is co-ordinated by the Executive Board. In accordance with the stated objective of developing human resources, Aberdare runs comprehensive education and training programmes to achieve the continuous advancement of personnel within the company (www.aberdare.co.za).

1.1.7 The Future

Aberdare Cables (Pty) Limited is Africa’s leading manufacturer of power, telecommunication, control and optical fibre cables. Since its establishment in 1946, its employees have endeavoured to follow a path of total commitment to product quality and customer care. They believe that it is this path that has allowed Aberdare to satisfy the demanding requirements of a diverse range of primary and secondary industries (www.aberdare.co.za).

It has been this half-century of experience that has enabled Aberdare to strive for the continuous development of a sophisticated, yet cost-effective product range, a product that proves particularly innovative in South Africa and other developing nations. The opportunities facing Aberdare, and indeed South Africa, will enable Aberdare to remain a growing force in the industry (www.aberdare.co.za).

1.1.7.1 Domestic and International Growth

Aberdare’s product range is distributed on the domestic market through a network of branches located in all the major centres, and supplemented by
appointed agents and distributors in the smaller centres and in international markets. Since the product range and services offered are so diverse, Aberdare Cables (Pty) Limited is broadly divided into autonomous operating divisions (www.aberdare.co.za).

1.1.8 Company’s Stance Regarding Quality

The company is committed to quality. Hence, all the products and processes reflect our ongoing commitment to attaining the highest quality standards, measured by the high level of customer satisfaction. Customer satisfaction means the retention of confidence in Aberdare as a trusted and valued supplier. It means that every delivery must create a recommendation for further business, and it means that through this drive for quality, Aberdare is able to generate new business opportunities. To this end, Aberdare operate its factories and plants according to internationally recognized quality assurance standards (www.aberdare.co.za).

1.2 THE MAIN PROBLEM

The main problem of this research is to analyze the degree of implementation of total quality and technology management principles for competitive advantage at Aberdare.

1.3 SUB-PROBLEMS

- Are total quality management principles implemented optimally at Aberdare to enhance the company’s competitiveness?
- Are technology management principles in terms of strategy implemented optimally at Aberdare to enhance the company’s competitiveness?
- How can Aberdare’s training and development be improved to support optimal implementation of total quality and technology management?
The following are the hypotheses that serve the purpose of guiding this research project:

- The principles of total quality management are not implemented optimally at Aberdare for competitive status.
- The principles of technology management are not implemented optimally at Aberdare for competitive status.
- Training and development of employees at Aberdare need some alignment to support TQM and technology management principles and hence the competitive advantage of Aberdare.

1.4 AIMS AND OBJECTIVES OF THE RESEARCH

This research paper aims at examining the degree of implementation of total quality and technology management principles for a competitive advantage in the cable manufacturing company. The aim is to review the best practices in the fields of total quality and technology management based on literature and collect some data and information for analysis from Aberdare, a cable manufacturing company, particularly in the Nelson Mandela Metropolitan area.

This data and information will be analyzed to identify any shortfalls or gaps that need to be eliminated to enhance competitiveness in this company. Lastly, some constructive suggestions and recommendations to eliminate any identified shortfalls based on best practice in management science will be made.

1.5 IMPORTANCE OF RESEARCH TOPIC

Total Quality Management and Technology Management are two different fields of study with a common feature of providing a competitive advantage to the organisations that apply their principles effectively (Oakland, 2000:3; Khalil 2000:208).

Modern lifestyle and people’s safety depend on cables used in the electrical network grid to transmit and distribute electricity. People’s electronic communication is through a telecommunications network made up of cables
which serve as a transmission medium for voice and non-voice or data and video signals.

The researcher chose to study Aberdare since it is part of the cable manufacturing industry of which two plants are based in the Nelson Mandela Metropolitan Municipality area within one of the poorest provinces of South Africa, the Eastern Cape.

As a cable manufacturer, Aberdare needs to continuously improve the way of conducting business in order to stay competitive and hence stay in business. Total quality and technology management principles could provide a competitive edge for Aberdare and the competitiveness of this company could result in it securing a greater market share in its industry. This implies high profitability and good chances of retaining a leading position in business.

The production of any non-confirming product is a waste which will either be reworked or scrapped, adding to cost of the product without adding value. If the defect is not detected within the company, it will result in dissatisfaction of the customer. A customer who is not totally satisfied with the product received will at best insist that it is satisfactorily repaired, adding cost to the product again without adding value, or at worse, will advertise dissatisfaction, causing a bad reputation for the company, resulting in a loss of future sales. It is important to know and understand that a good reputation in the market is needed for long term prosperity of the company. It is very hard to get, and if lost, is even harder to recover.

In addition to this, Aberdare’s success in business could prove positive for the economy of the Nelson Mandela Metropolitan Municipality area and hence the entire Eastern Cape region of South Africa. This would only be possible when Aberdare meets, and even exceeds, customer expectations through TQM and technology management principles. The implications of this kind of success would be:

- The increase of market share for Aberdare
Availability of local cable supplier to local power supplying industries, which is a necessary lean supply feature for success of those industries.

If the Aberdare’s manufacturing plant under investigation could implement the recommendations of this study, its success could be noted by other Aberdare plants through internal benchmarking.

In addition to being a critical element in operations, quality has other implications which include company reputation which can be affected by quality; product liability where courts increasingly hold that design, produce, or distribute faulty products or services liable for damages or injuries resulting from their use.

On the other hand, throughout human history, technology has had a profound effect on human development and on the progress of civilization (Khalil, 2000:1). This explains why technology and its management is regarded as the key to competitiveness and hence the justification of this study. In addition, training and development serves to support the TQM and technology management programmes for the best results.

Another point to bear in mind is that firms also reconfigure their value chains by introducing superior processes into their operations. Superior processes may evolve from technology progression or technology evolution. A radically different process could replace an existing process. Alternatively, an existing process may be made efficient through the naturally occurring learning that results from its continued utilization. Thus TQM methods help to incrementally harness the productivity gains inherent in existing processes.

1.6 DEFINITION OF KEY CONCEPTS

Total Quality Management is an organisation-wide approach to continuously improving the quality of all the organisation’s processes, products, and services (Kotler, 2000:56).
Technology refers to the theoretical and practical knowledge, skills, and artefacts that can be used to develop products and services as well as their production and delivery systems. Technology can be embodied in people, materials, cognitive and physical processes, plant, equipment and tools. Key elements of technology may be implicit, existing only in embedded form (e.g. trade secretes based on know-how). Craftsmanship and experience usually have a large tacit component, so that important parts of technology may not be expressed or codified in manuals, routines and procedures, recipes, rules of thumb, or other explicit articulations. The criteria for success regarding technology are also technical rather than commercial. Technologies are usually the outcome of development activities to put inventions and discoveries to practical use (Burgelman, Maidique & Wheelwright, 1996:2).

The technologies that exist in a business are technological aspects of that business. These assets may therefore include hardware, software, brainware and know-how. They constitute the collective knowledge and technical capabilities of the organisation, including its people, equipment and systems (Khalil, 2000:3).

Competitive advantage is a company’s ability to perform in one or more ways that competitors cannot or will not match. Hopefully, the competitive advantage is seen as customer advantage (Kotler, 2000:56).

The main purpose of training and development is to overcome the limitations, current or anticipated, that are causing an employee to perform at less than the desired level (Hellriegel et al, 2001:250).

Leedy and Ormrod (2001:6) define hypothesis as a logical supposition, a reasonable guess, an educated conjecture. It provides a tentative explanation for a phenomenon under investigation. It may direct one’s thinking to possible sources of information that will aid in resolving one or more sub-problems and in the process the principal research problem.
A point of note, however, is that a hypothesis about what the researcher may or may not discover is formed after the researcher has stated the research problem and its sub-problems (Leedy and Ormrod, 2001:6).

1.6.1 Main Abbreviations Used

In this document some abbreviations have been used. Some of these main abbreviations are listed below:

- CEO: Chief Executive Officer
- HRD: Human Resources Development
- IP: Internet protocol
- IPM: Institute of Personnel Management
- JIT: Just-In-Time
- ISDN: Integrated Services Digital Network
- NMMM: Nelson Mandela Metropolitan Municipality
- NT: New Technology
- OJT: On-the-Job-Training
- PER: Price Earnings Ratio
- QFD: Quality Function Deployment
- ROI: Return On Investment
- ROS: Return On Sales
- TM: Technology Management.
- TQC: Total Quality Control
- TQM: Total Quality Management

1.6.2 Symbols Used for Demographics Purposes

- A: Africans
- C: Coloureds
• I: Indians
• W: Whites

1.7 DELIMITATION OF THE RESEARCH

This section of the study serves the purpose of providing a manageable scope of this particular research. The delimitation is divided into geographical, demographic and conceptual.

1.7.1 Geographical Delimitation

This research is limited to one Aberdare’s manufacturing plant which manufactures power cables. This plant is located at Stanford Road, within the NMMM area.

1.7.2 Demographic Delimitation

The research will involve employees from various departments. These employees include clerical and administration staff, operational staff, team leaders or supervisors, technical or engineering staff and managers regardless of age, nationality or gender. However, only day-shift employees will be involved in this research.

1.7.3 Conceptual Delimitation

The researcher recognizes that Total Quality Management and Technology Management study fields are two separate and very broad fields on their own. It is for that reason that this research deals with total quality management in terms of eleven principles model developed by Goshi (2003:36-47). Secondly, Harrison & Samson (2002:1) believe that technology management and its sub-fields are relevant to the needs of government policymakers, industry leaders, and business management students. Some of the sub-fields of technology management include:
• Technology strategy
• Development of technological capability
• Innovation management
• Technological forecasting
• Technology management, manufacturing strategy and business competitiveness interfaces
• Barriers to the adoption of technology
• Technology and manufacturing flexibility and
• E-business, a rapidly developing field of new technology

Technology Management in this research mainly focuses on technology strategy in order to make the research manageable.

Training and development basic concepts covered in this study are those necessary to support the main concepts in the title of this research study as part of the practical solution to enhance their employment for competitive status of Aberdare. This excludes the normal orientation training offered by companies to new employees and other specialized disciplines of training.

1.8 PRIOR RESEARCH ON THE TOPIC

There was no study of this kind conducted in particular at Aberdare in the NMMM area that the researcher is aware of. However, prior research reveals that TQM can enhance the competitiveness of an organisation. Any organisation basically competes on its reputation – for quality, reliability, price and delivery – and most people now recognize that quality is the most important of these competitive weapons (Oakland, 2000:3).

Oakland (2000:18) further contends that TQM is an approach to improving the competitiveness, effectiveness and flexibility of a whole organisation. It is essentially a way of planning, organising and understanding each activity, and depends on each individual at each level. For an organisation to be truly effective, each part of it must work together properly towards the same goals, recognizing that each person and each activity affects and, in turn, is affected by
Concerning technology management, Harrison and Samson (2002:xiii) recognize the following as the three key variables thought to drive competitiveness in the modern organisation:

- Strategic leadership, meaning that the firm is set on a path and well led towards doing the right thing in terms of products, markets etc.
- A motivated and committed workforce, achieving the “high performance” work culture.
- Effective use of technology in driving effective and competitive outcomes for the organisation.

From these arguments it is evident that optimal implementation of total quality management and technology management principles can play a major role in the competitiveness of an organisation.

1.9 A BRIEF RESEARCH METHODOLOGY PLAN

The research will include a literature survey including Internet sources to increase the researcher’s confidence on the topic. The researcher will also organise a tour through Aberdare’s manufacturing plant in question in order to observe some of the operations.

Some research aspects involved structured interviews, either personal or telephonic. To enhance manageability of the research, among other tools of research, an inductive reasoning will be used since the researcher will not involve every employee at Aberdare’s manufacturing plant under investigation.

The research methodology and design is discussed in detail in chapter 3 of this research document.
1.10 KEY ASSUMPTIONS

This section of the research sets out the key assumptions made by the researcher during his investigation. The first assumption is that not all the employees of Aberdare fully understand the basic principles and significance of total quality and technology management, as is the case in other companies.

The second assumption is that the competitiveness of Aberdare could be greatly enhanced through optimal implementation of total quality and technology management principles. Thirdly, the researcher assumed that the end-result suggestions in this research paper will be beneficial to the entire Aberdare group, and even to other organisations in industries other than the cable manufacturing industry.

1.11 THE STRUCTURE OF THE STUDY

This dissertation consists of five chapters. Chapter 1 covers the introduction of the research. It consists of the introduction and background of Aberdare, the main problem and sub-problems and explains the importance of the research. It is in this chapter that the delimitations of the research, its structure, key assumptions and definition of key concepts are discussed.

Chapter 2 is based on literature. It provides a theoretical overview of the importance of employment of TQM and Technology Management principles for competitive advantage. The TQM model of eleven principles, based on Prof Akira Goshi (2003:36) employed in this chapter serves as a framework and supporting literature is employed to expand on some basic concepts of the framework. Training and development is also discussed in this chapter as a means of achieving the best out of the optimal implementation of TQM and Technology Management principles.

Chapter 3 is the chapter where the methodologies and sources of data and information backed up by literature for this research are discussed in more detail compared to the briefing provided in chapter 1. This is where the research methods used are discussed.
In chapter 4, the researcher analyzes the results of the research and interprets its findings. It is in this chapter that the shortcomings in the performance of Aberdare are identified.

Chapter 5 is made up of synopsis conclusions and recommendations. This is the final chapter that serves to provide possible solutions based on best known management practices in the disciplines of TQM, technology management and training and development.

CHAPTER 2

THE LITERATURE REVIEW
2.1 INTRODUCTION

This chapter is a review of literature with regard to total quality management, technology management in terms of technology strategy, and training and development. It is the revelation of what the literature points out regarding the implementation of key principles of Total Quality and Technology Management, including Training and Development for the competitiveness of an organisation. Various sources from different researchers have been used to study some of the best practices in these fields. The knowledge of how best to implement those principles for best results is presented in this chapter. Three sub-sections into which this chapter is divided are:

- The literature review of Total Quality Management;
- The literature review of Technology Management and
- The literature review of Training and Development.

2.2 LITERATURE REVIEW OF TOTAL QUALITY MANAGEMENT

This section is based on the TQM model developed by Goshi (2003:36) who contends that the following are the fundamental principles of total quality:

1. Quality first
2. Customer-driven
3. Partnership with all people
4. Top management leads
5. Built-in quality
6. Organisational alignment
7. Cross-functional management
8. Waste elimination
9. Development of reliable methods
10. Healthy work environment
11. Continuous improvement

A point of note is that figure 2 reveals that the continuous improvement
principle on which TQM is based is central to the rest of the other fundamental principles:

**Figure 2: The Fundamental Principles of Total Quality**

1. Quality First
2. Customer-driven
3. Partnership
4. Top Management Leads
5. Built-In Quality
6. Organisational Alignment
7. Cross-Functional Management
8. Waste Elimination
9. Reliable Methods
10. Healthy Work Environment
11. Continuous Improvement

Source: Goshi (2003:36)

### 2.2.1 Quality First Policy in Action

Goshi (2003:37) believes that the following provide the true meaning of giving priority to total quality:

- “Quality First” means quality comes before costs, before employees, before stockholders, before capital and before short-term profits. Quality for customers is top management’s primary business policy and should be as absolute as the company’s safety policy.

- Top management’s job is to ensure that everyone in the organisation complies with the “Quality First” policy.

- Only the long-term quality focus, not a short-term profit orientation, achieves long-term competitiveness. Therefore, the “Quality First” policy can never be compromised.

Based on prior research in the field of quality, the researcher agrees with this
sentiment. Indeed, if quality enhances the competitiveness of an organisation, and its means of survival in the business world, then it must be a priority.

To be successful in promoting business efficiency and effectiveness, TQM must be truly organisation-wide, and it must start at the top with the Chief Executive or equivalent. The most senior directors and management must all demonstrate that they are serious about quality. The middle management have a particularly important role to play, since they must not only grasp the principles of TQM, but also go on to explain them to the people for whom they are responsible, and ensure that their own commitment is communicated. Only then will TQM spread effectively throughout the organisation. This level of management also needs to ensure that the efforts and the achievements of their subordinates obtain recognition, attention and reward that they deserve (Oakland, 2000:20).

Elaborating further on this, Oakland (2000:20) stresses that the Chief Executive of an organisation should accept the responsibility for commitment to a quality policy in which he or she must really believe. This commitment is part of a broad approach extending well beyond the accepted formalities of the quality assurance function. It creates responsibilities for a chain of quality interactions between the marketing, design, production operations, purchasing, distribution and service functions.

This implies that there must be a drive within the organisation for all the stakeholders to be customer-driven. This idea must be filtered through from top management operational staff, engineers and technicians, and administration staff.

2.2.2 The Meaning of Being Customer-Driven

All the organisation’s activities must be designed to achieve on-going full customer satisfaction if an orientation of “customer-in” rather than “product-out” concept guides the organisational management and decision-making (Goshi,
To support himself on this Goshi (2003:38) highlights some of the best business practices. These include the following:

- Quality is defined by customers' needs and specifications. Quality is conformance to specifications defining characteristics required to ensure fitness for use.
- Maintaining full customer satisfaction as customer's needs change and grow requires a continual steam of new products and an organisational strength in new product development.
- Customer feedback and complaints form the basis for the development of new, more satisfying products.
- The voice of a customer must be heard throughout the organisation.
- The employees view each other as internal customers and suppliers establishing an interlocking grid of internal customer-supplier relationships integrated to assure total quality to the end-use customer.

Oakland (2000:13) relates that he was asked on more than one occasion if TQM applies to marketing. The answer to this question is not remarkable: it starts there. The researcher strongly supports this sentiment since the information acquired through market research determines the quality characteristics of a product or service. The marketing function of an organisation must take the lead in establishing the true requirements of the product or service.

One approach to accomplishing that is explained by two respected marketers, Dwyer and Tanner (1999:231) in terms of Quality Function Deployment (QFD). At the heart of the product development process involving the supplier and customer is the quality function deployment method. The quality function deployment method is a process of linking customer needs to a product development process so that customer needs are understood. Marketing research, the sales force, and other parts of the organisation can provide input from the customer, as discussed. From the customer, though, comes a list of
requirements or desired benefits that the product must offer.

In addition to the needs of the customer, the company has needs that must be met and design considerations that must also be taken into account. For example, the profit margin must be acceptable, which places an upward limit on costs. Also, competitive offerings must be considered, for the new product must be superior in some manner or customers will not buy it. There are also design considerations such as technology platform that will be used and how different benefits can be accomplished by using different features (Dwyer & Tanner, 1999:231).

2.2.2.1 Commitment to the Customer and Customer Satisfaction

Hanna and Newman (2001:179) believe that the very purpose of organisations is to meet customer needs and satisfy their expectations. Whether the customer is internal or external, making a true commitment to customer satisfaction requires managers to follow through in at least three ways:

- They must establish an ongoing process that effectively measures the level of satisfaction customers are receiving from the firm’s product-service bundle.
- They must maintain excellent communication between employees and the customers they serve.
- They must design processes and product-service bundles that delight customers both by responding to customers’ concerns and by anticipating customers’ needs and expectations.

The importance of committing to the customer cannot be overemphasized. The willingness to solicit input from customers and to respond in a tangible ways allows companies that are pursuing TQM to remain competitive, even in the face of intense global competition.

The researcher believes that TQM, of which commitment to meet customer
needs is a principle, cannot be achieved only by certain individuals within the organisation to the satisfaction of the customers. Management and marketing department cannot do it in isolation, nor can the quality department do it on their own. However, partnership with all the people can be a solution to a quality commitment.

2.2.3 Partnership with all People

TQM is everyone’s business in any organisation and as such, Goshi (2003:39) reckons that this could be achieved through education, development, respect, and mutual commitment of everyone forever through adhering to these factors:

- The competence and commitment of employees in the organisation are recognized as critical to the entire process of total quality.
- Involvement of everyone is a requirement for success.
- Management assumes responsibility for ensuring ongoing education and training of people to allow them to contribute significantly to quality improvement.
- Management design work groups, small group activities, quality circles, and suggestion systems to engage all employees in quality improvement.
- All human resource practices are carefully designed from the initial selection and placement, to career progression through the organisation, to rewards, recognition systems and performance appraisal systems. This is explained further by Schonberger (2001:85-86).
- Management establish a constructive relationship with the unions through communication processes, role clarity, expectations and joint goals.

As can be noted from these highlights, teamwork is also one of the critical factors for a successful TQM.

2.2.3.1 Teamwork Competency

In line with Goshi’s views of grouping people, Hellriegel et al (2001:18) wrote that
accomplishing tasks through small groups of people who are collectively responsible and whose work is interdependent requires teamwork competency. Managers in enterprises that utilize teams can become more effective by:

- designing teams properly
- creating a supportive environment, and
- managing team dynamics appropriately

Teamwork in some cases involves self-managed teams which differ from normal teams in that they even perform managerial activities to the extent of making some strategic decisions. Another difference is that these teams are rather large, made up of up to twenty people (Wilson, 1995:26).

According to Kreitner, Kinicki and Buelens (2002:344), the term **self-managed** does not mean simply turning workers loose to do their own thing. Indeed an organisation embracing self-managed teams should be prepared to undergo revolutionary changes in management philosophy, structure, staffing and training practices, and reward systems. Moreover, the traditional notions of managerial authority and control are turned on their heads. Not surprisingly, many managers strongly resist giving up the reigns of power to people they view as subordinates. They see self-managed teams as a threat to their job security.

Emphasizing this sentiment regarding team empowerment, Hellriegel et al (2001:345) state that perhaps the most difficult of being a work team leader is empowerment of team members. Work teams may be more successful in achieving organisational goals if their members are empowered or given authority and responsibility to do their jobs. Conversely, if their authority and responsibility are restricted, team members may well reduce their levels of commitment. They might continue to perform satisfactorily but with little enthusiasm for improving quality and productivity.

Total Quality Management, from its inception, intuitively recognized the importance of bringing organisations and individuals together through teams and processes. These two elements, teams and processes, brought new emphasis on training and technologies. The true heart of TQM is in this central role of
blending organisations with their individual performers in competitively meeting customer needs (Green, 2004)

Affirming these ideas, Slack et al (2001:678) and Naylor (1996:416) emphasized that TQM covers all parts of the organisation, and that for an organisation to be truly effective, every single part of it, each department, each activity and each person at each level, must work properly together, because each and every activity affects and, in turn, is affected by others.

Referring to the involvement of employees as highlighted by Goshi (2003:39), Hanna and Newman (2001:180) noted that there is a subtle distinction between the traditional view of the worker and the perspective promoted by TQM. Traditionally, a worker was viewed as a person who completes the task. In that context, it is easy for workers to “check their brains at the door” when they arrive at work. But in TQM, the worker is viewed as the source of process improvements. Thus, rather than seeing this week’s production quota in the workers’ hands, managers need to see the company’s future in the workers’ minds. For many firms seeking to pursue total quality, this kind of mental adjustment may require considerable change on the part of managers as well as employees.

With this idea in mind, Slack et al (2001:681) relate that a Japanese industrialist, Konosuke Matsushito, once issued a statement which attracted considerable publicity, namely that the Japanese industrialists were going to win and the industrial West was going to lose out, and there was nothing much they could do about that because the reasons for their failure were within their hands.

Apparently, for the industrial West, the essence of management was getting ideas out of the heads of the bosses into the hands of labour. For Japanese industrialists, the core of management was precisely the art of mobilizing and pulling together the intellectual resources of all employees in the services of the firm. Konosuke contended that, only by drawing from the brainpower of all its employees can a firm face up to the turbulence and constraints of the environment. That is why Japanese large companies give their employees three
to four times more training than Western companies do. That is why they foster within the firm such an intensive exchange of ideas and communication. That is why they constantly seek everybody’s suggestions and why they demand from the educational system increasing numbers of graduates as well as bright and well-educated generalists, because these people are the lifeblood of industry.

Hanna and Newman (2001:181) emphasised that employee involvement is a formal approach to creating a spirit of a teamwork that will lead to widespread process improvements. Typically, workers are encouraged to make suggestions that will produce improvements in their workplace, such as reduced costs, higher quality, greater safety, better ergonomics, more effective environmental safeguards, enhanced decision making, more efficient use of space, and the like. Once a suggestion has been approved by managers, a team of volunteers is asked to work on developing a specific approach to implementing the suggestion. Members of the team receive the training they need to follow the project through to its completion.

2.2.3.2 Communication Competency

This is another important aspect for the successful implementation of TQM. Hellriegel et al (2001:16) state that communication competency refers to the effective transfer and exchange of information that leads to an understanding of oneself and others. He further mentions that because managing involves getting work done through other people, communication competency is essential to effective managerial performance. According to Hellriegel et al (2001:18), communication competency involves:

- informal communication which promotes flexible two-way communication that builds strong interpersonal relationships with a diverse range of people;
- formal communication which keep people up-to-date of activities and events;
• negotiation which involves effective negotiation on behalf of the team over roles and resources.

Communication is important in providing guidance for ethical standards and activities that provide integration between functional areas of the business (Kreitner et al, 2002:288).

In order to enhance communication, many organisations today employ information systems. According to Loudon and Loudon (2002:4), such digital firms use the Internet and networking technology to make data flow seamlessly among different parts of the organisation, streamline the flow of work, and create electronic links with customers, suppliers and other organisations.

2.2.4 Top Management Leads

Regarding the leadership, Goshi (2003:40) strongly believes that the top management must lead and that:

• management must use Total Quality Control (TQC) as the fundamental business strategy upon which all other decisions are based.
• management must learn new ways of thinking and be thoroughly committed to total quality principles through assuming responsibility for its own learning and self-study.
• management as architect of organisation design and culture establishes systems and processes that support TQC and develops culture of excellence and high quality, a customer orientation to both internal and external customers, a learning and continuous improvement mentality.
• it establishes a plan for developing a quality assurance system for full customer satisfaction built on an understanding of TQC implementation and planned organisational change dynamics.
• management must issue practical policies for quality and ensure compliance to the “Quality First” policy and provide leadership throughout implementation and maintenance of TQC, disseminating quality concepts everywhere in the organisation.
Within each department of the organisation at all levels, starting at the top, basic changes of attitude may be required to operate TQM. The owners or directors of the organisation must recognize and accept their responsibilities for the initiation and operation of TQM. Controls, systems and techniques are very important in TQM, but they are not the primary requirement. It is more an attitude of mind, based on pride in the job and teamwork, and it requires total commitment from management, which must then be extended to all employees at all levels and in all departments (Oakland 2000:20).

It is the researcher’s conviction that management should take the lead for total quality and that these sentiments cannot be over-emphasized. Managers are the drivers of the organisation and therefore should take the initiative. This involves creating the necessary culture conducive for the implementation of TQM.

2.2.4.1 The Cultural Basis of TQM

Kreitner et al (2002:58) define an organisation culture as the set of shared, taken-for-granted implicit assumptions that a group holds and that determine how it perceives, thinks about and reacts to its various environments. Table 1 illustrates some cultural elements that should be borne in mind for a successful TQM:

Table 1: The Eight Crucial Elements of TQM

<table>
<thead>
<tr>
<th>Culture element 1:</th>
<th>Quality information must be used for improvement, not to judge or control people.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Culture element 2:</td>
<td>Authority must be equal to the responsibility.</td>
</tr>
<tr>
<td>Culture element 3:</td>
<td>There must be rewards for results.</td>
</tr>
<tr>
<td>Culture element 4:</td>
<td>Cooperation, not competition, must be the basis for working together.</td>
</tr>
<tr>
<td>Culture element 5:</td>
<td>Employees must have secure jobs.</td>
</tr>
</tbody>
</table>
Culture element 6: There must be a climate of fairness.
Culture element 7: Compensation should be equitable.
Culture element 8: Employees should have an ownership stake.

Source: Sashkin and Kiser (1993:77)

TQM works by empowering everyone, especially those at lower levels, and providing them with knowledge and skills they need to take action commensurate with their work responsibilities. The purpose of such action is to improve quality for the customer. But equally important is leadership from the top to define and construct a TQM culture. Without cultural support, TQM becomes just another programme, almost certain to fail eventually. And only leaders can construct such cultures. Thus the first step toward TQM requires active, perhaps even vehement support from the CEO (Sashkin & Kiser, 1993:155).

2.2.5 Built-In Quality

In TQM the prevention of defects should be emphasized. According to Goshi (2003:41):

- Quality is achieved through the prevention of errors and defects.
- It is process control and not inspection that helps assure quality is built-in.
- Everyone should be committed to never pass on or accept variance.
- Everyone should be involved in using facts and data to assess quality.

The impact of TQM on an organisation is, firstly, to ensure that the management adopts a strategic overview of quality. The approach must focus on developing a problem-prevention mentality (Oakland, 2000:19).

Gaither (1996:671) states that the concept of quality at the source aims to put the production worker in the driver’s seat in controlling the product quality. In order to achieve the goal of having each worker produce parts that are of perfect quality,
quality as the source follows these principles:

- Every worker’s job becomes a quality control station. Workers are responsible for inspecting their own work, identifying any defects and reworking them into non-defectives, and correcting any causes of defects.

- Statistical quality control techniques are used to monitor the quality of parts produced at each work station, and easy-to-understand charts and graphs are used to communicate progress to workers and managers.

- Each worker is given the right to stop the production line to avoid producing defective parts.

- Workers and managers are organised into quality circles, or QC circles. These are small group of employees who analyze quality problems, work to solve the problems, and implement programmes to improve product quality.

This set of arrangements does four things: Firstly, it assigns responsibility for product quality to production workers and the production function, where it belongs. Secondly, it can lead to production workers who are more committed to high product quality. Thirdly, rather than checking on others, quality control personnel can do work that has a direct impact on producing products of high quality: working with production personnel to remove the causes of defects, training workers in quality control, and working with suppliers to improve their product quality. Finally, it removes an obstacle to cooperation between quality control personnel and production workers so that they can better work together for higher product quality (Gaither, 1996:671).

2.2.6 The Organisational Alignment

To ensure that all the work activities within an organisation are aligned with its goals Goshi (2003:42) prescribes that:
• management by policy or management by improvement goals should be implemented. Management leads the organisation in continually developing organisational goals and methods for improvement, integrated for every level and function. A control system for monitoring each level and function should be tracked and followed up if out of control.

• management must be based on facts and data. Measurements mechanisms should be developed and used. All key aspects of inputs, processes, and outputs should be measured. TQM tools such as check-sheets, pareto diagrams, fishbone charts etc. should be used to collect, analyze and display data.

• the Plan-Do-Check-Action cycle serves as the foundation for systematic improvement planning and follow-through.

Strategic systematic planning for TQM needs itself to be done within the continuous improvement cycle to avoid the danger gaps shown in figure 3:

**Figure 3:** TQM implementation – Done with Deming’s Continuous Improvement Cycle

[Diagram of Deming’s Continuous Improvement Cycle with labels: Goals Targets Strategy (Danger Gap: Improvement not implemented), Plan, Goals Targets Strategy (Danger Gap: Goals without methods)]
Source: Oakland (2000:255)

From figure 3 it is clear that the goals planned for must have clear **methods** and **measurements**. **Data** and facts must be used and **improvement** through corrective action must be implemented.

### 2.2.7 Cross-Functional Management

To achieve full customer satisfaction, an integrated cross-functional management is required. TQC involves every person, all departments and all levels. TQC depends on coordinated efforts of the:

- Marketing & Sales;
- Research & Design,
- Engineering, Purchasing, Production, Quality Assurance
- Packaging, Shipping and Service Departments.

It is based upon viewing the next process or person as the customer and meeting customer specifications both internally and externally (Goshi, 2003:43).

According to Slack et al (2001:678), one of the most powerful aspects to emerge from TQM is the concept of the internal customer supplier. This is recognition that everyone is a customer within the organisation and consumes the goods or
services for other internal suppliers, and everyone is also an internal supplier of goods and services for other internal customers.

The implication of this is that errors in the service provided within an organisation will eventually affect the product or service which reaches the external customer. So one of the best ways to ensure that external customers are satisfied is to establish the idea that every part of the organisation contributes to external customer satisfaction by satisfying its own internal customers (Slack et al., 2001:678).

2.2.8 Waste Elimination

In an effort to eliminate waste which results in poor quality, Goshi (2003:44) believes that the focus should be on aspects of the business that add value. He highlights some important aspects in this regard as follows:

- Inventory is recognized as the root of all evil and that all-out war on waste should be declared and engaged.

- The foundation for world class manufacturing or work processing techniques is the principle: Do only those things that add value to the product or service.

- Goods and services should be produced as they are “pulled”, based on the needs of the customer.

- In order to be responsive to customer needs and to eliminate waste, small lot production is employed and lead time is reduced.

Some of the methods employed by manufacturing organisations to minimize, if not eliminate, waste include lean manufacturing and JIT. JIT is briefly discussed below.

2.2.8.1 Just-In-Time and Inventory Management
Just-in-time (JIT) manufacturing means producing goods and services exactly when they are needed. They should not be produced before they are needed so that they wait as inventory, or after they are needed so that it is the customer who has to wait (Slack et al, 2001:482).

According to Slack et al (2001:482), JIT is a disciplined approach to improving overall productivity and eliminating waste. It provides for the cost-effective production and delivery of only the necessary quantity of parts at the right quality, at the right time and place, while using a minimum amount of facilities, equipment, materials and human resources. JIT is dependant on the balance between the supplier’s flexibility and the user’s flexibility.

Based on this, apparently JIT is accomplished through the application of elements which require total employee involvement and teamwork. A key philosophy of JIT is simplification. Table 2 is a comparison of traditional systems and JIT:

**Table 2: Comparison of Traditional Systems and JIT**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Traditional</th>
<th>JIT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Priorities</strong></td>
<td>Accept all orders Many options</td>
<td>Limited market Few options Low cost, high quality</td>
</tr>
<tr>
<td><strong>Engineering</strong></td>
<td>Customized outputs Design from scratch</td>
<td>Standardized outputs Incremental design Simplify design for manufacturing</td>
</tr>
<tr>
<td><strong>Workforce</strong></td>
<td>Narrow skills Specialized Individualized Competitive attitude Change by edict Easy pace Status: symbols, pay, privilege</td>
<td>Broad skills Flexible Work teams Cooperative attitudes Change by consensus Hard pace No status differentials</td>
</tr>
<tr>
<td><strong>Suppliers</strong></td>
<td>Many Competitive Deliveries to central receiving area</td>
<td>Few or single source Cooperative, network Deliveries directly to assembly line.</td>
</tr>
</tbody>
</table>
### Independent forecasts | Shared forecasts
---|---
**Quality**<br>Via inspection<br>Critical points<br>Acceptance sampling | At the source<br>Continuous<br>Statistical process control
**Maintenance**<br>Corrective<br>By experts<br>Run equipment fast<br>Run one shift | Preventative<br>By operator<br>Run equipment slowly<br>Run 24 hours

Source: Adopted from Meredith and Shafer (1999:304)

According to Martinich (1997:752), the JIT system we see today, however, is the result of over 40 years of work by many people and many companies to improve the design and operation production systems. People also need to recognize that many features of JIT cannot be applied effectively to all production systems. In some situations they are simply not suitable.

### 2.2.9 Development of Reliable Methods

The development of reliable methods and their application in all organisational processes could be achieved if everything is treated as a process to be understood, standardized, controlled and then continually improved. The best known method should be followed as standard procedure until a better method is found. Operations should be mistake-proofed to guard against the likelihood of human error. Forms and check-sheets should be used to clarify procedures and guide excellent performance. Everyone in the organisation systematically searches for better methods (Goshi, 2003:45).

Flow diagrams and process charts are perhaps the most versatile techniques available for analyzing work methods. They are usually used together to eliminate or reduce delays, eliminate or combine tasks, or reduce travel time or distance (Gaither, 1996:618). The table below outlines the procedures of methods analysis:

**Table 3:** Procedures of Methods Analysis
1. Make an initial investigation of the operation under consideration.

2. Decide what level of analysis is appropriate.

3. Talk with workers, supervisors and others who are familiar with the operation. Get their suggestions for better ways to do the work.

4. Study the present method. Use process charts, time study, and other appropriate techniques of analysis. Thoroughly describe and evaluate the present method.

5. Apply the questioning attitude, the principles of motion economy, and the suggestions of others. Describe a new proposed method by process charts and other appropriate techniques of analysis.

6. Use time study if necessary. Compare new and proposed methods. Obtain supervisor’s approval to proceed.

7. Modify the proposed method as required after reviewing the details with workers and supervisors.

8. Train one or more workers to perform the proposed method on a trial basis. Evaluate the proposed method. Modify method as required.

9. Train workers and install the proposed method.

10. Check periodically to ensure that the expected savings are realized.

Source: Gaither (1996:619)

2.2.10 Healthy Work Environment

Goshi (2003:46) emphasizes that management must create a work environment conducive to producing high quality goods and services. This begins with the psychological climate within the organisation which will ensure that employees feel secure, optimistic about the organisation’s chances of achieving perfection. Management must create a threat-free culture with open information exchange, a focus on attacking methods not people, support for using mistakes as learning opportunities, and a commitment to use data for improvement, all in the context of reasonable employment security.

In addition to the psychological climate, Goshi (2003:46) believes that the physical environment must also be extraordinary. If basic housekeeping cannot be controlled, there is no way an organisation will be able to implement more complex innovative practices of total quality or to experiment on improvements. Excellent daily housekeeping ensures the following:
• Prevents waste and assures safety
• Improves material flow
• Prevents breakdown of equipment and improves quality
• Maintains standardisation which reduces costs
• Improves morale and makes problems that occur very visible
• The orderly and extremely clean work environment sends daily messages about quality and efficiency.

2.2.11 Continuous Improvement

The core issue for the survival and well-being of every organisation is its ability to fill and maintain a niche in its environment. Central to this is the organisation’s ability to adapt and respond to changing needs, and the ability to continually improve for the benefit of customers, shareholders, community and the society. Top management needs to recognize that everyone has a brain to contribute to improvement, and therefore it must involve everyone in the organisation in activities contributing to continuous improvement (Goshi, 2003:47).

To enable everyone in the organisation to contribute to continuous improvement, the researcher believes that people should be empowered. Naylor (1996:416) contends that empowerment can only occur when people are well trained, given access to relevant information, know and use the best techniques, are involved in the decisions and receive appropriate rewards. Most quality problems relate to materials, designs, specifications and processes and have little to do with poor employee performance. Yet these same employees are usually well aware of the shortcomings of the production system and can be valuable in finding solutions.

Goshi (2003:47) states that continuous improvement fundamentally results from many small steps. Therefore, small improvements must be encouraged, not just large “breakthrough” steps because:

• small improvements are more attainable
• momentum and involvement are maintained
• ownership at all levels is encouraged
• the “big brain” focus is avoided where special consultants are needed.

Goshi (2003:47) stressed that management must take responsibility for problems at lower levels and they must ensure that:

• goals and expectations are clearly understood
• methods and tools adequate to do the task are agreed to and provided
• responsible individuals have adequate skills and training.

2.2.11.1 Benchmarking for Continuous Improvement

Another very popular, although less “day-to-day” method for senior managers to drive organisational improvement is to establish operational benchmarks. According to Bendell, Boulter and Kelly (1993:15) TQM and benchmarking go hand in hand. By highlighting how key operational elements ‘shape up’ competitors, key areas for focused improvement can be identified. Originally, the term ‘benchmark’ derives from land surveying where a mark, cut in the rock, would act as a reference point (Slack and Lewis, 2002:366).

Salvatore (2001:66) states that TQM refers to constantly improving the quality of products and the firm’s processes so as to consistently deliver increasing value to customers. It involves worker teams and benchmarking.

Slack and Lewis (2002:366) state further that there are many different types of benchmarking, which are not necessarily mutually exclusive, some of which are listed below:

• *Non-competitive benchmarking* is benchmarking against external organisations which do not compete directly in the same markets.
• *Competitive benchmarking* is a comparison directly between competitors in the same, or similar, markets.
Performance benchmarking is a comparison between the levels of achieved performance in different operations. For example, an operation might compare its own performance in terms of some or all of the performance objectives namely quality, speed, dependability, flexibility and cost against other organisations’ performance in the same dimensions.

Practice benchmarking is a comparison between an organisation’s operations practices, or way of doing things, and those adopted by another operation.

2.1.11.2 Benchmarking Policies and Procedures

Concerning the benchmarking policies and procedures, Czarnecki (1999:167) states that each organisation needs to decide for itself how it is going to deal with the benchmarking issue. Top companies already have a coordinator to oversee efforts. Smaller organisations want to benchmark but may have to turn away opportunities just to keep up with the daily workload. From the chief executive perspective, there should be a set of rules for making contact with the outside organisations. Many organisations have elected to develop a corporate policy on the issue and disseminate it throughout the organisation. A good corporate policy might include:

- The company’s approach to benchmarking
- How information will be shared internally
- How to evaluate incoming requests
- Legal issues in benchmarking.

In addition to benchmarking and other issues discussed in this study, total quality management depends on a number of factors to succeed. Salvatore (2001:67); Leonard & McAdam (2004) provides five rules that determine the success of a TQM programme:
1. The corporate executive officer (CEO) must strongly and visibly support it with words and actions.
2. The TQM programme must clearly show how it benefits customers and creates value for the firm.
3. The TQM programme must have clear strategic goals.
4. The TQM programme must provide quick financial returns and compensation. People need to see early and concrete results to continue to support the programme.
5. The TQM programme should be tailored to a particular firm; that is one firm cannot simply copy another firm’s TQM programme.

2.2.13 Factors Contributing to TQM Success

Roufaieel and Meissner (1995) argue that the following are the keys to a successful TQM programme:

- Identifying business objectives, and measurement techniques in the long run, to increase profit, customer satisfaction, cost reduction, market share, global competitiveness, community support, social responsibility, etc.

- Maintaining compatibility. The TQM design must be consistent with the goal to be achieved.

- Designing for flexibility through adopting a multifunctional principle. Design the organisation so that it can achieve its objectives in more than one way.

- Focusing on causes of process, product and service variation and use of statistical tools to identify and reduce variation.

- Considering the organisational design as an interactive process. The closure of options opens new ones. Design is an ongoing process which requires constant work and attention.

- Designing the system of social support to reinforce the behaviour that the organisation’s structure is designed to elicit. This principle involves a
simultaneous commitment to providing opportunities for workers to take personal responsibility for their work.

- Utilizing and supporting a self-managing team. This involves skill variety, task identity, task significance, substantial latitude and trustworthy information.

- Defining minimal critical specifications for the processes. What is critical should be identified, and only that should be specified. Variances that cannot be eliminated should be dealt with (by quality circles) as near to their point of origin as possible (activity-based costing).

- Employing boundary location role, with shared access to experience or knowledge within the same departmental boundaries.

- Developing an information system to provide relevant data to the organisational unit that will take action on the basis of the information. The traditional flow (upward, downward, or horizontal) of information is ineffective in the relevant decision-making process.

- Integrating a multidisciplinary approach. It is a combination of a quality control programme, activity-based cost management and an accounting or finance project, covering all factors affecting and reflected in the overall effectiveness of the organisation.

- Involving users and forming alliances with suppliers and customers.

- Focusing on a pilot study to gain a quick sense of success.

- Emphasizing the importance of a clean environment and of commitment to community participation.

- Considering the human factor in an organisation as an asset to be maintained and reinvested.

2.3 SECTION HIGHLIGHTS
This section highlighted good organisational practices which include strong leadership that is in harmony with the mission statement. It calls upon effective operating procedures, staff support and training which is important for successful TQM programme.

Quality principles such as customer focus, continuous improvement, employee empowerment, benchmarking, just-in-time and tools of TQM should be implemented to achieve TQM goals. On the other hand, since employees play a vital role in TQM, their attitudes should be influenced through empowerment and organisational commitment. All these result in customer satisfaction, winning orders, repeat customers and an effective organisation with a competitive advantage.

2.4 LITERATURE REVIEW OF TECHNOLOGY MANAGEMENT

Manufacturing, like other industries, is rising to the challenges imposed by aggressive consumer demands and the need for cost-effective processing which delivers quality in the fastest possible time. Fierce competition means that keeping abreast of new developments and applications in technology is essential if companies are to meet market demands profitably and keep ahead of their competitors. This section focuses on technology management in terms of strategy as a source of competitive advantage.

2.4.1 Technology: the Source of Competitive Advantage

Technology in some form or other is a means of building competitive advantage in a wide variety of operations once largely untouched by technology. Whatever the specific strategic intent of the firm or the exact functionality of the technology, the significant amounts of invested capital in such systems must reflect a managerial belief that they offer a response to both competitive pressures and customer demand for high-quality products and services. For many operations,
technology can, and indeed should, contribute to the long-term performance of companies (Slack et al, 2001:720).

According to Slack et al (2001:721) technology gives a competitive advantage to an organisation as a result of either being better than its competitors or being different from its competitors in what it offers. So, for example:

- technology can increase automation, which in conjunction with centralization can produce significant economies of scale. It is thus helping the company to be better than its competitors.

- technology may help an organisation to improve its decision-making performance. For example, one department store has put in place a video link infrastructure that permits all of its 1500 store managers to be actively involved in the central purchasing decision. Technology is again helping the company to be better than its competitors.

Harrison and Samson (2002:74) also agree that new technology can be considered as the single most important differentiating factor that enables firms in today's fast-changing technological environment to achieve competitive advantage within their chosen market industry. In an era in which most firms have comparable efficiencies in other areas of corporate management, such as human resources, process and product quality, raw materials and cost management, new technology or innovation or innovations can play a decisive role in bestowing firms with suitable competitive advantage. Technological innovations enable firms to produce new products or deliver new services, adopt new processes and management systems, or continue with their old products, services, processes and systems at much lower costs.

2.4.2 Technology Strategy

Technology strategy is the revealed pattern in the technology choices of firms. The choices involve the commitment of resources for the appropriation,
maintenance, deployment and abandonment of technological capabilities. These technology choices determine the character and the extent of the firms’ principal technical capabilities and the set of available product and process platforms (Narayanan, 2001:250).

Narayanan (2001:250) highlights four important points that are captured in this definition:

1. Technology strategy focuses on the kinds of technologies that a firm selects for acquisition, development of resources, deployment or divestment. For example, Research and Development (R&D) strategies, which involve investment in further development of selected technologies, are embraced by this definition. Also, the technologies that are embedded in products, as well as those that constitute the value chain of a firm, reflect the firm’s technology strategy.

2. Commitments surrounding technology selection define technology strategies. The term revealed pattern relate to a pattern that is not merely intended but accomplished. Execution implies commitment of resources; commitment refers to the decisions to invest or not invest. For example, firms may choose to invest in technologies to be first in the market with a product, or they may decide to adopt a “me-too” strategy. Alternatively, they may invest in a major test facility or a flexible factory.

3. Technology strategies are not confined to high technology industries. Even a capacity-driven industry or a customer-driven industry requires a technology strategy. Such strategies may be implicit and may not reflect the conscious decisions by executives, but nonetheless they determine the choice of technical capabilities and available product and process platforms of the firms.

4. Finally, technology strategies embrace both the hardware and software elements of technology. Although the term technology is often
associated with hardware elements, the preceding definition of technology strategy includes both software and hardware elements.

According to Khalil (2000:193), strategic management is a process consisting of three important and interrelated components, namely:

1. Strategic planning which include strategic vision setting and strategy formulation. This component of strategic management concentrates on “strategizing”.

2. Strategic implementations which include detailing actions that need to be followed and designating the functional units responsible for implementing operational actions and strategic actions and strategic projects. This component of strategic management deals with tactics and systematic planning.

3. Strategic evaluation which involves performance measures, feedback mechanisms, continuous improvement, and the organisational learning process. This component of strategic management permits refinement of the strategy and corrections to the plans.

The purpose of the business strategy is to gain a sustainable economic advantage while the purpose of technology strategy is to gain a competitive advantage. The two strategies must be closely intertwined and highly integrated. This requires extensive forethought about the firm’s distinctive technologies, the products and services it can provide, the potential customers and where the organisation wants to be in the future (Khalil, 2000:207).

Technology is a factor that affects most aspects of the organisation’s strategy. Technology is essential in the first stage of strategic segmentation, which aims to identify the relevant business units on which strategy will be based. It affects the value of the organisation as well as the forces that structure competition and one of the main sources of competitive advantage. The main tool to link the selection
The integration of technologies with the formulation of strategy is the technology audit (www.technology4sme.com).

Top management is aware of the increasing strategic importance of technology and of the difficulty of preparing the organisation to compete in an environment where technology is a prevailing factor. There is a strong discrepancy between the perceived importance of technology and the attention it is given by top managers. Managers view technology as essential but difficult to manage (www.technology4sme.com).

Technology decisions are delegated to lower level executives associated with the research and development and engineering functions. These conditions make it difficult to manage technology strategically. Top managers are not involved in technology decisions, while technology specialists do not participate in the strategy-making process. The implication is that technology is seen as an external factor over which the organisation has little control. The management of technology is thus limited to the anticipation of technological changes and its impact on the organisation’s businesses, whether these changes are produced by the organisation itself or originate in its external environment. Methods designed to guide the organisation into the future of a given technology have been designed to answer such a question.

Organisations have only recently decided to integrate technology in the overall strategy-making process, leading to the development of methods aimed at improving the strategic management of technology. Managing technology strategically implies going beyond the anticipation of forecasting and scenario methods with the internal and proactive perspective of management of innovation. The strategic management of technology is the determination of how technology can be used to create competitive advantage (www.technology4sme.com).

This requires taking into account the organisation’s technological environment as well as its own technical capabilities and integrating decisions regarding
Before selecting technologies to develop and formulate technological strategies, an organisation must inventory the technologies it possesses and assess the strengths and weaknesses these entail. This process requires identifying all the technologies of the organisation and evaluating relative technological capabilities; a competitive list of technologies can then be drawn up by critically analyzing such capabilities in a strategic perspective. Taking the lifecycle of technologies into account puts the technological audit in a dynamic perspective, leading to the extension of the organisation’s technology portfolio (www.technology4sme.com).

2.4.2.1 Developing a Technology Strategy

When developing new strategies for technology, the focus must be on one technology at a time to eliminate any possibility of confusion. Technology and operational processes must be developed in conjunction with each other, to help reduce lead-time and therefore increase the productivity of the organisation. The technology development process must be analysed by comparing the technology development with those of the competition and the cost of the development with the time that it will take. The organisation needs to consider the possibility of acquiring new technology through acquisitions, joint ventures, or the purchase of licenses to use technology (www.1000ventures.com).

The speed to imitate new developed technology by the competition must be estimated. The development of new technology becomes more attractive when it can be exploited in a global arena, adding new markets to the ’s market portfolio. The size of the organisation will determine the degree to which the above tasks will be used to gain or maintain an advantage from a technology edge. Larger s can fail to see the advantages of developing technology when operating in a mature industry. Technology developments might be prescriptive in the overall approach, in the sense that clear objectives need to exist (www.1000ventures.com).
The different technologies implemented in a given organisation do not all have the same competitive impact. The mastery of some of the technologies is a condition for success in business, owing to its implication for cost and differentiation. The contribution of other technologies is less important, either because of their impact on differentiation or because the cost of the product is low, or because it is easily accessed by all the competitors in the industry (www.1000ventures.com).

The competitive impact of technologies is related to its cost and the performance of the products into which it is integrated. The competitive impact of technologies is also related to how easily the suppliers in the industry can benefit from the technologies, either by internalising the technology, or by calling upon external suppliers (www.1000ventures.com).

The size of the organisation will determine the degree to which the above tasks will be used to gain or maintain an advantage from a technology edge. Larger organisations can fail to see the advantages of developing technology when operating in a mature industry. Technology developments might be prescriptive in the overall approach, in the sense that clear objectives need to exist. Technology strategy is the task of building, maintaining and exploiting an organisation’s technological assets. Road mapping leads to portfolio development, which provides for division-level project evaluation, as well as -wide technology assessments (www.1000ventures.com).

2.4.2.2 Technology Strategy and Manager

A key responsibility of operations managers, if they are to carry out ‘their impresario role’ within the, is to have a grasp of the technical nature of process technologies. This does not necessarily mean that operations managers need to be experts in engineering, computing, biology, electronics, or whatever is the core science is on which the technology is based. It does mean, however, that
they need to know enough about the principles behind the technology to be comfortable in evaluating some technical information, capable of dealing with experts in the technology and confident enough to ask questions (Slack & Lewis, 2002:251).

Supporting this sentiment, Burgelman, Maidique and Wheelwright (1996:4) also stress that managers do not need to have backgrounds in science or engineering, but they do need to invest significant effort in learning to understand the technologies important to their business. They must also identify reliable and trustworthy sources of technical advice. Most importantly they must be able to frame key strategic questions in relation to technology.

Three significant managerial implications noted by Narayanan (2001:56) from the technological environment are that:

- technological environment is dynamic and needs to be tracked on an ongoing basis. From an open-systems perspective, management of organisations, including technology, should be predicted on an environment facing organisations.

- tracking technological changes in the environment requires managers to penetrate the organisations and networks that conduct and facilitate technology development.

- the three trends, globalization, time compression and technology integration require managers to adopt a global perspective, enhance organisational speed of response, and work with other organisations to adapt to technological changes as well as to fully exploit the potential of new technology.

Regarding the role of the manager, Narayanan (2001:184) emphasises that recent trends indicate that the process technology changes necessitate a more highly skilled workforce and different forms of managerial practices.
Organisational structures have responded to those changes by taking advantage of increased worker skills to enhance the productivity of the organisation as a whole. Further, the managerial style has shifted from one of command and control to a more participative style in team-based structures common in lean production. Managers tend to be less involved in running and controlling day-to-day operations and instead act as facilitators, insuring that the teams have necessary resources. Additionally in mass customization, the role includes a conceptual dimension, both interfacing with external entities in the value constellation on a frequent basis and anticipating resource requirements and importing newer technologies for speed and customer responsiveness.

2.4.2.3 Technology Strategy and Technology Leadership

In 1999 a study of firms classified as technology leaders in four different industries namely automotive; chemicals and plastics; computers and electronics and telecommunications equipment, revealed that these firms were not only more profitable than their competitors but also performed better in terms of revenue growth. These firms were able to either price their innovative products higher or produce them at a much lower cost or, in some cases, do both. It was also found that these technology leaders excelled in the four key areas of technology management: technology strategy, technology portfolio management, technology planning, and technology development and transfer processes (Shadowski & Roth, 1999).

Shadowski and Roth (1999) highlight further that among these firms, technology strategy played an important role in enabling them to achieve their leadership positions as well as develop substantial and sustainable advantages in the industry that were difficult to replicate. For example, firms such as Intel and Microsoft developed explicit technology strategies in order to gain appropriate contexts for making coherent technology investment decisions and allocating resources to projects that made the most strategic sense.

2.4.3 Strategic Identification of Core Competencies
A core competence is an activity or a process that gives advantage because it fundamentally underpins the value in the product, is performed better than competitors and is difficult for competitors to imitate (Johnson & Scholes, 2002:516).

At least three tests can be applied to identify core competencies in a company. Firstly, a core competence provides potential access to a wide variety of markets. Secondly, a core competence should make a contribution to the perceived customer benefits of the end product. Finally, a core competence should be difficult for competitors to imitate (Burgelman et al, 1996:67).

In the short run, a company’s competitiveness derives from price or performance attributes of the current products while in the long run, competitiveness derives from an ability to build, at lower cost and more speedily than competitors, the core competencies that spawn unanticipated products. The real sources of advantage are to be found in management’s ability to consolidate corporate-wide technologies and production skills into competencies that empower individual businesses to adapt quickly to changing opportunities (Burgelman et al, 1996:66).

2.4.4 Strategic New Technology Project Selection Criteria

The more radical a proposal, the more likely it is that it will require the application of knowledge and skills new to the company. Their acquisition involves more than the allocation of financial resources. It takes time and may necessitate preliminary applied research to validate the feasibility of the proposal. A sound technological base must be established and there must be a reasonably high level of confidence before a more detailed proposal is submitted. With regard to Production capability, a product incorporating new technology, for example new materials, might be incompatible with current production equipment. As a consequence a substantial investment in capital equipment together with the recruitment and training of staff may be needed.
The achievement of the corporate plan through the contribution of individual innovations depends in the final analysis upon the appropriate selection of projects. It is therefore vital that strategic considerations are reflected explicitly in the project selection procedure (Twiss, 1992:131). Annexure D has a list of decision considerations and possible alternatives for employment in adoption of the new technology. This table can be very useful.

2.4.4.1 Funding and Location of Technology Development

An important debate in many larger organisations concerns who within the organisation should be driving the technology development and who should be funding it. Decisions on this could be important in enabling strategic success through technology (Johnson & Scholes, 2002:519).

**Figure 4: Funding and Location of Research & Development**

<table>
<thead>
<tr>
<th>LOCATED AT</th>
<th>Corporate</th>
<th>Divisional</th>
</tr>
</thead>
<tbody>
<tr>
<td>FUNDED BY</td>
<td>Corporate</td>
<td>Divisional</td>
</tr>
<tr>
<td>Corporate</td>
<td>Assessing new technologies</td>
<td>Commercialising new technologies</td>
</tr>
<tr>
<td>Divisional</td>
<td>Exploratory development of new technologies</td>
<td>Incremental product or process improvements</td>
</tr>
</tbody>
</table>

Source: Adapted from Tidd, Bessant and Pavitt (2001).

Figure 4 show that different arrangements are likely to be suitable for different aspects of technology development. For example, at one extreme, new technologies are best assessed and funded corporately whilst at the other, incremental product and process improvements are best undertaken and funded locally. Between these extremes, the commercialization of new technologies is often best done locally but funded corporately since others will learn and benefit from first moves. Experimentation with new technologies may remain corporate
but funded by divisions who see commercial potential in the arena.

These same principles might lead to conclusions that some technology development activities might be outsourced where the technological expertise is inadequate in both divisions and the corporate centre but the particular technology development is crucial to securing current and future business.

2.4.4.2 New Tools for Optimizing Strategic Decisions

Since resources are scarce and time is limited, Khalil (2000:56); Garrison & Noreen (2000:836) and Harvey, Mclaney and Atrill (2001:408), emphasize that optimal allocation of financial, material and human resources is critical. Areas of interest include:

- Improving methodologies of technology forecasting and integrating technology forecasting within the planning and decision-making processes. Because of technological discontinuities, adaptive models providing for the continuous evaluation of prior assumptions are required in lieu of methods based on the extrapolation of past data.

- Developing a new and more representative set of criteria to optimise the performance of high-technology firms. Classical optimisation methods rely on performance measures such as return on investment (ROI), return on sales (ROS) and price / earnings ratio (PER). In recent years, corporate managers have become better sensitised to the limitations of these measures and management should be more cautious in using strict, tangible, financial justification models in evaluating technological projects. Both tangible and intangible criteria are needed for the optimisation of decisions.

- Determining the optimum mix of high-technology versus traditional products in a large business. New tools are needed to assist managers in making correct resource allocation decisions.
Regarding the use of ROI, Garrison and Noreen (2000:572) warn that although ROI is widely used in evaluating performance, it is not a perfect tool. The method is subject to the following criticisms:

- Just telling managers to increase ROI may not be enough. Managers may not know how to increase ROI. They may do that in a way that is inconsistent with the company’s strategy, or they may take actions such as cutting back on research and development that increase ROI in the short run but harm the company in the long run.

- A manager who takes over a business segment typically inherits many committed costs over which he or she has no control. These costs can be used to assess the business performance as an investment. They cannot be fairly used to fairly assess the performance of a manager.

- A manager who is evaluated based on ROI may reject profitable investment opportunities.

2.4.5 Technology Strategy and the Value Chain

Narayanan (2001:124) contends that technological changes enable firms to reconfigure their value chains, thus influencing the cost and speed of doing business. For example, continuous improvement practices, often the cornerstone of TQM, enable a firm to incrementally capture the productivity that is embedded in its existing value chain. Alternatively, a firm may substitute a newer technology for an existing one to enhance its speed of operations. For example, optical scanners used in retail outlets enable faster and more accurate recording of transactions than manually operated checkout counters. On the other hand, information technology provides links across the full supply chain, cutting manual redundancies and other non-value-adding functions (Poirier & Reiter, 1996:20).

2.4.5.1 Leveraging Technology in the Value Chain
The value chain model identifies specific critical leverage points where a firm can use information technology most effectively to enhance its competitive position. This model views the company as a series or “chain” of basic activities that add a margin of value to a firm’s products or services. These activities can be categorised as primary activities or support activities (Laudon & Laudon, 2002:86).

Laudon and Laudon (2002:86) explain these further by highlighting that primary activities are most directly related to the production and distribution of the firm’s products and services that create value for the customer. Primary activities include:

- inbound logistics
- operations
- outbound logistics
- sales and marketing
- service.

Inbound logistics include receiving and storing materials for distribution to production. Operations transform inputs into finished products. Outbound logistics entail storing and distributing finished products. Marketing and sales include promoting and selling the firm’s products. The service activity includes maintenance and repair of the firm’s goods and services. Support services make the delivery of the primary activities possible and consist of organisational infrastructure (administration and management), human resources (employee recruiting, hiring, and training), technology (improving products and production process) and procurement (purchasing input).

Discussing the company’s supply chain, Kuglin (1998:11) argues that although technology alone cannot transform the company’s supply chain, experts agree on two things: firstly, the winners are those who use technology and core competencies effectively to satisfy the ever-changing demands of customers and secondly, there are more losers than winners.

2.4.6 Technology Strategy and Culture
Narayanan (2001:438) identifies five cultural traits of innovative organisation:

1. *Enthusiasm for Knowledge*. Perhaps the most important characteristic is the respect and encouragement for accumulation of knowledge as a legitimate undertaking. Both managers and people who are involved in the organisation are curious: They are information seekers. They believe that perhaps the fundamentally most important skill is the ability to learn.

2. *Drive to stay ahead in knowledge*. This means staying knowledgeable about the latest developments in technology. This is not necessarily being first to commercialise technology. However, it reflects a commitment to stay ahead of capabilities. This drive to access the latest knowledge keeps people listening, another absolutely critical skill.

3. *Tight coupling of complementary skill sets*. This refers to simultaneous attention to both developing deep reservoirs of knowledge and skill in special capabilities and having a plan to diminish the boundaries between disciplines. Tight coupling requires a respect for a knowledge basis other than one’s own and enables a flow of knowledge from research organisations into product development. The researchers reside inside a firm’s laboratories or are outside entities such as thinktanks or national laboratories.

4. *Alteration in activities*. This reflects the comprehension of the fact that activities are never completely perfected. There is a continual re-examination of assumptions through experimentation and further divisions. There is a “try it and learn it” attitude to counteract the arrogance of excellence.

5. *Higher order teaming*. There is continual self-examination to discover insights within one activity that may be transferred to other activities within
2.4.7 Strategic Recruitment of High Technology Personnel

One of the most important policies that managers of a high technology company must establish concerns the recruitment of new personnel. In view of the critical role the human factor plays in high technology, management should strive to get the best people for every job in the company. Recruiting the best professionals is not a trivial job. It becomes particularly challenging in periods of strong competition between companies for talented and/or experienced people in a given professional field. Because the most critical capability in high technology industries is knowledge, and because knowledge resides in people, managers cannot expect to achieve a long-term competitive advantage if they compromise the quality of people recruited (Levy, 1998:27).

Thinking about the reputation of the organisation for innovation in relation to hiring and retention of high-tech personnel, Trott (1998:47) states that the reputation of a company for innovation takes many years to develop. It is also linked to overall performance. Figure 5 depicts a cycle of innovation which serves to elaborate further on this.

**Figure 5: Propagating a virtuous cycle of innovation**
As the figure 5 shows, the innovation cycle affects the company’s reputation as follows:

- **Attraction of creative people**: Creative people will be attracted to those companies that themselves are viewed as creative. In much the same way as undergraduates apply for positions of employment with those companies viewed as successful, top scientists will seek employment from those companies which have a reputation for innovation and scientific excellence.

- **Organisation encourages creativity**: Most organisations pay lip service to creativity without putting in place any structures or plans to encourage innovation. It has to be supported with actions and resources. The organisation has to provide people with time to be creative. In addition, the organisation should try to build an environment that tolerates errors and mistakes. This will encourage people to try new ideas and put forward suggestions.

- **Development of innovative products**: This means developing new products that are genuine improvements compared to products currently available.

- **A willingness to accept new ideas**: Many organisations suffer from an inability to implement changes and new ideas, even after rewarding the
people involved in developing the new idea. Once a product idea has been accepted, it is important that it is carried through to completion.

- **Increased motivation and reduced frustration:** If individuals within the organisation can see their ideas and efforts contributing to the performance of the business, they will be encouraged still further. On the other hand, if seemingly good ideas are constantly overlooked, this will lead to increased frustration.

- **High morale and retention of creative people:** All of the proceeding activities will help contribute to increased morale within the organisation. A rewarding and enjoyable working environment will help to retain creative people. This, in turn, should reinforce the company's innovative capabilities.

2.4.8 Strategic Collection of Intelligence

Technology intelligence is technology-related information that is useful and utilized by firms during strategic decision-making (Narayanan, 2001:201). Having reliable and timely intelligence is as important for a high technology company as for any army. Companies can hardly expect to win the highly competitive war for high technology markets consistently by guessing in the dark. Therefore, successful high technology companies have to devote management attention and adequate resources to a competent and efficient marketing intelligence service (Levy, 1998:160).

New technology might require years to develop, so effective technology intelligence frequently focuses on very early indicators of change. However, these early signals of technology change are often very weak and difficult to relate to potential consequences, such as product launches, that may occur many years later. The first signs often emerge in scientific and technical discussions, “grey literature” or statements that resources are being directed towards certain areas of science and technology. These signals might be weak;
but gathering, assessing and communicating this information are crucial objectives of technology intelligence programmes, especially those that uncover and anticipate pre-commercial developments (Narayanan, 2001:201).

Different methods are available to companies in organising their intelligence gathering. Usually, in the marketing division there are information centres or organisations that scan and search publications. The name of this needed source for information gathering does not matter. It is essential that the task of such groups is to collect, organise, and distribute anything that is relevant to the company's business to the right people in a timely manner. In today's world of information, a small staff of competent people familiar with computerised database searches can provide a bonanza of highly valuable market intelligence (Levy, 1998:160).

As with gathering technological information, the main difficulty in making the most practical use of market intelligence is not the availability of information but the ability of users to formulate clearly and effectively what they need. Even today management must often impose discipline and coerce the marketing people to make effective use of information that is readily available in open databases. The new generation of marketing people, however, are expected to be sufficiently computer literate to perform such searches themselves, enjoying the full benefits of immediate access to essential information (Levy, 1998:160).

According to Narayanan (2001:202), technology intelligence serves three major purposes:

1. The intelligence provides an understanding of current and potential changes taking place in the environment. “Current” has been emphasized to highlight that changes taking place currently are an important guide to anticipating the future, and “potential” to underscore the idea that strategic decisions should cover a time frame from short run to long run.
2. Technology intelligence provides important information for strategic decision-makers. The technological information is often intrinsically interesting, but the primary goal is the generation of information, not for its own sake, but rather information that is of use in determining and managing a firm’s strategies.

3. Finally, the intelligence facilitates and fosters strategic thinking in organisations. The intelligence is typically a rich source of ideas and understanding of the context in which a firm operates. It should also challenge the current technology strategies by bringing fresh points of view into the organisation.

The value of technology intelligence lies not merely in the information but in the process of generating it. When conducted properly, the process of generating technological intelligence leads to enhanced capacity and commitment to understanding, anticipating, and responding to external changes on the part of a firm’s key strategic managers. Responsiveness is achieved by inducing managers to think beyond their immediate circumstances, often forcing them to change major courses of action (Narayanan, 2001:203).

2.4.8.1 Learning Competitors’ Strategies

In addition to collecting information on competitors’ products and closely following their moves in local and foreign markets, companies also need to learn and thoroughly understand the strategy of their market adversaries. Firstly, management must analyze the competitors’ strong and weak points, much as they did for their own company. Secondly, managers should learn from the long-term behaviour of the competitor, analyze and understand the trends. Where the competitor was, where it is, and where it is going are among the pertinent questions that must be asked and answered as accurately as possible (Levy, 1998:161).
2.4.9 Technology Strategy: Superior Performance Characteristics

Best practice, in respect to technology strategy and management processes, is reflected in the following Harrison and Samson (2002:30-31) list of characteristics:

- Effective mechanisms are in place to integrate technology and business strategy.
- Effective mechanisms are in place to coordinate the activities of technology-related s and work groups.
- All affected functions are involved in the strategy formulation process.
- The interconnections between the key decision elements and the need to manage these elements as collective entity are understood.
- The appropriate skill mix is available to develop and implement strategies effectively. This means that the process is not dominated by technocrats and adequate levels of technical competence are found at the executive management level.
- Clear responsibility for technology management is allocated.
- Organisational structures are aligned to support the business technology strategies identified.
- Effective mechanisms are in place to commercialise new technology.
- There is substantive characterisation of core technologies and posture is defined with respect to each.
- A long-term understanding exists regarding how technology contributes to shaping the business.
- Metrics are tied to strategic objectives and are recognised and accepted both within the technical function and throughout the business.
- Clear criteria exist for making versus buy versus licencing out decisions.
- Effective dual ladder (technical and generalist management) career progression systems exist.
- A mix of individual and team rewards and incentives for entrepreneurial behaviour exists.
There are clear links between project selection criteria and business and product line strategy.

Specialists are multi-skilled and there is an awareness of and respect for other functions, developed by systematic cross-functional assignments and job rotation.

There is regular assessment of technical capabilities and technology management processes via benchmarking of products and processes.

There is a proactive long-term management of technology and technical functions.

Opportunities and threats are actively explored, using a well-developed network of customers, suppliers, universities, government agencies and rivals.

2.4.9.1 Critical Factors for Success in Technology Management

Pinto and Slevin (1989) stated that in the highly competitive business environment at the turning of the century, management of high technology poses a particular challenge. To manage a high-technology, innovative organisation successfully, one needs not only master the basic managerial knowledge and skills necessary to run any type of organisation but also to acquire and thoroughly understand a body of specific knowledge about factors that play a key role in this industry. Levy (1998:13) identified some critical success factors as:

- **Innovation** which he refers to as the main feature of high technology.

- **The human factor.** Extremely important in the management of any organisation, this factor becomes critical in high technology for two reasons. Firstly, high technology companies, unlike the more traditional industries, are based on innovation. Innovation depends entirely on individuals. Secondly, in high technology organisations, the proportion of engineers, scientists, mathematicians and other professionals is much larger than in low technology industries.
• The organisation factor. Most companies need to change and adapt their organisations over time, but the pace in the high technology sector requires a much faster and more dynamic matching of the organisational structure to the changing needs of a company as it grows from start-up to a mature, diversified firm. In addition, changes in technology and production processes also require organisational change and restructuring.

• Management competence factor. A certain degree of professionalism is required to manage any type of organisation successfully. In the high-tech era, however, managers at all levels have to be better educated and more competent to perform their task than other managers because of the extreme complexity of balancing the factors just discussed.

• Know-how factor. This is a prerequisite for business success in the high technology sector and needs to be complemented by and distinguished from know-why factor. Much as one differentiates between efficiency and effectiveness, one should distinguish between know-how and know-why. Know-how is important to develop an innovative product. Know-why, however, implies insight and understanding of future trends and is essential for exploiting the market success of the product.

Nystrom (1990:82) mentioned three main determinants of success as being the organisational flexibility, technological orientation and technology application:

• Companies need organisational flexibility and openness both internally and in relation to the outside environment, to make possible radical change. Burgelman, Maidique and Wheelwright (2001:25) refer to this as adaptability.

• Technology orientation: In the search of new ideas and development of new technology, internally oriented companies emphasize their own competence and their own expertise. Externally oriented companies, on
the other hand, rely to a large extent on knowledge carriers and generators in the outside environment (Nystrom, 1990:87) and (Burgelman et al, 2001:25).

- Technology application refers to the way in which technologies are applied to the critical technical problems in developing new products and processes (Nystrom, 1990:92).

### 2.5 SECTION HIGHLIGHTS

Technology strategy can play a vital role in the competitiveness of a company as it involves a direct link of processes to corporate strategy through identifying and selection of necessary technologies. Recruiting of high-tech people and collection of technology intelligence is very critical technological strategy for any organisation’s competitive advantage.

### 2.6. LITERATURE REVIEW OF TRAINING AND DEVELOPMENT

The previous sections of this research which covered TQM and Technology Management both mentioned the need for training of employees in those fields respectively. Training refers to improving an employee’s skills to the point where he or she can do the current job more effectively (Hellriegel et al, 2001:250). This section covers the training aspects to enhance both TQM and Technology Management programmes and hence the competitiveness of the company.

#### 2.6.1 A Model for Systematic Training.

If any training and development is to succeed, some basic requirements need to be defined. Amongst others according to McNamara (2004), these include the following considerations:
• **Budget necessary funds for resources learner will need:**
  Funds may be required for course tuition and materials, self-study materials, videos, training fees, labour to attend courses, etc.

• **Supervisor and learner should set aside regular times for meetings:**
  Meetings should be scheduled beforehand as that makes it much more likely that regular, ongoing feedback will occur between the supervisor and learner.

One of the main reasons why training fails in an organisation is the lack of a systematically developed model. The principal aim of training is to contribute to an organisation’s overall objectives. However, in many instances such objectives have not been clearly formulated, training programmes are never evaluated and it seems that behaviour changes do not form part of the Human Resources Development (HRD) effort (Swanepoel, Erasmus, Van Wyk & Schenk 2000:497).

In figure 6, a three-phase systematic approach to training is outlined. The first phase is needs assessment, the second is training phase and the third an evaluation phase:

---

**Figure 6: General Systems Model for Training**

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needs assessment</td>
<td>Training</td>
<td>Evaluation</td>
</tr>
<tr>
<td>Assess instructional needs</td>
<td></td>
<td>Evaluating levels</td>
</tr>
</tbody>
</table>
Successful training begins with a needs assessment to determine which employees need to be trained and what they need to be trained to do. The training needs analysis phase culminates in the formulation of a set of objectives which clearly state the purpose of training and the competences required of trainees once they have completed the programme. Needs analysis requires time, money and expertise. Unfortunately many organisations undertake training without this essential preliminary investment. Often there is no systematic plan to predict future training needs or to determine whether perceived needs and problems can be addressed by training (Swanepoel et al, 2002:497; Singer, 1990:173).

Training needs assessment is an investigation which is undertaken to determine the nature of performance problems in order to establish the underlying causes and how these can be addressed by training. A training gap is usually defined as the difference between the required standard of the job normally specified in a

Naylor (1996:127) stresses that the delivery of instruction is a personal service. In principle each needs analysis establishes an individualised plan. Managers are then faced with the problem of supplying the service to each employee within budget constraints. It is not surprising that a compromise has to be reached and employees are given standardised training courses in spite of their not needing every element of them. To some extent, training resources are wasted.

This phase also involves an organisational analysis which according to Singer (1990:174), is a continuous process of gathering information and reviewing it to determine training needs. Although many departments contribute data, the majority of the information is gathered from the human resource area. Information regarding employee skills and demographic information is compiled as well. This fragmentary information, coupled with general statistics such as typical retirement age and average age of mortality, often provides clues to training needs. For example, the existence of an aging managerial workforce alerts companies to the fact that successors may be needed in the near future.

McNamara (2004) strongly recommends that learners be included in training and development planning. The learner will get the most out of the plan if he or she feels strong ownership in the plan. Ownership comes from taking part in developing the plan. Also, professional development rarely includes only gaining knowledge and skills about a job role. Professional development often includes self-development as well, for example admitting one's limits and capabilities. Learners are often the best experts at realizing their own needs for self-development. Therefore, learners should be involved as much as possible in developing the plan.

2.6.1.2 The Training Phase

Once the training needs have been determined and behavioural objectives stated, a training programme can be developed to achieve the stated objectives.
In order to ensure the success of the training programme, appropriate training methods must be selected and suitable training materials developed to convey the required knowledge and skills identified in the training objectives. The necessity of understanding how people learn in order to design an effective training programme cannot be overemphasised (Swanepoel et al, 2002:504).

Amrine, Ritchey, Moodie and Kmec (1993:457) and Singer (1990:179) state that on-the-job-training is the most popular training method used by many companies. According to Dessler (1994:244), this kind of training involves having a person learn a job by actually performing it.

Although on-the-job-training is cost efficient and easily administered, it does pose some problems. When trainees are using equipment for learning purposes, productivity is diminished. Experienced workers cannot use machinery while it is being used for training. Furthermore, because training is conducted with the equipment paced at the normal production speed, trainees are more likely to damage equipment, waste materials and have significantly higher accident rates (Singer, 1990:179).

Singer adds that another major disadvantage of on-the-job-training centres around the trainer. In the majority of cases, particularly when line workers are being trained, the instructors are either supervisors or experienced production workers. In either case, the trainer may not have the teaching abilities, interest or time necessary to spend training workers. These conditions could produce anxious, frustrated employees who, through no fault of their own, are incapable of performing satisfactorily.

Dessler (1994:244) contends that there are trainer-related factors to keep in mind when designing OJT programmes. The trainer themselves should be carefully trained and given the necessary training materials. Experienced workers who are chosen to be as trainers should be thoroughly trained in proper methods of instruction, in particular the principles of instruction, the principles of learning and job instruction technique.
2.6.1.2.1 A Systematic Approach to Training for Quality

According to Oakland (2000:236), training for quality should have as its first objective an appreciation of the personal responsibility for meeting the ‘customer’ requirements by everyone, from the most senior executive to the most new junior employee. Responsibility for the training of employees in quality rests with management at all levels and, in particular, the person nominated for the co-ordination of the organisation’s quality effort. Quality training will not be fully effective, however, unless responsibility for the quality rests clearly with the Chief Executive. One objective of this policy should be to develop a climate in which everyone is quality conscious.

The main elements of effective and systematic quality training may be considered under four broad headings:

2.6.1.2.2 Error, Defect and Problem Prevention

The following contribute to effective and systematic training for the prevention of problems in the organisation:

1. An issued quality policy.
2. A written management system.
3. Job specifications that include quality requirements.
4. Effective steering committees, including representatives of both management and employees.
5. Efficient housekeeping standards.
6. Preparation and display of maps, flow diagrams and charts for all processes.

2.6.1.2.3 Error, Defect and Problem Reporting and Analysis

It will be necessary for the management to arrange the necessary reporting procedures and ensure those concerned are adequately trained in these
procedures. All errors, rejects, defects, defectives, problems, waste, etc. should be recorded and analysed in a way that is meaningful for each organisation, bearing in mind the corrective action programmes that should be initiated at appropriate times.

2.6.1.2.4 Error, Defect and Problem Investigation

The investigating of errors, defects and problems can provide valuable information that can be used in their prevention. The following information is useful for the investigation:

1. Nature of problem
2. Date, time and place
3. Product/service with problem
4. Description of problem
5. Causes and reasons behind causes
6. Action advised
7. Action taken to prevent recurrence.

2.6.1.2.5 A Review of Training for Quality

Reviewing the effectiveness of quality training programmes should be a continuous process. However the measurement of effectiveness is a complex problem. One way of reviewing the content and assimilation of the training course or programme is to monitor behaviour during quality audits. This review can be taken a stage further by comparing employees’ behaviour with the objectives of the quality training programme. Other measures of the training process should be found to establish the benefits derived.

2.6.1.2.6 Education and Training for Technology

The current educational system structure, particularly at the university level, is viewed as rigid and unable to change to meet the demands of the changing world
environment. According to Khalil (2000: 77), the following points deserve attention:

1. The existing system of education is seen as hindering the rate of progress achieved in technology and economic growth. A change in the educational model is needed.

2. A change in formal education style is required. A style that fosters free thinking, creativity, innovation and interdisciplinary flow, rather than compartmentalization of thoughts, is needed.

3. A change in the mode of education delivery is also needed. Advances in communication and multimedia technology, including the Internet, offer new ways of teaching and delivering course materials to the students.

4. New disciplines such as knowledge infrastructure engineering, should emerge. Transcultural engineering, which involves designing for cultural acceptance, should also be stressed.

5. Multiple degrees seekers will emerge, where no manager will have only a single degree in future. The explosion of knowledge will require life-long learning experience. There will be a need for more technological and managerial education for all managers.

6. Higher education is lagging behind industry in making the changes necessary to meet the industrial challenges. Virtual universities and electronic teaching methods will increase in number, size and popularity. Virtual laboratories will be created. The challenge is how to harness the new technology in education to optimize learning and deliver quality, cost-effective education to the public at large, as well as how to satisfy industry’s needs for a highly skilled, technologically literate workforce.

2.6.1.2.7 Training for Safety
Training is an important factor in ensuring that work is conducted in a safe manner. The focus of responsibility has shifted over the years. For employers, there has been a shift from compliance with detailed regulations towards a more general duty to ensure premises, products and working practices. Each process must be studied for safety implications. The process should be designed to be safe as possible and workers should be trained accordingly. It has been found that conformance is best achieved if staff are encouraged to develop positive attitudes towards, and opinions about, safety (Naylor, 1996:129).

During training an ongoing feedback and support should be provided. Even if things seem to be going fine, trainers must be sure to stop in and visit the learner on a regular basis. Some learners may not feel comfortable asking for help. Supervisors should provide any feedback, that is timely and useful information for the learner. Affirmation and support should be provided (Mcnamara, 2004).

2.6.1.3 The Evaluation Phase

The purpose of this phase is to determine the extent to which the training activities have met the stated objectives and is the last phase in the training process. Evaluation of training is often done poorly or not done at all. One reason for this is that there is a general assumption that training will work and that those who initiated the training fear that an objective evaluation of the effectiveness of the training will prove otherwise. The basic approach to evaluation should be to determine the extent to which the training programme has met the learning objectives identified prior to the training. Planning for evaluation should commence at the same time that planning for the training programme begins (Swanepoel et al, 2002:517; Singer, 1990:193).

Singer further highlights that to simplify the evaluation procedure requires that the evaluation process be broken down into four logical steps, namely:
• **Reaction:** The degree to which trainees enjoyed the programme. The standard procedure is to administer an evaluation form to each participant at the conclusion of the training programme. These evaluation forms typically require trainees to rate on a bi-polar scale both the trainer and the material taught. In addition, trainees are given an opportunity to subjectively provide any additional reactions or recommendations.

• **Learning:** Liking and learning are not necessarily correlated therefore learning cannot be measured adequately by an evaluation form. The appropriate measure is dependent on the goals of the training. If the material to be learned can be measured through paper-and-pencil testing, then this type of format should be employed. If, on the other hand, other skills were to be mastered, appropriate ability measures should be developed to assess them. McNamara (2004) contends that when assessing results of employees’ learning, feedback about performance should be maximized. Getting feedback from the learner’s peers and subordinates about the learner’s needs and progress to meet those needs should be considered. A 360-degree performance review is a powerful practice when carried out with clarity and discretion. When first carried out, it may be wise to get the help of an outside professional.

• **Behaviour:** Material which has been learned must be transferred into practice in order for training to be effective. Evaluating this phase requires that before and after measures be established. If training has the desired effect, then there should be a significant difference in the work performed before and after training.

• **Results:** The final phase of the evaluation process is concerned with the overall impact training has on the organisation. Training may have increased individual productivity, but the cost of total effort may have been excessive. Furthermore, the training may have had significant personal gain for the worker but too little, if any, for the company.
The four-step evaluation is an important tool for determining the usefulness of the training endeavours. Realistically, however, most companies judge training effectiveness solely on the trainees’ evaluation of the programmes (Singer, 1990:195).

2.7 SECTION HIGHLIGHTS

Large sums of money are spent by companies on training endeavours. Realization of training benefits is contingent on the degree of planning and effort expended on designing, implementing and evaluating the training programmes. A systematic approach should be implemented for successful TQM programme and technology management principles in terms of technology strategy.

2.8 SUMMARY

It is clear from this chapter that total quality and strategic technology management principles can significantly improve the competitive status of an organisation if they are implemented optimally. Careful employment of best practices of well designed training and development programme to all employees would have a positive impact in the successful implementation of total quality and technology management principles.

CHAPTER 3

RESEARCH METHODOLOGY
3.1 INTRODUCTION

Chapter 1 introduced the main problem and its sub-problems that were to be resolved by this research study. In this chapter, the research design and methodology and tools employed in the empirical study on which scientific research is based are examined.

3.2 DEFINITION AND CONCEPT OF RESEARCH

The Oxford Dictionary (1995:1169) and Hawkins (1994:433) defines research as the systematic investigation into sources in order to establish facts and reach new conclusions or collate old facts by the scientific study of the subject or by a course of critical investigation. However, various definitions of the concept research can be given. Mouton and Marais (1992:7) define research as a collaborative human activity in which social reality is studied objectively with the aim of gaining a valid understanding of it. Another definition states that research can be seen as a process of expanding the boundaries of one’s ignorance (Melville & Goddard 1996:14). Finally, Leedy (1993:11) and Leedy and Ormrod (2001:4) define research as studious inquiry or examination, having for its aim the discovery of new facts and their correct interpretation.

There are different modes of acquiring knowledge through research. However, scientific approach differs from others by the assumptions on which it is based and its methodology. The scientific methodology is a system of explicit rules and procedures on which research is based and against which claims for knowledge are evaluated (Frankfort-Nachmias & Nachmias, 1992:14).

According to Frankfort-Nachmias and Nachmias (1992:16), the scientific methodology explains the logical foundations of reasoned knowledge and is the essential tool of the scientific approach, along with factual observations. The scientific methodology is also a system of valid reasoning about factual observations that permits reliable inferences to be drawn from the factual observations. This research is also based on factual observations and explicit
3.3 RESEARCH DESIGN

The Oxford Dictionary (1995:1169) and Hawkins (1994:141) state that design is a preliminary plan, concept or purpose. Supporting and expanding on this, Yin (1994:20) defines design as the preparation of a working plan aimed at systematically assembling, organising and integrating data, in order to solve the research problem. Leedy and Ormrod (2001:91) state that research design includes the planning, visualisation of the data and the problems associated with the employment of the data in the entire research project.

3.3.1 The Basic Format of all Research

Leedy and Ormrod (2001:91) contend that the research process follows a basic format and that no matter which academic discipline gives rise to the research endeavour, the general research procedure is fundamentally the same. Table 4 below shows the basic format:

Table 4: The basic format of the research

- A question that has no known resolution is posed in the mind of a researcher.
- The researcher converts the question to a clearly stated problem.
- The researcher poses a temporary hypothesis or a series of hypotheses.
- The literature is searched for possible solution to the problem.
- If the search leads nowhere, another avenue must be found to resolve the problem.
- The researcher looks for data that may relate to the problem, analyze and interpret to suggest a conclusion.
- Either the data seemingly resolve the problem or they do not, or either the data support the hypotheses or they do not.

Source: adopted from Leedy & Ormrod (2001:92)

Leedy and Ormrod (2001:91) further state that in planning a research design, the researcher in quest of new knowledge and understanding cannot be shackled by discipline-specific methodological restraints. They argue that the research project will frequently lead the investigator to new unfamiliar territories that have
historically been associated with other academic disciplines.

Research reports for most quantitative studies are similar in their organisational format. After their preliminary pages which include title page, acknowledgements, table of contents etc, Leedy and Ormrod (2001:297) state that they typically have five major sections:

- An introduction which includes the statement of the main problem, assumptions, definition of terms, etc,
- A review of related literature
- A description of research methodology
- Discussion of results and
- Conclusions including implications and suggestions for further research.

This is the actual design of this research study. This research report is composed of five chapters which are briefly outlined in chapter 1.

3.4 RESEARCH DATA COLLECTION

Leedy and Ormrod (2001:94) define data as *manifestation of reality*. According to this definition data are not reality itself or “naked truths” as Leedy and Ormrod put it. Wegner (2001:12-14) points out that there are two classifications of data sources, namely:

- Firstly, internal data sources which refer to the availability of data which are generated during the course of normal business activities, from within an organisation. Contrary to this, external data sources are outside an organisation.

- Secondly, primary data sources where data are captured at a point where they are being generated for the first time with a specific purpose. Secondary data are data collected and processed by others for a purpose other than the problem at hand. Leedy and Ormrod (2001:95) state that
primary data are closest to the truth and are truth-manifesting. Contrary to this, secondary data are derived from primary data and not from the truth itself.

Focusing on primary and secondary data types, table 5 highlights some of the advantages and disadvantages of the two.

**Table 5: Advantages and Disadvantages of Primary and Secondary Data**

<table>
<thead>
<tr>
<th></th>
<th>Primary Data</th>
<th>Secondary Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advantages</strong></td>
<td>• Directly relevant to the problem at hand.</td>
<td>• Already exist thus access time is short.</td>
</tr>
<tr>
<td></td>
<td>• Offer greater control over data accuracy.</td>
<td>• Less expensive to collect.</td>
</tr>
<tr>
<td><strong>Disadvantages</strong></td>
<td>• Time consuming to collect.</td>
<td>• Data may not be relevant to problem at hand.</td>
</tr>
<tr>
<td></td>
<td>• Expensive to collect.</td>
<td>• It may be difficult to assess data accuracy.</td>
</tr>
</tbody>
</table>


As can be seen from table 6, both of these two data types have advantages and disadvantages. However, in order to resolve the main problem of this research study, data had to be collected. This included the employment of:

- literature review
- site observations
- sampling
- qualitative research methods
- qualitative research methods
- questionnaires and
- interviews

**3.4.1 Literature Review**
Leedy and Ormrod (2001:70) state that the literature review describes the theoretical perspectives and previous research findings related to the problem at hand. The researcher has used literature in this research study for that purpose and possible solutions to the problem. The Internet was also used for the research for more information.

3.4.2 Site Observations

According to Lawrence and Pasternack (2002:11), those performing a management science analysis should make every effort to observe the problem from various points of view within the organisation, with the goal of understanding the problem at least as well as, if not better than, those individuals directly involved. In the manufacturing process, the perspectives of managers, foremen and workers might be solicited.

The researcher also organised three site visits to the company under investigation on different occasions in order to observe some of the manufacturing operations with which the researcher is familiar since he previously worked for this company. Those site visits were organised through some managers of the company. Direct observation is one of the three approaches used for data collection Mouton (2001:105; Wegner, 2001:14).

Wegner (2001:15) states further that observation is advantageous in that the respondent is generally not aware of being observed and therefore behaves naturally. This reduces the likelihood of gathering biased data. The disadvantage, however, is that it is a passive form of data collection. There is no opportunity to probe for reasons or investigate behaviour further.

3.4.3 Sampling

Leedy and Ormrod (2001:221) state that generally, the basic rule is that the larger the sample, the better. However, this does not fit all situations. To some
extent the size of an adequate sample depends on how homogenous or heterogeneous the population is, in other word how alike or different its members are. A heterogeneous population requires larger samples and smaller samples are adequate for a homogenous population.

Gay (1996:125) suggests that if the population is less than 100, then there is little point in sampling it as the entire population should be surveyed. If a population is about 500, then 50% should be sampled. The researcher used these guidelines to determine an adequate sample for this research study. Aberdare has three shifts, but only day shift employees participated in this study. There were 239 (1+ 19+67+42 + (27+138+165 divided by 3)) of them and 50 of them were willing to participate in the research. Table 6 presents the categories:

**Table 6: Aberdare’s Human Resources September 2004 Statistics**

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Tot</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>C</td>
<td>I</td>
</tr>
<tr>
<td>Legislators, senior officials and managers</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professionals</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professionals</td>
<td>6</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Professionals</td>
<td>17</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Service and sales workers</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Skilled agricultural and fishery workers</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Craft and related trades workers</td>
<td>1</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Plant and machine operators and assemblers</td>
<td>83</td>
<td>38</td>
<td>0</td>
</tr>
<tr>
<td>Elementary occupations</td>
<td>119</td>
<td>31</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL PERMANENT</strong></td>
<td><strong>232</strong></td>
<td><strong>103</strong></td>
<td><strong>3</strong></td>
</tr>
</tbody>
</table>

**Source:** Anonymous Respondent from Aberdare

3.4.4 Quantitative Research Method

Mouton and Marais (1992:159) define quantitative research as more highly formalised as well as more explicitly controlled, with a range that is more exactly
defined, and which, in terms of the methods used, is relatively close to the physical sciences. This definition once again shows a preference for the positivist approach.

Quantitative research seeks to quantify, through numbers, observations about human behaviour. The emphasis is on precise measurement, the testing of hypotheses based on a sample of observations and a statistical analysis of the data. Relationships among variables are described mathematically and the subject matter is, as in the physical sciences, treated as an object (Van Biljon 1999:40). Variables play key roles in quantitative research. Variables take on two or more values. Attributes, on the other hand, are the values of categories of a variable and people sometimes confuse variables with attributes.

A quantitative research project would usually test the most important causal links to be found in the research domain. This relationship between variables is usually expressed as a hypothesis, and hypotheses are tested to answer the research question or to find empirical support for a theory (Neuman 1994:99).

3.4.5 Qualitative Research Method

Qualitative research relies on interpretative and critical approaches to social sciences. The aim of qualitative research is to study individuals and phenomena in their natural settings in order to gain a better understanding of them. It is also evident that qualitative research does not follow a fixed set of procedures. The researcher will, however, need to develop a set of strategies and tactics in order to organise, manage and evaluate the research (Neuman 1994:317; Dooley 1995:258).

Scientists who wish to describe everyday life from the point of view of the phenomenological perspective prefer qualitative research. Quantitative researchers manipulate figures and statistics; the data of the qualitative researcher is in the form of words, sentences, and paragraphs. Qualitative research is more at risk in terms of validity and reliability (Miles & Huberman
Mouton and Marais (1992:155) define qualitative research projects as those in which the procedures are not strictly formalised, while the scope is more likely to be under-defined, and a more philosophical mode of operation is adopted.

3.4.6 Quantitative Versus Qualitative Research

Quantitative research is usually associated with positivism and qualitative research with interpretativism. It is best to visualise the distinction between quantitative and qualitative research as a continuum. All research methods could be placed somewhere between the extremes of pure quantitative and pure qualitative research (Jackson 1995:13).

It is, however, plausible to indicate whether research projects have a more qualitative or more quantitative nature. This in turn would play an important role in decisions on process to follow and measuring instruments to select (Van Biljon 1999:37). A summary of the main differences between qualitative and quantitative research is given in table 7.

<table>
<thead>
<tr>
<th>Quantitative Research</th>
<th>Qualitative Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Test hypothesis that researcher begins with. Hypotheses are stated explicitly and</td>
<td>• Capture and discover meaning once the researcher becomes immersed in data.</td>
</tr>
<tr>
<td>and are formulated beforehand.</td>
<td>Hypotheses are frequently undeclared or stated in the form of a research goal.</td>
</tr>
<tr>
<td>• Concepts are in the form of distinct variables. Concepts have an ambiguous meaning.</td>
<td>• Concepts are in the form of themes, motifs, generalisations, taxonomies. Concepts</td>
</tr>
<tr>
<td>• Measures are systematically created before data collection is standardised.</td>
<td>can be interpreted in a number of ways.</td>
</tr>
<tr>
<td>The researcher remains largely aloof.</td>
<td>• Measures are created in an ad hoc manner and are often specific to the individual</td>
</tr>
<tr>
<td>• Data are in the form of numbers from precise measurement.</td>
<td>or researcher. The researcher is involved with the events/phenomena.</td>
</tr>
<tr>
<td></td>
<td>• Data are in the form of words from documents, observations and transcripts.</td>
</tr>
</tbody>
</table>
An important choice that researchers face is the research method to be used. Leedy (1993:145) believes that the answer to this question can be found in the nature of the data, the problem of the research, the location of the data, obtaining of data and the intention with the data. If the data is verbal, the methodology is qualitative. If it is numerical, the methodology is quantitative (Van Biljon 1999:37).

Leedy & Ormrod, 2001:35 state that in qualitative research inductive reasoning is used. People use specific instances or occurrences to draw conclusions about the entire classes of objects or events. In other words, they observe a sample and then draw conclusions about the population from which the sample comes. According to Patton (1987:15), qualitative research methods are particularly orientated towards exploration, discovery and inductive logic. The following are some features of inductive logic:

- Inductive designs begin with conjecture, guesses, ideas and expectations.
- No hypotheses are designed, nor are any theory-building exercises performed.
- Data is collected through observation, interviews and other qualitative methods.
- The product of the research is a new model, theory or hypothesis.
Quantitative research methods, on the other hand, support deductive reasoning and analysis. Deductive designs begin with an explicit conceptual framework developed from existing theory and models. It requires the formulation of specific research hypotheses leading to a theory-building exercise. A known data collection instrument, the fixed alternative questionnaire, is used to collect the data. The hypotheses are accepted or rejected and a causal relationship between variables is established (Miles & Huberman 1994:44; Dooley 1995:65).

3.4.7 Questionnaires

Questionnaires were used to gather both qualitative and quantitative data. These form annexure A and B of this report. Wegner (2001:17) contends that the design of the questionnaire is critical to ensure that the correct research questions are addressed and that accurate and appropriate data are collected. He further explains that a questionnaire should consist of three sections, namely:

- The *administrative section* used to record the identity of the respondent and the interviewer by name, date, and address and where the interview was conducted.

- The *demographic section* which describes the respondent by a number of characteristics which generally include age, gender, residential location, marital status, language, qualifications etc for individual respondents; or company size, economic sector, managerial level, functional area, etc. for company respondents. The selection of demographic characteristics should be dictated by the nature and purpose of the research.

- The *information sought* makes up the major portion of the questionnaire as it includes all the questions needed to extract data from respondents to address the objectives of the research.

Leedy and Ormrod (2001:202) argue that questionnaires can be tricky to construct and administer. Frankfort-Nachimias and Nachimias (1992:239)
recommends that question sequence, content and structure be given a particular consideration. To optimize cooperation from respondents, a few guidelines that were followed during the questionnaire design of this research which are outlined by Leedy and Ormrod (2001:202-204) are given below:

- Questionnaires should be as brief as possible.
- Simple, clear, unambiguous language should be used.
- Questions should not give clues of preferred or more desired responses.
- A respondent task should be kept simple as possible by creating a user-friendly questionnaire with clear instructions.
- A questionnaire should be attractive and professional-looking.
- A Pilot test should be done to ensure ease of understanding the questions.
- The almost-final product should be scrutinized to ensure that it addresses the research needs.

The researcher conducted a pilot study. Questionnaires of this research study were given to a few individuals to test user-friendliness and whether questions make sense after they were scrutinized and debugged with the help of Dr Jacques Pietersen, a senior lecturer for Statistics and head of the Research Support Unit in the Department of Mathematical Sciences of Port Elizabeth Technikon.

3.4.8 Interviews

This research involved structured interviews through the use of structured questionnaires as a means of gathering information, in particular on technology management. Wegner (2001:15) states that interview methods elicit primary data responses through direct questioning.

Wegner (2001:15) argues that there are three approaches to gathered interview data: personal interviews involving face-to-face contact with the respondent, postal survey involving mailed questionnaires, and telephone survey where an
interview is conducted telephonically.

Each of these approaches has advantages and disadvantages. These are summarized in table 8.

**Table 8: Advantages and Disadvantages of Approaches to Gathered Interview Data.**

<table>
<thead>
<tr>
<th></th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal Interviews</strong></td>
<td>• Higher response rate.</td>
<td>• Time-consuming.</td>
</tr>
<tr>
<td></td>
<td>• Question allows probing for reasons.</td>
<td>• Require trained interviewer and therefore expensive.</td>
</tr>
<tr>
<td></td>
<td>• Data collection is immediate.</td>
<td>• Generally fewer interviews conducted due to time constraints.</td>
</tr>
<tr>
<td></td>
<td>• Greater data accuracy is generally ensured.</td>
<td>• Possibility of gathering biased data is introduced by interviewer.</td>
</tr>
<tr>
<td></td>
<td>• Non-verbal responses can be observed and noted</td>
<td></td>
</tr>
<tr>
<td><strong>Postal Survey</strong></td>
<td>• A larger sample of respondents can be reached.</td>
<td>• Response rates are very low (between 5% and 15%).</td>
</tr>
<tr>
<td></td>
<td>• More cost effective.</td>
<td>• The respondent cannot obtain clarity on questions.</td>
</tr>
<tr>
<td></td>
<td>• Interviewer bias eliminated</td>
<td>• Limited possibility of probing and investigating further.</td>
</tr>
<tr>
<td></td>
<td>• Respondents have more time to consider their responses.</td>
<td>• Data collection takes longer.</td>
</tr>
<tr>
<td></td>
<td>• Anonymity is assured, generally resulting in honest responses.</td>
<td>• No control over who actually answer the questionnaire.</td>
</tr>
<tr>
<td></td>
<td>• Respondents are more willing to answer personal questions.</td>
<td>• No possibility of checkbacks to check on the validity of responses.</td>
</tr>
<tr>
<td><strong>Telephone Survey</strong></td>
<td>• Allows quicker contact with geographically dispersed respondent.</td>
<td>• Respondent anonymity is lost.</td>
</tr>
<tr>
<td></td>
<td>• Low cost relatively to personal surveys.</td>
<td>• Non-verbal responses cannot be observed.</td>
</tr>
<tr>
<td></td>
<td>• Interviewer probing possible.</td>
<td>• Interviewer bias possible.</td>
</tr>
<tr>
<td></td>
<td>• People more willing to talk</td>
<td>• Trained interviewers are required which increases costs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Respondents prematurely may</td>
</tr>
</tbody>
</table>
on the phone from security of their home.

- Larger sample of respondents possible in short time.
- Clarity on questions by interviewer possible.

terminate interview by putting the phone down.

Source: Compiled from Wegner (2001:15-17)

The researcher used all the interview approaches described in table 8, namely postal survey using annexure A, and personal and telephonic interview using annexure B. Wegner (2001:17) describes a questionnaire as a data collection instrument used to collect data in all interview situations. To make this successful this research involved structured interviews through the use of structured questionnaires as a means of gathering information. Sekaran (2003:227) states that structured interviews are interviews conducted when the information required is known in advance.

In this case the interviewer had a list of predetermined questions to be asked from the respondents or through a questionnaire, as can be seen from annexure A and annexure B.

### 3.5 DRAWING CONCLUSIONS FROM ANALYZED DATA

Robson (1997:372) believes that regardless of the research method used, the major task is to resolve the main problem of the research by finding answers to the question posed. Trustworthy answers result from unbiased, fair treatment of data.

In the case of qualitative research, to order and interpret raw data Robson (1997:384) recommends firstly, preparing research notes from interview transcripts or a structured questionnaire; secondly, searching for categories and patterns or themes and thirdly, drawing conclusions from patterns discovered.

On completion of the data collection process, Robson (1997:390) contends that data should be analyzed accurately and verified in order to draw reliable
conclusions. The researcher has done just that during the data analysis phase of the research. Since the questionnaires used were structured, the researcher was able to identify patterns and ultimately make conclusions based on the findings.

3.6 RESEARCH QUALITY

For good research quality it is important that the researcher track of the research from the field. Mouton (2001:107) suggests that the researcher records key decisions and activities during the research process as a form of quality assurance. These include:

- dates when access was granted in the field
- dates when interviews were conducted
- keeping track of the length of interviews
- recording of information on interviews
- keeping track of factors that influence the fieldwork adversely; and
- keeping track of refusal rates.

The researcher kept track of these and recorded some difficulties encountered during the entire research study process. Interviews were done in October 2004. Some interviews were done telephonically, only one was done face to face and their duration was 15 to 20 minutes each. The difficulty included postponed interviews owing to work pressure of the respondents and some difficulty in getting the timely return of the maximum questionnaires posted to the respondents.

3.7 SUMMARY

This chapter covered the concept of research as the systematic investigation into sources in order to establish facts and reach new conclusions or collate old facts by the scientific study of the subject or by a course of critical investigation and methods used in research. The chapter also explained that research has five major sections:
• An introduction which includes a statement of the main problem, assumptions, definition of terms etc,
• A review of related literature
• A description of research methodology
• Discussion of results and
• Conclusions, including implications and suggestions for further research.

The importance of sampling and the difference between qualitative and quantitative research were described. Research tools and data collection instruments and techniques were discussed.

CHAPTER 4

THE RESEARCH RESULTS AND ANALYSIS

4.1 INTRODUCTION

In chapter 3 it was explained that once data is collected, it needs to be analysed
carefully without any bias so that an accurate conclusion based on findings can be made. This chapter aims to address just that. The results of this research study are presented and analyzed in this chapter, which allows the researcher to draw conclusions that are presented in chapter 5.

4.2 RESEARCH RESULTS

The research results of this study are presented in order of the research components as discussed in chapter 2, namely:

- results on Total Quality Management
- results on Technology Management
- results on Training and Development

Each of these is presented in section 4.2.1 through to section 4.2.3 respectively. The results presented are based on Annexure A, Annexure B which is made up of a questionnaire and AUDIT CHECKLIST and Annexure C.

The researcher was informed by one of the respondents that Aberdare had 459 employees altogether in different departments and shifts during the research period in September 2004. Among those there were 239 day shift employees. These employees included clerical and commercial staff, operational, technical, supervisory and managerial staff. Considering studying only the day shift personnel as mentioned in the delimitation section, the researcher planned to provide an equal opportunity to all these categories of employees to take part in the empirical study. As discussed in chapter 3, the target sample based on willingness was 50 employees. Of these employees only 25 respondents returned their questionnaires. Table 9 indicates the number of respondents, upon whom this report is based, as per job category.

Table 9: Respondents According to Job Category

<table>
<thead>
<tr>
<th>JOB CATEGORY</th>
<th>TARGET SAMPLE</th>
<th>ACTUAL RESPONDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clerical / Commercial</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Operational</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Technical</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>
In addition to these respondents, three key employees dealing with technology management projects in the company under investigation were willing respondents and they were interviewed. Audit checklist information in Section 4.2.2 of this report is based on data acquired from these respondents.

4.2.1 Results on Total Quality Management

The following is table 10 that presents some of the findings based on question 1 to 12 of Annexure A. Row 3 to 14 of the table present answers to questions. Each column per job category presents the number of respondents whose answer was either yes or no. The TOTALS column presents the sum of all the answers.

<table>
<thead>
<tr>
<th>Job Category</th>
<th>Clerical Yes</th>
<th>Clerical No</th>
<th>Operational Yes</th>
<th>Operational No</th>
<th>Technical Yes</th>
<th>Technical No</th>
<th>Supervisory Yes</th>
<th>Supervisory No</th>
<th>Managerial Yes</th>
<th>Managerial No</th>
<th>TOTALS Yes</th>
<th>TOTALS No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>2</td>
<td>0</td>
<td>8</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>23</td>
<td>2</td>
</tr>
<tr>
<td>Question 2</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>Question 3</td>
<td>2</td>
<td>0</td>
<td>6</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>Question 4</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Question 5</td>
<td>2</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Question 6</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>Question 7</td>
<td>2</td>
<td>0</td>
<td>8</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>Question 8</td>
<td>2</td>
<td>0</td>
<td>8</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>23</td>
<td>2</td>
</tr>
<tr>
<td>Question 9</td>
<td>2</td>
<td>0</td>
<td>6</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>Question 10</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>7</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>0</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Question 11</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>Question 12</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>7</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>19</td>
</tr>
</tbody>
</table>

Source: Author’s own compilation based on received data

An analysis based on table 10 in order of the questions indicates that it is clear that:

- Most respondents 23 out of 25 or 92% of them know the concept of TQM.
• Only nine respondents out of 23 or 39% of those who know TQM were actually trained on it by Aberdare. The rest were never trained. The rest revealed that they knew TQM through self-study, and these include all four supervisors who participated as respondents.

• 20 respondents out of 23 or 87% of them agree that a TQM programme exist at Aberdare. Three respondents (of which 2 have a formal Technikon and University education on TQM) do not agree. One of the respondents from the quality department however, confirmed to the researcher during one site visit for observations that there is no organised TQM programme at Aberdare.

• Only 11 respondents out 23 or 48% of them believe that TQM programme has been implemented effectively at Aberdare.

• All the respondents agree that machine operators at Aberdare are authorised to stop the machines without asking for permission from the superiors when some production fault affects quality.

• Only nine respondents out of 25 or 36% of them believe Aberdare encourage workers to make suggestions by placing suggestion boxes in the factory where employees can put their written suggestions for improvement of quality and safety in the workplace. The researcher, however, did not personally see the strategically placed, adequately visible suggestion boxes for this purpose during the site visits to the Aberdare plant under investigation for observations.

• 20 respondents out 25 or 80% of them indicated that there are visible charts in their working environment, which are used to record their standard of performance in housekeeping so that everyone knows when the standard is achieved or vice versa.

• 23 respondents out of 25 or 92% of them indicated that there are visible charts in their working environment, which are used to record their standard of performance in quality so that everyone knows when the standard is achieved or vice versa.

• Regarding operational efficiency, 19 respondents out of 25 or 76% of them indicated that they use computers to do some of their job activities.
- 13 respondents out of 25 or 52% of them indicated that they have access to internet.
- 14 respondents out of 25 or 56% of them indicated that they get rewards and recognition for best performance in their job. Some of these even remarked that they only get paid to do their job.
- Only 6 respondents out of 25 or 24% of them indicated that there are promotion opportunities in their departments.

Table 11 below presents respondents responses to questions 13 through to 17 of Annexure A. The relationship of symbols G, L, and N to answers of questions 13 – 17 in this table G: Means to a Great extent; L: To a Less extent and N: Not at all

<table>
<thead>
<tr>
<th>Job Category</th>
<th>Question13</th>
<th>Question14</th>
<th>Question15</th>
<th>Question16</th>
<th>Question17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clerk</td>
<td>1 G 1 H 0 N</td>
<td>1 G 1 H 0 N</td>
<td>1 G 1 H 0 N</td>
<td>1 G 1 H 0 N</td>
<td>2 G 0 H 0 N</td>
</tr>
<tr>
<td>Operational</td>
<td>5 G 3 H 1 N</td>
<td>5 G 4 H 0 N</td>
<td>6 G 3 H 0 N</td>
<td>5 G 4 H 3 N</td>
<td>5 G 1 H 1 N</td>
</tr>
<tr>
<td>Technical</td>
<td>3 G 0 H 2 N</td>
<td>3 G 2 H 0 N</td>
<td>4 G 1 H 0 N</td>
<td>1 G 2 H 2 N</td>
<td>4 G 1 H 0 N</td>
</tr>
<tr>
<td>Supervisory</td>
<td>2 G 2 H 0 N</td>
<td>3 G 1 H 0 N</td>
<td>2 G 2 H 0 N</td>
<td>2 G 2 H 0 N</td>
<td>2 G 2 H 0 N</td>
</tr>
<tr>
<td>Managerial</td>
<td>4 G 1 H 0 N</td>
<td>1 G 4 H 0 N</td>
<td>3 G 2 H 0 N</td>
<td>1 G 3 H 1 N</td>
<td>2 G 3 H 0 N</td>
</tr>
<tr>
<td>TOTAL</td>
<td>15 G 7 H 3 N</td>
<td>13 G 12 H 0 N</td>
<td>16 G 9 H 0 N</td>
<td>10 G 12 H 3 N</td>
<td>13 G 1 H 1 N</td>
</tr>
</tbody>
</table>

Source: Author’s own compilation based on received data

Based on the data in table 11 it is clear when looking at the TOTAL figures in order of the questions that:

- 15 respondents out of 25 or 60% of them indicated that management takes lead in quality improvement.
- Most respondents 13 out of 25 or 52% of them feel that teamwork for quality is encouraged to a great extent. The researcher was informed by one of the respondents that since June 2003 that Aberdare introduced Continuous Improvement Action Teams (CIAT) formed by management and union representatives; and Mission Directed Work Teams (MDWT). Both these groups are actively involved in sensitising employees about
quality-related issues. However, 80% of the respondents who are managers, as can be seen in table 11 believe that much still need to be done for successful teamwork.

- 16 respondents out of 25 or 64% of them indicated that job processes and activities at Aberdare are designed to allow every employee to improve quality.
- 15 respondents out of 25 or 60% of them indicated that customer needs are explained to a less extent or not at all to employees.
- Most respondents 13 out of 25 or 52% of them feel that their jobs are less secure. Some of these indicated that they see people either as being demoted or given voluntary packages (as confirmed by Aberdare’s HR officer to the researcher) in order to leave the company owing to restructuring happening there. They highlighted that if voluntary packages are not taken, this can lead to forced retrenchments. The rest of the respondents feel safe to a great extent.

The respondents revealed that in one month period there are more than 15 cables that need to be re-worked on. The scrapped cables are on average between 6 – 10 in one month while the cables returned by customers are between 1 – 5 in the during one month period.

In table 12 below column X is a column chosen by all respondents who believe that the culture at Aberdare is such that quality is every worker’s responsibility. Column Y is the column chosen by all respondents who believe that the culture at Aberdare is such that quality is Quality Department’s responsibility.

Table 12 Responses based on Question 21 of Annexure A

<table>
<thead>
<tr>
<th>Job Category</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clerical</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Operational</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Technical</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Supervisory</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Managerial</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>20</td>
<td>5</td>
</tr>
</tbody>
</table>
It is clear from table 12 that 20 respondents out of 25 or 80% of them indicated that the culture at Aberdare is such that quality is every worker’s responsibility.

Table below based on question 22 of Annexure A has result columns named ‘Always’, ‘Sometimes’ and ‘Never’. Most respondents, 16 out of 25 or 64% of them indicated that at *some times* employees treat each other as internal customers and suppliers.

<table>
<thead>
<tr>
<th>Job Category</th>
<th>Always</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clerical</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Operational</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Technical</td>
<td>1</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Supervisory</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Managerial</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>7</strong></td>
<td><strong>16</strong></td>
<td><strong>2</strong></td>
</tr>
</tbody>
</table>

This implies that an internal customer-supplier relationship at Aberdare is not happening consistently. Two operational respondents on the other hand indicated that it never happens.

Figure 7 is a representation of Corrective Action Requests (CAR) issued and outstanding ones during week 21 through to week 31 at Aberdare. The percentage success rate column of table 14 which is based on figure 7 indicates that there had been only three 100% success rates of clearing CAR’s in 12 weeks.

Figure 8 is also a representation of Corrective Action Requests (CAR) issued and outstanding ones during the month of January to August 2004 at Aberdare. The percentage success rate column of table 15 which is based on figure 8 indicates that there had been no 100% success rates of clearing CARs.
Figure 7: A Weekly Corrective Action Requests

Table 14 Analysis of data from figure 7

<table>
<thead>
<tr>
<th>WEEKS</th>
<th>CARS ISSUED</th>
<th>CARS O/STANDING</th>
<th>CARS CLOSED OFF</th>
<th>% SUCCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>16</td>
<td>14</td>
<td>2</td>
<td>12.5</td>
</tr>
<tr>
<td>22</td>
<td>12</td>
<td>6</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>23</td>
<td>11</td>
<td>9</td>
<td>2</td>
<td>18.18</td>
</tr>
<tr>
<td>24</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>25</td>
<td>10</td>
<td>8</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>26</td>
<td>12</td>
<td>10</td>
<td>2</td>
<td>16.67</td>
</tr>
<tr>
<td>27</td>
<td>13</td>
<td>10</td>
<td>3</td>
<td>23.07</td>
</tr>
</tbody>
</table>

Source: Aberdare’s Anonymous Respondent’s e-mail
Figure 8: A Monthly Corrective Action Requests

Table 15 Analysis of data from figure 8

<table>
<thead>
<tr>
<th>MONTHS</th>
<th>CAR’S ISSUED</th>
<th>CAR’S CLOSED OFF</th>
<th>% SUCCESS RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>16</td>
<td>1</td>
<td>6.25</td>
</tr>
<tr>
<td>February</td>
<td>20</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>March</td>
<td>22</td>
<td>1</td>
<td>4.54</td>
</tr>
<tr>
<td>April</td>
<td>36</td>
<td>18</td>
<td>50</td>
</tr>
<tr>
<td>May</td>
<td>32</td>
<td>20</td>
<td>62.5</td>
</tr>
<tr>
<td>June</td>
<td>36</td>
<td>18</td>
<td>50</td>
</tr>
<tr>
<td>July</td>
<td>55</td>
<td>7</td>
<td>12.72</td>
</tr>
<tr>
<td>August</td>
<td>27</td>
<td>2</td>
<td>7.4</td>
</tr>
</tbody>
</table>
Source: Researcher’s Compilation from figure 8

These results as shown on figure 7 and figure 8 do not reflect a true commitment to TQM. In TQM the main emphasis is to do something right first time.

4.2.2 Results on Technology Management

The following is table 16 that presents some of the findings based on question 1 to 8 of Annexure B. Row 3 to 10 of the table present answers to questions. Each column per job category presents the number of respondents whose answer was either yes or no. The TOTALS column presents the sum of all the answers.

Table 16 Responses based on Question 1 to 8 of Annexure B

<table>
<thead>
<tr>
<th>Job Category</th>
<th>Clerical</th>
<th>Operational</th>
<th>Technical</th>
<th>Supervisory</th>
<th>Managerial</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answers</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Question 1</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Question 2</td>
<td>2</td>
<td>0</td>
<td>6</td>
<td>3</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Question 3</td>
<td>2</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Question 4</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Question 5</td>
<td>2</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Question 6</td>
<td>2</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Question 7</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Question 8</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>

Source: Author’s own compilation based on received data

The results from table are such that:

- Most of the respondents 20 out of 25 or 80% of them indicated that management at Aberdare view technology as a means of gaining a competitive advantage.
- Most respondents 22 out of 25 or 88% of them indicated that technology management is linked to business strategy such that the company is willing to invest money and time to adopt new technology that would enhance competitiveness at Aberdare.
• All respondents indicated that Aberdare has a team specifically designed to keep track of the latest technology developments relevant to the company.

• Most of the respondents 18 out of 25 or 72% of them indicated that when new technology is to be adopted or bought by the company, the technology management team involve all stakeholders in the new technology planning stage, including operators in the case of a new machine.

• All respondents indicated that Aberdare’s technology management team invest a significant effort in learning to understand technologies important to the company’s business.

• All respondents indicated that Aberdare has intranet for internal communication and information purposes.

• All respondents indicated that Aberdare does not make use of cybertrade or videoconferencing.

The information from Aberdare’s Information Technology Department indicates that all staff members or monthly paid employees have access to internet and they have e-mail addresses for electronic communication. There are 150 such employees. This serves is an added advantage to some of the processes that supports efficiency of the production.

4.2.2.1 Audit Checklist Results

As mentioned in section 4.2 of this report, three respondents were interviewed. These include key role players in various projects of technology management. The results presented in this section are based of the information provided by them. Audit checklist in Annexure B has been employed to collect the information. However only, sections 1.1; 1.2; 1.3; 1.5; 2.1; 2.2; 3.2; 5.1; 6.1; 6.2 and 6.3 of the audit checklist have been used.
4.2.2.1.1 Corporate Environment

Managers at Aberdare are active members of the technology culture within the corporation. In other words managers are involved in technology related matters. They have close relationships with the chief technology officer and with technology gatekeepers. Technology is appreciated and managed as a key factor in the overall business strategy.

The respondents interviewed agreed that a corporate strategy exists at Aberdare. They all stated that the technology strategy is linked to corporate strategy. These respondents also mentioned that the goal that the R&D has is to establish technology standards and position Aberdare as the industry leader. All the respondents also indicated that the technical strategy is effectively communicated and deployed throughout all levels in the organisation.

4.2.2.1.2 Technology Culture Advancement

Learning: The respondents indicated that Aberdare is skilled at creating, acquiring and transferring knowledge and at modifying its behaviour to reflect new knowledge and insights. The has established methods for systematic problem solving, experimentation with new approaches, learning from its own experiences (both successes and failures) and most successful practices of others and transferring knowledge quickly and efficiently throughout the . Lessons are documented and distributed throughout the organisation.

Communication: The respondents also indicated that there are no al barriers threatening the communication top-down, bottom-up, and horizontally. Ideas and concerns can be freely expressed and, in fact, Aberdare encourages that. Information is made available to whoever might need it. The al structure is not a barrier when trying to communicate with top management levels.

Management of change: the respondents are quick to point out that at Aberdare, like in any other company there is a resistance to change at times. However, Aberdare is effective in dealing with change. People are made to perceive
change as an opportunity, rather than a threat. Teams can be easily red to adapt quickly to new corporate needs.

4.2.2.1.3 Human Resources

With regard to teamwork the respondents indicated that the roles and jobs are designed to facilitate teamwork. The teams are self-managed, with only occasional reviews from the manager.

_Recruiting policies:_ Human resources at Aberdare are in continuous contact with the operative departments in order to be aware of their needs regarding new employees. Candidates are identified and selected by taking into account their initiative, leadership and technical skills.

_Training:_ A process is in place to ensure that the employees are high-skilled, knowledge resources, customer-driven, trainers and problem solvers. _Empowerment:_ Employees at Aberdare are empowered to take direct action when a problem occurs or an opportunity exists. Managers are perceived as facilitators. Data are accessible to the individuals or team that require information.

4.2.2.2 Categorisation of Technologies

The respondents indicated that the technologies are categorized at Aberdare as product and back office technologies. These are briefly discussed in sections 4.2.2.4.1 and 4.2.2.4.2.

4.2.2.2.1 Product Technologies

_Internal technologies:_ Aberdare has clearly identified its core competencies and
core service/products. Managers make sure that efforts are focused on strengthening and exploiting them.

**External technologies:** Technology gatekeepers have identified the external technologies included in the products, and made sure that none of them are of strategic importance.

**Basic technologies:** The basic technologies of the industry are clearly identified and maintained in a good competitive position.

**Technology trends:** Technology gatekeepers at Aberdare know the current standing and trends of the key process technologies that support the manufacturing process of the core products.

4.2.2.2.2 Back Office or Process Technologies

**Internal technologies:** Aberdare values the development of process technologies as much as the development of product technologies. Managers make sure that efforts are focused on strengthening and exploiting them.

**External technologies:** Technology gatekeepers have identified the external technologies included in the processes. They make sure that the latest developments are included in the processes to enhance the competitiveness of Aberdare. The basic technologies of the industry are clearly identified and maintained in a good competitive position.

**Technology trends:** Technology gatekeepers at Aberdare know the current standing and trends of the key process technologies that support the manufacturing process of the core products.

4.2.2.3 Markets and Competitors
**Competitor assessment:** Cross-functional teams are in charge of periodically assessing the core competencies, technological status and possible future capabilities of competitors.

**Benchmarking:** Aberdare periodically looks for the best practices related to its business, wherever they can be found. Internal processes and policies are compared with the benchmarks, and plans are developed to reduce the gaps. However, benchmarking needs some improvement at Aberdare since no standard known procedure is in place.

**4.2.2.4 Research and Development**

**Cross-functional teams:** Cross-functional and autonomous teams are used at Aberdare to plan, develop and implement new products, processes and/or services. Design for manufacturability is achieved through early involvement of all departments in the company. If, for example, the project involves production technology at Aberdare, the production manager and personnel, purchasing and accounts and technical people will be involved. Every new venture has a champion leading the effort.

**Portfolio justification:** The research and development portfolio is fully consistent with the corporate and technology strategies, with the maturity of the industry and with the core competencies of the corporation. There is a process to select new projects that will support the overall strategy and its congruency with technology priorities, acquisition and exploitation.

**Success/failure analysis:** Projects at Aberdare are analysed to identify and understand causes of success or of failure. Learning is documented and distributed within the company.

**4.2.2.5 Operations Improvement**

**Improvement:** There are measures related to all the important variables of the
processes. There is evidence of continuous improvement in those measures as Aberdare is able to reach economies of scale and economies of scope to satisfy market needs.

4.2.2.6 Acquisition and Exploitation of Technology

*Method of acquisition:* The technology acquisition options which include internal research and development, joint ventures, licensed in or purchase support the technology strategy at Aberdare. The decisions are based on the lifecycle position of the specific technology. Decisions take into account factors such as the company’s standing, urgency of acquisition, investment, lifecycle position and technology category.

*Capital investment:* Capital appropriations are analysed and approved based not only on financial statements but also on the competitive advantage they may create. At Aberdare such investments are approved at corporate level.

4.2.2.7 Technology Transfer

*Transfer procedures:* Aberdare has transfer procedures, which allow it to successfully transfer technologies from other institutions, i.e. companies, laboratories, and universities. When a new technology is acquired, people are also transferred to support the transfer process. At Aberdare, this includes consultants and engineers from other plants of Aberdare.

4.2.2.8 Exploration of Profit and Protection of Profit

*Exploitation for profit:* Procedures exist to ensure the optimal exploitation of technologies, whether in product or processes, contracting out manufacturing, joint venture or licensing out. The decisions are consistent with the overall technology strategy and the technology classification. The innovation process at Aberdare is a closed loop requiring that the knowledge be protected either by patenting, secrecy or other methods.
4.2.3 Results on Training and Development

The following is table 17 that presents some of the findings based on question 1 to 4 of Annexure A. Row 3 to 6 of the table present answers to questions. Each column per job category presents the number of respondents whose answer was either yes or no. The TOTALS column presents the sum of all the answers.

Table 17 Responses based on Question 1 to 4 of Annexure C

<table>
<thead>
<tr>
<th>Job Category</th>
<th>Clerical</th>
<th>Operational</th>
<th>Technical</th>
<th>Supervisory</th>
<th>Managerial</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answers</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Question 1</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Question 2</td>
<td>2</td>
<td>0</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Question 3</td>
<td>2</td>
<td>0</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Question 4</td>
<td>0</td>
<td>2</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>

Source: Author’s own compilation based on received data

Data on table 17 indicates that:

- 18 respondents out of 25 or 72% of them indicated that Aberdare offer some training courses to improve employee’s skills.
- 15 respondents out of 25 or 60% of them indicated that Aberdare involve them in developing the training plan that suits their needs.
- 15 respondents out of 25 or 60% of them indicated that Aberdare assess the training needs to determine which training is necessary for the employees.
- Only nine respondents out of 25 or 36% of them indicated that Aberdare offer some computer-related courses. However, all of them indicated that there are no computer courses on site. Individual departments decide if and when there is a necessity to send individuals to external institutions. According to these respondents, e-learning does not exist at the Aberdare training centre.

The respondents indicated that they attend between one to three courses per
Almost 50% of all the respondents including those interviewed for technology management believe that the current training and evaluation methods at Aberdare need improvement. The respondents also claim that the evaluation methods used to measure some understanding of the training material are insufficient. The current style of evaluation is to allow question from the trainees and that no questions indicates to the trainers that every trainee understands.

4.3 SUMMARY

This chapter presented the results of the study. Some shortfalls on TQM, technology management, training and development and best performances at Aberdare were identified. Chapter 5 will present some concluding remarks and recommendations based on these results.

CHAPTER 5

THE SYNOPSIS, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This is the final chapter of this research study. The topic of this chapter indicates that this chapter is composed of:

- a synopsis of the study
- conclusions and
The initial part in this chapter, namely the synopsis in section 5.2 covers the highlights of the entire study. Conclusions based on findings as presented in chapter 4 are discussed and the recommendations are made.

5.2 SYNOPSIS OF THE STUDY

The synopsis of this research study is presented in order of the topics as discussed in three sub-sections of chapter 2, namely:

- Total Quality Management
- Technology Management
- Training and Development

The flow of thought and argument is ensured throughout this chapter for ease of understanding.

5.2.1 Total Quality Management

The importance of total quality management in any organisation cannot be overemphasized. The research highlighted that TQM is the competitive tool in the business arena. The implications of overlooking its basic principles are severe.

In today’s business globalisation, all businesses that strive to be world class, or at least continue to retain and even expand their market share, would by no means compromise quality in any way, under any circumstance. Customers have a bargaining power and a wide choice of suppliers. The mental attitude of all managers should be that of acknowledging that businesses are not doing a favour to customers, but customers are doing businesses a favour. After all they are the reason for the existence of businesses. Therefore overlooking quality could result in the business going down the drain.
5.2.1.1 Top Management and Managers

Total quality is different from traditional means of quality control in that it involves everybody within the organisation. Every worker’s job becomes a quality control station. Workers are responsible for inspecting their own work, identifying any defects and reworking them into non-defectives, as well as correcting any causes of defects.

Top management of any organisation must play a leading role if everybody else is to play the game. It must not simply be a mere “talk of the town” within the organisation which only exist in the organisations policy documents. There must be a clearly defined TQM programme which is communicated to everyone in the organisation. Based on research results, it is clear that not everyone at Aberdare knows about TQM or gets enough training on it. Others knew about TQM through self-study.

Managers should recognise that quality comes before costs, before employees, before stockholders, before capital and before short-term profits. Quality for customers is top management’s primary business policy and should be as absolute as the company’s safety policy. Top management’s job is to ensure that everyone in the organisation complies with that. Operators at Aberdare are allowed to stop the machines if quality of the product is negatively affected by a fault on the machine. During such down-time a potential income is sacrificed for quality. In this way Aberdare recognises that quality comes before costs.

This commitment is part of a broad approach extending well beyond the accepted formalities of the quality assurance function. It creates responsibilities for a chain of quality interactions between the marketing, design, production operations, purchasing, distribution and service functions. Within each and every department of the organisation at all levels, starting at the top, basic changes of attitude may be required to operate TQM. If the owners or directors of the organisation do not recognise and accept their responsibilities for the initiation
and operation of TQM, then these changes will not happen.

Management by policy or management by improvement goals should be implemented. Committed management leads the organisation in continually developing organisational goals and methods for improvement, integrated for every level and function. A control system for monitoring each level and function should be tracked and followed up if out of control. Management must be based on facts and data. Measurements mechanisms should be developed and used. All key aspects of inputs, processes and outputs should be measured.

5.2.1.2 Customer First

It is clear that customers should be at the heart of the plans for any TQM programme. No organisation serious about quality would regard high production as a priority while quality is compromised. The marketing department must do a thorough market research in an effort to find out exactly what it is that the customer wants. This could even be encouraged through provision of customer feedback systems.

Managers who are serious about quality face the challenge of establishing an ongoing process that effectively measures the level of satisfaction customers are receiving from the products and services of the organisation. The information acquired through such efforts should be shared to every stakeholder within the organisation through various means of communication.

In addition to this, customer needs must be linked to the product development process. It should be inculcated in everyone’s mind that the employee in the next production process must be viewed as a customer, thus establishing an interlocking grid of internal customer-supplier relationships integrated to assure total quality to the end-use customer. The research results reveal that this concept needs to be emphasized to Aberdare’s employees.

5.2.1.3 TQM Environment and Human Resources
There should be a clean, safe and healthy climate conducive to production of good quality products. The psychological climate within the organisation must be such that employees feel secure and optimistic about the organisation’s chances of achieving perfection. Management must build a threat-free culture with open information exchange, a focus on attacking methods not people, support for using mistakes as learning opportunities, a commitment to using data for improvement, all in the context of reasonable employment security. A good psychological climate includes prevention of waste and assurance of safety. Safety and housekeeping also comes first at Aberdare.

As a means of eliminating waste, some organisations employ Just-in-time (JIT) techniques. JIT is a disciplined approach to improving overall productivity and eliminating waste. It provides for the cost-effective production and delivery of only the necessary quantity of parts at the right quality, at the right time and place, while using a minimum amount of facilities, equipment, materials and human resources. This approach, however, should be carefully planned and used only as it fits the needs of a particular organisation. There is no particular subscription that can be given to an organisation since JIT is not the “one size that fits all”, as it were. The researcher was informed that JIT at Aberdare is not implemented properly.

Regarding the human resources, the study emphasises that all human resource practices are carefully designed from the initial selection and placement, to career progression through the organisation, to rewards, recognition systems and performance appraisal systems. Employees should be regarded as a source of knowledge and therefore a feedback system must be organised to allow and encourage positive suggestions from all the employees. Employees at Aberdare are encouraged to make suggestions. There are also rewards and recognition for best performers. However, some respondents claim that their efforts are not being recognised and rewarded.

Management establish a constructive relationship with the unions through
communication processes, role clarity, expectations and joint goals. Empowered teams are valuable in an TQM programme, and therefore teams should be carefully designed and managed. Work teams may be more successful in achieving organisational goals if their members are empowered or given authority and responsibility to do their jobs.

5.2.1.4 Communication and Culture for TQM

Another critical aspect that contributes to successful TQM programmes is communication. Communication takes the form of:

- informal communication which promotes flexible two-way communication that builds strong interpersonal relationships with a diverse range of people.
- formal communication which keep people up-to-date of activities and events
- negotiation which involves effective negotiation on behalf of a team over roles and resources.

Communication should not only be top-down but a two way communication should be encouraged by all means. Communication is open at Aberdare. Unions are consulted on some quality related issues. This research study also highlighted the need for a good TQM cultural environment. Quality information must be used for improvement, not to judge or control people. This is the norm at Aberdare. Quality information is never used to judge people.

There must be rewards for results and compensation should be equitable. Employees should exercise cooperation, not competition and that must be the basis for working together. Employees must have secure jobs. There must be a climate of fairness. Employees should have an ownership stake. Some employees at Aberdare feel that their jobs are not secure owing to restructuring within the company.
5.2.1.5 Development of Reliable Methods

The study highlighted that the development of reliable methods and their application in all organisational processes could be achieved if everything is treated as a process to be understood, standardised, controlled, and then continually improved. The best known method should be followed as standard procedure until a better method is found. Operations should be mistake-proofed to guard against the likelihood of human error.

A method of procedures and methods analysis should be designed. It is always best to study the current processes, involving all the stakeholders and using the necessary tools and techniques to develop reliable working procedures. This should be followed by training of employees before the installation of new methods. The new methods should be monitored and improved, if necessary.

5.2.1.6 Continuous Improvement

The study revealed that small improvements must be encouraged, not just large “breakthrough” steps because:

- small improvements are more attainable
- momentum and involvement are maintained
- ownership at all levels is encouraged
- the “big brain” focus is avoided.

One very popular, although less “day-to-day” method for senior managers to drive organisational improvement, is to establish operational benchmarks. Benchmarking can be done internally and externally. By highlighting how key operational elements ‘shape up’ competitors, key areas for focused improvement can be identified. This can be enhanced through the employment of the Plan-Do-Check-Act cycle.
5.2.2 Technology Management

Fierce global business competition demands that companies keep abreast of new developments and applications in technology. This is essential if companies are to meet market demands profitably and keep ahead of their competitors. Whatever the specific strategic intent of the firm or the exact functionality of the technology, the significant amounts of invested capital in such systems must reflect a managerial belief that they offer a response to both competitive pressures and customer demand for high-quality products and services.

5.2.2.1 The Source of Competitive Advantage

Technology can be considered as the single most important differentiating factor that enables firms in today’s fast-changing technological environment to achieve competitive advantage within their chosen market industry. It can increase automation, which in conjunction with centralisation, can produce significant economies of scale. It is thus helping the company to be better than its competitors. Technology may also help an organisation to improve its decision-making performance. All these benefits require that organisations have a good technology strategy, and that is what Aberdare is proud of.

5.2.2.2 Technology Strategy

Technology strategy is defined as the revealed pattern in the technology choices of firms. The choices involve the commitment of resources for the appropriation, maintenance, deployment and abandonment of technological capabilities. These technology choices determine the character and the extent of the firms’ principal technical capabilities and the set of available product and process platforms. Technology strategy identifies the contribution of technology to the competitive advantages pursued and the means to increase that contribution. Different technologies offer different benefits with regard to productivity, quality, flexibility and timeliness. Technology strategy focuses on the kinds of technologies that a
firm selects for acquisition, development of resources, deployment or divestment.

Technology strategies are not confined to high technology industries. Even a capacity-driven industry or a customer-driven industry requires a technology strategy. Such strategies may be implicit and may not reflect the conscious decisions by executives, but nonetheless they determine the choice of technical capabilities and available product and process platforms of the firms.

Strategic implementations include detailing actions that need to be followed and designating the functional units responsible for implementing operational actions and strategic actions and strategic projects. This component of strategic management deals with tactics and systematic planning.

5.2.2.2.1 Developing Technology Strategy

When developing new strategies for technology, the focus must be on one technology at a time to eliminate any possibility of confusion. Technology and operational processes must be developed in conjunction with each other, to help reduce lead-time and therefore increase productivity of the organisation. Aberdare processes are also developed in conjunction with technology.

The development of new technology becomes more attractive when it can be exploited in a global arena, adding new markets to the organisation’s market portfolio. The size of the organisation will determine the degree to which the above tasks will be used to gain or maintain an advantage from a technology edge.

5.2.2.2.2 Technology Strategy and the Manager

A key responsibility of operations managers, if they are to carry out ‘their impresario role’ within the organisation, is to have a grasp of the technical nature of process technologies. This does not necessarily mean that operations
managers need to be experts in engineering, computing, biology, electronics, or whatever is the core science is on which the technology is based. Tracking technological changes in the environment requires managers to penetrate the organisations and networks that conduct and facilitate technology development and leadership.

In 1999, a study of firms classified as technology leaders in four different industries, namely automotive; chemicals and plastics; computers and electronics and telecommunications equipment, revealed that these firms were not only more profitable than their competitors but also performed better in terms of revenue growth. These firms were able to either price their innovative products higher or produce them at a much lower cost or, in some cases, do both. It was also found that these technology leaders excelled in the four key areas of technology management: Technology strategy, technology portfolio management, technology planning and technology development and transfer processes.

Furthermore, another highlight is that among these firms, technology strategy played an important role in enabling them to achieve their leadership positions as well as develop substantial and sustainable advantages in the industry that were difficult to replicate.

5.2.2.3 Strategic Identification of Core Competencies

A core competence is an activity or a process that gives an advantage because it fundamentally underpins the value in the product, is performed better than competitors and is difficult for competitors to imitate.

At least three tests can be applied to identify core competencies in a company. Firstly, a core competence provides potential access to a wide variety of markets. Secondly, a core competence should make a contribution to the perceived customer benefits of the end product. Finally, a core competence should be difficult for competitors to imitate.
5.2.2.4 Strategic Selection of New Technology Projects

Technology projects include engineering projects, development projects, continuous improvement of products and production processes, etc. The more radical a proposal, the more likely it is that it will require the application of knowledge and skills new to the company. Their acquisition involves more than the allocation of financial resources. It takes time and may necessitate preliminary applied research to validate the feasibility of the proposal. A sound technological base must be established and there must be a reasonably high level of confidence before a more detailed proposal is submitted.

5.2.2.5 Funding of New Technology Projects

Decisions on this could be important in enabling strategic success through technology. For example, at one extreme, new technologies are best assessed and funded corporately whilst at the other, incremental product and process improvements are best undertaken and funded locally. Between these extremes, the commercialisation of new technologies is often best done locally but funded corporately since others will learn and benefit from first moves. Experimentation with new technologies might remain corporate but funded by divisions who see commercial potential in the arena.

5.2.2.6 New Tools for Optimizing Strategic Decisions

Because of technological discontinuities, adaptive models providing for the continuous evaluation of prior assumptions are required in lieu of methods based on the extrapolation of past data. Secondly, classical optimisation methods rely on performance measures such as return on investment (ROI), return on sales (ROS) and price/earnings ratio (PER). In recent years, corporate managers have become better sensitised to the limitations of these measures and management should be more cautious in using strict, tangible, financial justification models in evaluating technological projects. Both tangible and intangible criteria are needed for the optimisation of decisions.
5.2.2.7 Technology Strategy and Culture

Five cultural traits of innovative organisation had been identified. These include:

- **Enthusiasm for Knowledge.** Both managers and people who are involved in the organisation must be information seekers who believe that perhaps the fundamentally most important skill is the ability to learn.

- **Drive to stay ahead in knowledge.** This means staying knowledgeable about the latest developments in technology.

- **Tight coupling of complementary skill sets.** This refers to simultaneous attention to both developing deep reservoirs of knowledge and skill in special capabilities and having a plan to diminish the boundaries between disciplines. The flow of knowledge from research organisations into product development whether the researchers reside inside a firm’s laboratories or are outside entities such as think-tanks or national laboratories should be enabled.

- **Alteration in activities.** This reflects the comprehension of the fact that activities are never completely perfected. There is a continual re-examination of assumptions through experimentation and further divisions.

- **Higher order teaming.** There is continual self-examination to discover insights within one activity that may be transferred to other activities within the firm.

5.2.2.8 Strategic Recruitment of High Technology Personnel

One of the most important policies that managers of a high technology company must establish concerns the recruitment of new personnel. In view of the critical role the human factor plays in high technology, management should strive to get
the best people for every job in the company. The most critical capability in high technology industries is knowledge, and because knowledge resides in people, managers cannot expect to achieve a long-term competitive advantage if they compromise the quality of people recruited.

Creative people will be attracted to those companies that themselves are viewed as creative. Top scientists will seek employment from those companies which have a reputation for innovation and scientific excellence.

Organisations should try to build an environment that tolerates errors and mistakes. This will encourage people to try new ideas and put forward suggestions. Many organisations suffer from an inability to implement changes and new ideas, even after rewarding the people involved in developing the new idea. This leads to increased frustration. Once a product idea has been accepted, it is important that it is carried through to completion. All of the proceeding activities will help contribute to increased morale within the organisation.

5.2.2.9 Strategic Collection of Intelligence

Technology intelligence activities are evaluated in terms of formulation of information needs, selection of information sources, data collection and evaluation, storage and communication of information. The organisation must monitor the developments in the field of their existing technologies and monitor technologies planned for the future. Technology identification is the first sub-process of the technology management process. Identification and evaluation of the technologies that may have a significant influence on the organisation’s current and future activities is the primary objective of technology intelligence activities.
Technology intelligence provides important information for strategic decision-makers. It should also challenge the current technology strategies by bringing fresh points of view into the organisation. The technological information is often intrinsically interesting, but the primary goal is the generation of information, not for its own sake, but information that is of use in determining and managing a firm’s strategies.

5.2.2.9.1 Learning Competitors’ Strategies

In addition to collecting information on competitor’s products and closely following their moves in local and foreign markets, companies also need to learn and thoroughly understand the strategy of their market adversaries. Firstly, management must analyze the competitor’s strong and weak points, much as they did for their own company. Secondly, managers should learn from the long-term behaviour of the competitor, analyze and understand the trends. Where the competitor was, where it is, and where it is going are among the pertinent questions that must be asked and answered as accurately as possible.

5.2.2.10 Technology Strategy: Superior Performance Characteristics

Effective mechanisms should be in place to integrate technology and business strategy and to coordinate the activities of technology-related organisations and work groups. All affected functions should be involved in a strategy formulation process. The appropriate skill mix should be available to develop and implement strategies effectively. This means that the process is not dominated by technocrats and adequate levels of technical competence are found at the executive management level. Clear responsibility for technology management is allocated.

There should be a regular assessment of technical capabilities and technology
management processes via benchmarking of products and processes. There should be a proactive long-term management of technology and technical functions. Opportunities and threats should be actively explored, using a well-developed network of customers, suppliers, universities, government agencies and rivals. All structures should be aligned to support the business technology strategies identified.

5.2.2.11 Critical Factors for success in Technology Management

Some identified critical success factors in Technology Management include:

- **Innovation** which he refers to as the main feature of high technology.
- **The human factor.** Extremely important in the management of any organisation because technology based on innovation depends on engineers, scientists, mathematicians, and other professionals.

- **The organisation factor.** Most companies need to change and adapt their organisations over time, but the pace in the high technology sector requires a much faster and more dynamic matching of the organisational structure to the changing needs of a company as it grows from start-up to a mature, diversified firm.

- **Management competence factor.** A certain degree of professionalism is required to manage any type of organisation successfully.

- **Know-how factor.** A prerequisite for business success in the high technology sector.

5.2.3 Training and Development

Training refers to improving an employee’s skills to the point where he or she can do the current job more effectively. The principal aim of training is to contribute to an organisation’s overall objectives. However, in many instances such objectives have not been clearly formulated, training programmes are never evaluated and
it seems that behaviour changes do not form part of the Human Resources Development (HRD) effort

The basic training format has three phases, namely:

- Needs assessment
- Training
- Evaluation

5.2.3.1 The Needs Assessment Phase

Successful training begins with a needs assessment to determine which employees need to be trained and what they need to be trained to do. Training needs assessment is an investigation which is undertaken to determine the nature of performance problems in order to establish the underlying causes and how these can be addressed by training.

Although many departments contribute data, the majority of the information is gathered from the human resource area. Information regarding employee skills and demographic information is compiled as well. This fragmentary information, coupled with general statistics such as typical retirement age and average age of mortality, often provides clues to training needs. Learners are often the best experts at realising their own needs for self-development. Therefore, learners should be involved as much as possible in developing the plan. It is also highlighted that needs analysis requires time, money and expertise.

5.2.3.2 The Training Phase

In order to ensure the success of the training programme, appropriate training methods must be selected and suitable training materials developed to convey the required knowledge and skills identified in the training objectives. The necessity of understanding how people learn in order to design an effective training programme cannot be overemphasized. An on-the-job-training is the
most popular training method used by many companies. This kind of training involves having a person learn a job by actually performing it. Although on-the-job-training is cost efficient and easily administered, it does pose some problems:

- When trainees are using equipment for learning purposes, productivity is diminished as experienced workers cannot use machinery while it is being used for training.

- Trainees are more likely to damage equipment, waste materials and have significantly a higher accident rates.

- Instructors are either supervisors or experienced production workers. In either case, the trainer may not have the teaching abilities, interest, or time necessary to spend training workers.

These conditions could produce anxious, frustrated employees who, through no fault of their own, are incapable of performing satisfactorily.

The study highlighted that for successful On-the-Job-Training programmes, the trainer themselves should be carefully trained and given the necessary training materials. Experienced workers who are chosen to be trainers should be thoroughly trained in proper methods of instruction in particular the principles of instruction, the principles of learning and job instruction technique.

5.2.3.2.1 Systematic Approach to Training for Quality

Responsibility for the training of employees in quality rests with management at all levels and, in particular, the person nominated for the co-ordination of the organisation’s quality effort. Quality training will not be fully effective, however, unless responsibility for the quality rests clearly with the Chief Executive.

The main elements of effective and systematic quality training may be
considered under four broad headings:

- **Error, Defect and Problem Prevention:** This calls for an issued quality policy; a written management system; job specification that include quality requirements; effective steering committees, including representatives of both management and employees; efficient housekeeping standards; and preparation and display of maps, flow diagram and charts for all processes.

- **Error, Defect and Problem Reporting and Analysis:** It will be necessary for the management to arrange the necessary reporting procedures and ensure those concerned are adequately trained in these procedures.

- **Error, Defect and Problem Investigation:** The investigating of errors, defects and problems can provide valuable information that can be used in their prevention. Investigation should include investigating the nature of the problem; date, time and place; product/service with problem; description of a problem; causes and reasons behind the causes; action advised; action taken to prevent recurrence.

5.2.3.2.2 Review of Training for Quality

Reviewing the effectiveness of quality training programmes should be a continuous process. However, the measurement of effectiveness is a complex problem. One way of reviewing the content and assimilation of a training course or programme is to monitor behaviour during quality audits. This review can be taken a stage further by comparing employees’ behaviour with the objectives of the quality training programme. Other measures of the training process should be found to establish the benefits derived.

5.2.3.2.3 Education and Training for Technology
The current educational system structure, particularly at the university level, is viewed as rigid and unable to change to meet the demands of the changing world environment. A change in formal education style is required. A style that fosters free thinking, creativity, innovation and interdisciplinary flow, rather than compartmentalisation of thoughts, is needed. New disciplines such as knowledge infrastructure engineering should emerge.

The explosion of knowledge will require life-long learning experience. There will be a need for more technological and managerial education for all managers. Virtual universities and electronic teaching methods will increase in number, size and popularity. Virtual laboratories will be created. The challenge is how to harness the new technology in education to optimise learning and deliver quality, cost-effective education to the public at large, as well as how to satisfy industry’s needs for a highly skilled, technologically literate workforce.

5.2.3.2.4 Training for Safety

Training is an important factor in ensuring that work is conducted in a safe manner. The focus of responsibility has shifted over the years. For employers, there has been a shift from compliance with detailed regulations towards a more general duty to ensure premises, products and working practices. Each process must be studied for safety implications. The process should be designed to be safe as possible and workers should be trained accordingly. During training ongoing feedback and support should be provided, even if things seem to be going fine. Trainers must be sure to stop in and visit the learner on a regular basis.

5.2.3.3 The Evaluation Phase

The purpose of this phase is to determine the extent to which the training activities have met the stated objectives. It is the last phase in the training process. The basic approach to evaluation should be to determine the extent to which the training programme has met the learning objectives identified prior to
the training. Planning for evaluation should commence at the same time that planning for the training programme begins.

It was further highlighted that to simplify the evaluation procedure requires that the evaluation process be broken down into four logical steps, namely:

- **Reaction**: The standard procedure is to administer an evaluation form to each participant at the conclusion of the training programme. These evaluation forms typically require trainees to rate on a bi-polar scale both the trainer and the material taught. In addition, trainees are given an opportunity to subjectively provide any additional reactions or recommendations.

- **Learning**: If the material to be learned can be measured through paper-and-pencil testing, then this type of format should be employed. If, on the other hand, other skills were to be mastered, appropriate ability measures should be developed to assess them. Getting feedback from the learner's peers and subordinates about the learner's needs and progress to meet those needs should be considered. A 360-degree performance review is a powerful practice when carried out with clarity and discretion. When first carried out, it may be wise to get the help of an outside professional.

- **Behaviour**: Evaluating this phase requires that before and after measures be established. If training has the desired effect, then there should be a significant difference in the work performed before and after training.

- **Results**: The final phase of the evaluation process is concerned with the overall impact training has on the organisation. Training may have increased individual productivity, but the cost of the total effort may have been excessive. Furthermore, the training may have had significant personal gain for the worker but too little, if any, for the company.
The four-step evaluation is an important tool for determining the usefulness of the training endeavours. Realistically, however, most companies judge training effectiveness solely on the trainees’ evaluation of the programme.

5.3 THE CONCLUSIONS

The research has been conducted, data collected and analyzed and results presented in chapter 4. Based on these results the conclusions are presented in the following sub-sections.

5.3.1 Conclusions: Total Quality Management

The concept of total quality management at Aberdare is not known by some employees. There has been conflicting reports that the majority of respondents claim that a TQM programme does exist at Aberdare. Some respondents, of whom two are Production Management students at Technikon, and one respondent from quality department, claim that it does not exist. However, the great majority of the respondents claim that the TQM programme at Aberdare is not implemented effectively.

The researcher noted that some respondents remarked that JIT is not implemented properly and benchmarking needs some improvement. Other points noted are that:

- Only nine respondents out of 23 or 39% of those who know TQM were actually trained on it by Aberdare. The rest were never trained. The rest revealed that they knew TQM through self-study, and these include all four supervisors who participated as respondents.
- 14 respondents out of 25 or 56% of them indicated that they get rewards and recognition for best performance in their job. Some of these even remarked that they only get paid to do their job.
Only 6 respondents out of 25 or 24% of them indicated that there are promotion opportunities in their departments.

Correction action requests presented in chapter 4 do not reflect the spirit of TQM.

Lawrence and Pasternack (2002:12) warn that some managers and employees can naturally be expected to provide some distorted or incomplete information, avoiding providing negative information that would show their division to be inefficient. It is a political reality that must be recognised. Therefore, owing to the fact that few employees were trained on TQM and others knew TQM through self-study, the researcher is not too sure whether these respondents can differentiate between the traditional quality assurance performed by a quality department and a formal TQM programme.

Naturally, one would expect the two respondents who are students at Technikon and the one from the Quality Department who were trained on TQM to recognize whether a TQM programme exists at Aberdare or not and actually believe their claim, based on other issues already observed. However, whatever the actual truth is the researcher concludes that if the TQM programme exists at Aberdare, it is not implemented optimally. The hypothesis that principles of total quality management are not implemented optimally at Aberdare for competitive status is therefore accepted.

5.3.2 Conclusions: Technology Management

Regarding technology strategy the researcher concludes that Aberdare is doing very well. The company’s R&D department manages technology in an impressive manner that is in harmony with Aberdare’s corporate strategy. Technology managers at Aberdare are following the trends of technology. However, more can be done about the company’s strategy in collecting technology intelligence and improving benchmarking. Perhaps this could help the company employ technologies such as video conferencing and cybertrade to enhance business processes. The hypothesis that principles of technology
management are not implemented optimally at Aberdare for competitive status is therefore accepted.

5.3.3 Conclusions: Training and Development

The researcher took note that some respondents claim that they do not get the training they need to improve their skills. Some claim that their training needs are not being assessed and that they never get involved in the planning of their training requirements. All the respondents indicated that there is no computer training or e-learning offered at site. Based on these findings, the researcher believes training at Aberdare is not conducted optimally. The hypothesis that training and development of employees at Aberdare need some alignment to support TQM and Technology Management Principles and hence the competitive advantage of Aberdare is accepted.

5.4 RECOMMENDATIONS

Conclusions are made and this section deals with recommendations. The recommendations are presented in the sub-sections below.

5.4.1 Recommendations: Total Quality Management

It would be very difficult, if not impossible, for an outsider to install TQM in a particular company as the situations are unique and no one TQM programme can fit all organisations. This means that involvement of the stakeholders at Aberdare is crucial.
If a TQM programme does not exist at Aberdare, TQM principles on section 2.1 of this study could serve as the basis to build one. However, if it does exist, then it is recommended that proper steps be taken to implement it optimally:

- Top management should take responsibility for this and empower all employees with necessary skills as well as define and construct a good environment and culture for TQM. Naturally people tend to resist change, therefore management will need to acquire and use change management skills.

- To define and construct a good TQM culture CEO and executives, union members together with employees from various departments at different job levels should be involved in a study group which will examine the entire organisation. The aim of this group should not be simply to tell the employees what to do, but to find out from them what problems they encounter that could be affecting quality. This should be a serious study and not just meetings to discuss basic quality issues. Of course, all employees should be informed about the intentions and aims of this group before the study so that nobody will wonder or have suspicions when the study commences. During the study, both quantitative and qualitative measures should be employed. In this case no sample will be necessary since everyone should get involved even though not all should be part of the study group. Assistance from an outside professional consultant could be valuable in this case.

- Once the culture has been defined and the TQM programme to be implemented decided upon, all employees should be trained on TQM principles. A TQM programme should then be installed and monitored in order to debug it when necessary.

- An atmosphere of fairness should then prevail where all individuals are recognised and rewarded for best performances. This would keep the TQM spirit as described in section 2.2 glowing.
5.4.2 Recommendations: Technology Management

As mentioned earlier, Aberdare is stronger on technology management in terms of strategy. Section 2.4 of this study highlighted that technology strategy has a bearing on identifying both product and process and tracking trends of technology. Aberdare does that; however, the researcher noticed during research that Aberdare does not use video conferencing for communication purposes in meetings. Employees physically go to attend meetings in a particular venue, sometimes at other plants.

Video Conferencing is one of the technology tools used by major companies today to save costs and improve communication. It provides a degree of interaction only previously available face to face.

Now multi-conferencing enables one to have a video conference with multiple sites simultaneously, automatically switching the video picture according to the active speaker at any time. Multi-conferencing has many advantages as it:

- Creates the feeling that all parties are sitting around the same table, in the same room, involved in the same meeting.
- Allows critical decisions to be made quickly, collaboratively and effectively.
- Saves time and money through reduced travel requirements and reduces the associated stress and physical risks.
- Improves communications within and between organisations: meetings over long distances can be held more often and arranged at very short notice. It is reliable and easy to use.
- Saves capital outlay and maintenance on expensive video conference multipoint equipment; an affordable service is provided on a usage basis.
- Automatic Voice Activation ensures the current speaker's image is always displayed at all sites.
Multi-Site Viewing allows between two and nine sites to be seen simultaneously without changing any of the video conferencing equipment.

Telephone Add-In means that participants who cannot make it to their conference venue can still participate telephonically and have audio interaction in both directions. Lecturer Mode allows a speaker to address a number of sites simultaneously but without interactivity being enabled (http://www.telkom.co.za/portal/page?_pageid=554,56935&_dad=portal&_schema=PORTAL).

CyberTrade is an electronic commerce product addressing the high-end business-to-business market, the medium to low-end business-to-business market and the business-to-consumer market. Access is via analogue or ISDN dial-up, leased line or satellite facilities into a closed, high performance 'gold standard', secure, redundant, auditable countrywide IP-based network.

The product serves as a facilitator for secure banking transactions, including e-commerce payments via a payment gateway. CyberTrade offers an e-mail and web hosting facility to all registered users, plus optional access to the Internet. CyberTrade's rating engine allows for rating customers, for log-on sessions as well as for the time spent on the system.

Features and benefits of CyberTrade include:

- CyberTrade can be accessed from anywhere in the country by dialling an 0860 number; therefore the customer only pays the cost of a local call.

- CyberTrade is managed and monitored end to end allowing for a 75% threshold on bandwidth capacities and modem usage to be upheld. This results in the following:
  
  o The speed of the network is faster than the Internet, saving time and money for customers.
  
  o Security can be guaranteed; numerous security measures can be implemented, thus giving customers peace of mind.
Response times are much quicker and can be predetermined.

Access and transaction attempts are tracked therefore fraud can be detected early.

Customers can access the Internet but people on the Internet cannot break into CyberTrade.

CyberTrade is clean of pornography and other offensive material and can thus be used by children.

Businesses can enrich their intranets through a link from their intranets to CyberTrade (http://www.telkom.co.za/portal/page?_pageid=554,56935&_dad=portal&_schema=PORTAL).

This kind of knowledge can enhance the value chain of the company and could be sourced and made available through technology intelligence. The researcher recommends that the company should have a group of people whose focus would be on collecting technology intelligence. Technologists, engineers and marketing individuals can work together on this, as explained in section 2.4.

5.4.3 Recommendations: Training and Development

The training department should take a lead in and be keen on knowing the latest technologies used for educational purposes like e-learning which could be taken advantage of by all employees as it happens in the company where the researcher works. Virtual campus, as the system is called, allows employees at their own time and pace to study and complete courses ranging from aids, IT, engineering etc. The system evaluates the employees and when the course has been completed, the system awards a certificate to the employee. This will, however, need basic computer courses including Internet knowledge if employees are to succeed in it.

Training department employees and all those involved in on-the-job training must be thoroughly trained as facilitators. Section 2.6 of this study discusses some
basic points they should be aware of. Based on knowledge of the product technologies used, the training department should design some courses that cover the construction of cables and the significance of each component of the different types of cables produced. These courses may then be improved continuously as needed.

REFERENCES


Modeling, Spreadsheet Analysis, and Decision Making. (2nd ed.). USA: John Wiley & Sons, Inc.


Telkom Business Products and Services Available:


ANNEXURE A

QUESTIONNAIRE
(Quantitative Research)

Thank you for your participation in this MBA research project. You do not have to identify yourself or your department. The information you provide here is only for study purposes which may improve working conditions in future. Your identity will not be revealed by the researcher. Please answer the following questions as honest as possible. If a question is not applicable in your particular work environment, please answer it based on your knowledge of what is happening in your company. Please mark your answer with X. If you have additional comments for any question, you may write your comment in the space provided.

For research purposes, please indicate which type of job you are doing by choosing the occupation that best suits your position below:

<table>
<thead>
<tr>
<th>Occupation</th>
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<tbody>
<tr>
<td>Clerical / Commercial</td>
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<tr>
<td>Operational</td>
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<tr>
<td>Technical</td>
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<tr>
<td>Supervisory</td>
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<td>Managerial</td>
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Total Quality Management

Total Quality management (TQM) is more than just a mere quality assurance / control. Please answer questions below by choosing the most applicable answer.

1. Do you know what TQM is all about? 
   [ ] YES  [ ] NO

2. If your answer above is yes, did Aberdare train you on TQM? 
   [ ] YES  [ ] NO

3. If you know TQM, does Aberdare have a TQM programme? 
   [ ] YES  [ ] NO

4. If Aberdare has a TQM programme, do you think the programme been implemented effectively? 
   [ ] YES  [ ] NO

5. Are machine operators authorized to stop the machine without asking for permission from superiors when some production fault affects quality? 
   [ ] YES  [ ] NO

6. Does Aberdare encourage workers to make suggestions by placing suggestion boxes in the factory where employees can put their written suggestions for improvement of quality and safety in the workplace? 
   [ ] YES  [ ] NO

7. Are there any visible charts in your working environment, which are used to record your
standard of performance in **housekeeping** so that everyone knows when the standard is achieved or vice versa?

8. Are there any visible charts in your working **environment**, which are used to record your standard of performance in **quality** so that everyone knows when the standard is achieved or vice versa?

9. Do you use a computer to do some of your job activities?

10. If you do use a computer, do you have access to the **Internet**?

11. Do you get rewards and recognition for best performance in your job?

12. Does Aberdare have job promotion opportunities in your section?

13. To what extent does top management of your company set an example by taking the lead in quality improvement?

14. To what extent does Aberdare encourage teamwork where team leaders take the lead to meet specific objectives related to jobs and quality?
15. To what extent do you think the job processes and activities at Aberdare are designed to allow every employee to improve quality?

Great extent | Less extent | Not at all

16. To what extent are customer needs explained to every employee so that not only marketing department staff know the customer needs?

Great extent | Less extent | Not at all

17. At times companies retrench people to solve some management problems. To what extent do you feel that your job at Aberdare is secure?

Great extent | Less extent | Not at all

18. On average how many faulty cables need to be re-worked on, in a one month period? (Choose the correct answer below by marking the corresponding range):

1 to 5
6 to 10
11 to 15
More than 15

19. On average how many cables are scrapped in one-month period? Choose the correct answer below:

1 to 5
6 to 10
11 to 15
More than 15

20. On average how many cables are returned to Aberdare by the customers
owing to bad quality or a fault? Choose the correct answer below:

<p>| | | |</p>
<table>
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<tbody>
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<td>1 to 5</td>
<td></td>
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<tr>
<td>6 to 10</td>
<td></td>
<td></td>
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<tr>
<td>11 to 15</td>
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<tr>
<td>More than 15</td>
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</table>

21. Which one of the following statements is the reflection of the real situation at Aberdare? (Choose answer by marking one of the spaces provided with X).

<table>
<thead>
<tr>
<th>Statement</th>
<th></th>
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<tbody>
<tr>
<td>Quality is every worker’s responsibility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality is Quality Department worker’s responsiblity</td>
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<td></td>
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</table>

22. If your job depends on other workers’ jobs to be done, do those workers treat you as a customer by giving you good quality service?

<p>| | | |</p>
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<thead>
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<th></th>
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<tbody>
<tr>
<td>Always</td>
<td>Sometimes</td>
<td>Never</td>
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........................................................................................................................................................................
ANNEXURE B

QUESTIONNAIRE USED AS INTERVIEW GUIDE
AND AUDIT CHECKLIST

Company: ……………………………………………
Interviewer:…………………………………………
Respondent(s)’ Occupation:……………………
Date:………………………………………………….Time……………………………

Technology Management

1. Does Aberdare have a team designed to specifically keep track of the latest technology developments relevant to the company?

   YES  NO

   ……………………………………………………………………………………………
   ……………………………………………………………………………………………
   ……………………………………………………………………………………………

2. When new technology is to be adopted / bought by the company, does the technology management team involve all stakeholders in the new technology planning stage, including operators in the case of a new machine?

   YES  NO

   ……………………………………………………………………………………………
3. Does Aberdare’s technology management team invest a significant effort in learning to understand technologies important to the company’s business?  

YES  NO

4. Does management view technology as a means of gaining a competitive advantage?  

YES  NO

5. Is technology management linked to business strategy so that the company is willing to invest money and time to adopt new technology that would enhance competitiveness at Aberdare?  

YES  NO

9. Does Aberdare have intranet?  

YES  NO

10. Does Aberdare make use of cybertrade?  

YES  NO
11. Do Aberdare employees use videoconferencing for meetings?

12. How many employees have access to the Internet at Aberdare? To be specified here_______

13. How many employees have e-mail addresses at Aberdare? To be specified here_______

AUDIT CHECKLIST (continued)

<table>
<thead>
<tr>
<th>Assessment areas</th>
<th>Elements</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning organisation</td>
<td>The organisation is skilled at creating, acquiring, and transferring knowledge, and at modifying its behaviour to reflect new knowledge and insights. The organisation has established methods for systematic problem solving, experimentation with new approaches, learning from its own experiences (both successes and failures) and most successful practices of others, and transferring knowledge quickly and efficiently throughout the organisation. Lessons are documented and distributed throughout the organisation.</td>
<td>Poor</td>
</tr>
<tr>
<td>Communication</td>
<td>There are no organisational barriers threatening the communication top-down, bottom-up, and horizontally. Ideas and concerns can be freely expressed. Information is made</td>
<td>Poor</td>
</tr>
</tbody>
</table>
available to whoever might need it. The organisational structure is not a barrier when trying to communicate with top management levels.

- **Management of change**: The organisation is effective in dealing with change. People perceive change as an opportunity, rather than a threat. Teams can be easily reorganised to adapt quickly to new corporate needs.

- **Recruiting policies**: Human resources are in continuous contact with the operative departments to be aware of their needs regarding new employees. Candidates are identified and selected by taking into account their initiative, leadership, and technical skills.

- **Training**: A process is in place to ensure that the employees are high-skilled, knowledge resources, customer-driven, trainers, and problem solvers.

- **Empowerment**: Employees are empowered to take direct action when a problem occurs or an opportunity exists. Managers are perceived as facilitators. Data are accessible to the person/team that requires information.

- **Reward system**: The reward system takes into account the different motivation factors for managers, engineers, scientists, and entrepreneurs, as well as the flexible nature of the organisation.

<table>
<thead>
<tr>
<th>Poor</th>
<th>Outstanding</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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### People

1.5 People

*Employees are considered to be and treated as the company's most important assets. All levels of management uphold a commitment to treating people with respect and fairness.*

<table>
<thead>
<tr>
<th>Poor</th>
<th>Outstanding</th>
<th>1</th>
<th>2</th>
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<tbody>
<tr>
<td>Assessment areas</td>
<td>Elements</td>
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<tr>
<td>2.1 Service/product technologies</td>
<td>** Technologies categorisation**</td>
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<tr>
<td></td>
<td>• Internal technologies: The corporation has clearly identified its core competencies and core service/products. Managers make sure that efforts are focused on strengthening and exploiting them.</td>
<td>Poor  Outstanding</td>
<td></td>
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<tr>
<td></td>
<td>• External technologies: Technology gatekeepers have identified the external technologies included in the products, and made sure that none of them are of strategic importance. The system must be able to identify any important technology and develop it in-house before it becomes a competitiveness factor. There are established systems to forecast future developments.</td>
<td>Poor  Outstanding</td>
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<tr>
<td></td>
<td>• Basic technologies: The basic technologies of the industry are clearly identified and maintained in good competitive position. There are established systems to forecast future developments.</td>
<td>Poor  Outstanding</td>
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<tr>
<td></td>
<td>• Technology trends: Technology gatekeepers must know the current standing and trends of the technologies behind the core competencies. There are established systems to forecast the future developments.</td>
<td>Poor  Outstanding</td>
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<tr>
<td>2.2 Back office/process technologies</td>
<td>• Internal technologies: The organisation values the development of process technologies as much as the development of product technologies. Managers make sure that efforts are focused on strengthening and exploiting them.</td>
<td>Poor  Outstanding</td>
<td></td>
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<tr>
<td></td>
<td>• External technologies: Technology gatekeepers have identified the external technologies included in the processes. They make sure that the latest developments are included in the processes. There are established systems to forecast future developments.</td>
<td>Poor  Outstanding</td>
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<tr>
<td></td>
<td>• Basic technologies assessment: The basic technologies of the industry are clearly identified and maintained in good competitive position. There are established systems to forecast future developments.</td>
<td>Poor  Outstanding</td>
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<tr>
<td></td>
<td>• Technology trends: Technology gatekeepers know the current standing and trends of the key process technologies that support the manufacturing process of the core products. There are established systems to forecast future development.</td>
<td>Poor  Outstanding</td>
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</table>
AUDIT CHECKLIST (continued)

<table>
<thead>
<tr>
<th>Assessment areas</th>
<th>Elements</th>
<th>Rating</th>
</tr>
</thead>
</table>
| 2.3 Technology in marketing           | • *Innovation in marketing*: The company develops sound and aggressive marketing plans to better capitalise on the characteristics of the products, making them more accessible to customers.  
  • *The product-service concept*: The company is able to identify the service customers require from the products and to look for alternative ways to satisfy that need. Products are customised solutions. The boundary between product and service becomes less obvious. | Poor Outstanding  |
| 3 Markets and competitors             | • *Market assessment system*: There are systems which effectively identify the market’s needs and its future possible trends. This information is available to research and development leaders, and people within the organisation are encouraged to understand it. Market trends are included in the overall corporate strategy. Technology gatekeepers are active participants in this process.  
  • *Marketing of technology*: The marketing department has developed systems to exploit not only products but technologies. Plans must be consistent with exploitation policies and with the overall technology strategy. | Poor Outstanding  |
| 3.1 Market needs                      | • *Competitor assessment*: Cross-functional teams are in charge of periodically assessing the core competencies, technological status, and possible future capabilities of competitors.  
  • *Benchmarking*: The company periodically looks for the best practices related with its business, wherever they can be found. Internal processes and policies are compared with the benchmarks, and plans are developed to reduce the gaps. | Poor Outstanding  |
| 3.2 Competitors’ Status               | • *Intrapreneurship*: Policies exist to permit innovation at all organisational levels. Employees are encouraged to suggest new ideas for products, services, or processes. Reward systems are in place to motivate innovation within the company. Employees know the market needs and build on them in order to create new products or services. There exists a system that enables intrapreneurs to communicate and develop new ideas.  
  • *Entrepreneurship*: Entrepreneurs are motivated to develop their ideas within the organisation if the ideas are consistent with the strategy. Otherwise, the system allows the entrepreneur to go elsewhere to develop the idea. | Poor Outstanding  |
| 4 Innovation process                  | • *Intrapreneurship*: Policies exist to permit innovation at all organisational levels. Employees are encouraged to suggest new ideas for products, services, or processes. Reward systems are in place to motivate innovation within the company. Employees know the market needs and build on them in order to create new products or services. There exists a system that enables intrapreneurs to communicate and develop new ideas.  
  • *Entrepreneurship*: Entrepreneurs are motivated to develop their ideas within the organisation if the ideas are consistent with the strategy. Otherwise, the system allows the entrepreneur to go elsewhere to develop the idea. | Poor Outstanding  |
<table>
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<tr>
<th>Assessment areas</th>
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<th>Rating</th>
</tr>
</thead>
</table>

### 4.2 Technology generators

- **Science push**: Technology gatekeepers have the resources to be experts within their fields and are empowered to suggest new directions and trends. They are aware of the latest scientific discoveries within their specific fields.

- **Market pull**: Marketing is able to relate current products to market needs, identifying gaps and opportunities. The information regarding market needs is available to all interested persons/teams.

### 4.3 From concept to market

- **Break-even time and break-even cost**: There is evidence of continuous improvement on the time-to-market variable. The teams are able to provide follow-up on their expenses throughout the entire time-to-market period.

### 5 Value-added functions

#### 5.1 Research and development

- **Cross-functional teams**: Cross-functional and autonomous teams are used to plan, develop, and implement new products, processes and/or services. Design for manufacturability is achieved through early involvement of all departments in the company. Every new venture has a champion leading the effort.

- **Portfolio justification**: The research and development portfolio is fully consistent with the corporate and technology strategies, with the maturity of the industry, and with the core competencies of the corporation. There is a process to select new projects that will support the overall strategy and its congruency with technology priorities, acquisition, and exploitation.

- **Success/failure analysis**: Projects are analysed to identify and understand causes of success or failure; learning is documented and distributed within the company.

#### 5.2 Operations

- **Improvement**: There are measures related to all the important variables of the processes. There is evidence of continuous improvement in those measures. The organisation is able to reach economies of scale and economies of scope to satisfy market needs.

#### 5.3 Environment-conscious technology

- **Green products and processes**: The company is concerned about designing and producing environment-friendly products. The processes are equipped with filters or appropriate non-pollution devices.

- **After-life analysis**: The design of the product takes into account the fact that the product will be discharged at the end of its lifetime; its recycling is already considered.
<table>
<thead>
<tr>
<th>Assessment areas</th>
<th>Elements</th>
<th>Rating</th>
</tr>
</thead>
</table>
| 6.1 Acquisition of technologies  | • Method of acquisition: The technology acquisition options (internal research and development, joint ventures, licensed in, or purchase) support the technology strategy. The decisions are based on the lifecycle position of the specific technology. Decisions take into account factors such as the company’s standing, urgency of acquisition, investment, lifecycle position, and technology category.  
• Capital investment: Capital appropriations are analysed and approved based not only on financial statements but also on the competitive advantage they may create. | Poor   |
| 6.2 Transfer of technology        | • Transfer procedures: The company has transfer procedures, which allow it to successfully transfer technologies from other institutions, i.e., companies, laboratories, universities.  
• People transfer: When a new technology is acquired, people are also transferred to support the transfer process. | Poor   |
| 6.3 Exploitation for profit       | • Exploitation for profit: Procedures exist to ensure the optimal exploitation of technologies, whether in product or processes, contracting out manufacturing, joint venture or licensing out. The decisions are consistent with the overall technology strategy and the technology classification. | Poor   |
| 6.4 Protection                   | • Protection: The innovation process is a closed loop requiring that the knowledge be protected either by patenting, secrecy, or other methods. | Poor   |

Source: (Khalil, 2000:268)
1. Does Aberdare offer some training courses or any kind of training related to your job to improve your skills?

2. Does Aberdare involve you in developing the training plan that suits your needs?

3. Does Aberdare assess the training needs of the employees in order to decide which training is necessary?

4. Does Aberdare offer some computer-related courses to employees thus equipping them for e-learning?

5. How many training courses do you attend in a year? Please state here_______.

6. What is your opinion about the current training?

   ( Poor = 1; need improvement = 2; good = 3; excellent =4 )

   - Training methods

   - Evaluation
## Annexure D: A List of Variables and Decision Alternatives to be Considered When Adopting New Technology

<table>
<thead>
<tr>
<th>Decision Area</th>
<th>Decision Considerations</th>
<th>Decision Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Why should NT be considered?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increased technological availability</td>
<td>Seize opportunity; or retain existing processes.</td>
</tr>
<tr>
<td></td>
<td>Degree of NT adoption by competition</td>
<td>Respond to competitors; or maintain current processes.</td>
</tr>
<tr>
<td></td>
<td>Labour cost considerations</td>
<td>Reduce labour costs by seeking to improve existing workforce productivity; or substitute NT applications for direct labour requirements</td>
</tr>
<tr>
<td></td>
<td>Degree of operating Leverage</td>
<td>Increase application of NT; or decrease greater labour emphasis; or pursue existing policies.</td>
</tr>
<tr>
<td></td>
<td>Dependability</td>
<td>Achieve shorter lead times resulting from increased efficiency of NT applications; or change inventory policies; or reassess capacity constraint.</td>
</tr>
<tr>
<td></td>
<td>Total system emphasis</td>
<td>Increase integration and interaction among functional areas within firm utilizing NT applications; or apply traditional organisational method.</td>
</tr>
<tr>
<td></td>
<td>Information accessibility requirements</td>
<td>Bridge information gap traditionally found between upper management and operations and function through automation of information systems; or address information requirements via existing organisational structure.</td>
</tr>
<tr>
<td></td>
<td>Engineering and design</td>
<td>Utilise CAD system or traditional manual approach.</td>
</tr>
<tr>
<td></td>
<td>Economies of scale</td>
<td>Achieve similar benefits at lower volumes – with product diversity – by applications of NT; or expand plant capacity with existing processes.</td>
</tr>
<tr>
<td></td>
<td>Distinctive competence</td>
<td>Utilise NT to establish distinctive competence / retain such in face of environmental pressures; or pull strategic levers utilising current process emphasis.</td>
</tr>
<tr>
<td><strong>When should NT be considered?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Competitive pressures</td>
<td>Adopt reactive strategy; or proactive strategy.</td>
</tr>
<tr>
<td></td>
<td>Social Pressures / implications</td>
<td>Coordinate timing so as to minimise negative social impacts/maximise positive social impacts; or base timing on internal factors to the firm only.</td>
</tr>
<tr>
<td></td>
<td>Market considerations</td>
<td>Time NT acquisitions in response to market demands or independent of market demand.</td>
</tr>
<tr>
<td></td>
<td>Corporate culture</td>
<td>Base timing considerations in adherence to traditional corporate policies or irrespective of past practices.</td>
</tr>
<tr>
<td></td>
<td>Management and</td>
<td>Introduce NT applications when management and</td>
</tr>
</tbody>
</table>
### When should NT be considered?

<table>
<thead>
<tr>
<th>Technical preparedness</th>
<th>Staff have developed capability; or do not postpone acquisition based on such considerations.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash flow considerations</td>
<td>Acquire NT when incoming revenues can accommodate purchase; or base acquisitions on other criteria (dept financing).</td>
</tr>
<tr>
<td>New product introductions</td>
<td>Time NT acquisitions in accordance with or irrespective of new product introductions.</td>
</tr>
<tr>
<td>Recovery of the technological innovation</td>
<td>Acquire NT applications immediately after market introduction; or postpone acquisition until developed further.</td>
</tr>
</tbody>
</table>

### Where should NT be introduced?

<table>
<thead>
<tr>
<th>Plant and equipment condition</th>
<th>Introduce NT as a means of replacing dated equipment and facilities; or introduce irrespective of existing condition.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Departmental / functional adaptability</td>
<td>Restrict NT introductions based on suitability of process; or seek to alter given processes to broaden adaptability.</td>
</tr>
<tr>
<td>Impact ramifications</td>
<td>Focus NT introduction on specific processes that hold greatest potential for benefit; or adopt an encompassing approach.</td>
</tr>
<tr>
<td>Product life cycle stage</td>
<td>Introduce NT applications particular to specific products which display adequate remaining sales potential; or allocate priorities based on other criteria.</td>
</tr>
<tr>
<td>Availability of labour</td>
<td>Introduce NT specifically into areas lacking sufficient labour resource base; or adopt a policy of even dispersion coupled with retraining or redistribution of displaced workers.</td>
</tr>
<tr>
<td>Growth implications</td>
<td>Incorporate NT acquisitions into areas of anticipated growth; or utilise NT applications to maintain consistent and broad support.</td>
</tr>
</tbody>
</table>

### How should NT be introduced?

<table>
<thead>
<tr>
<th>Introduction speed</th>
<th>Adopt gradual or swift approach.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee / union participation</td>
<td>Involve employees in decision-making process; or conduct decision independent of employee output.</td>
</tr>
<tr>
<td>Impact on employee levels</td>
<td>Consider whether immediate and long-term effects on employment play a considerable role or insignificant role in implementation decisions.</td>
</tr>
<tr>
<td>Utilization of support services</td>
<td>Heavy reliance on government / consultant support services during implementation; or reliance on in-house expertise</td>
</tr>
<tr>
<td>Pre-generation of concept acceptance</td>
<td>Initiate measures to encourage positive disposition among employees regarding NT applications; or allow employee reactions to run their course.</td>
</tr>
<tr>
<td>Degree of prior orientation</td>
<td>Preclude NT implementation with training and orientation of personnel as well as process testing; or</td>
</tr>
</tbody>
</table>
implement NT and learn by doing.

Source: Noori and Radford (1990:492)