TOTAL QUALITY MANAGEMENT IN THE SUPPLY CHAIN OF A PETROCHEMICAL ORGANISATION

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ABSTRACT

The objective was to investigate the extent of the use of total quality management (TQM) practices in a supply chain of a petrochemical organisation. TQM is a method by which management and employees can become involved in the continuous improvement of the production of goods and services. It is a combination of quality and management tools aimed at increasing business and reducing losses due to wasteful practices. The study was carried out in the petrochemical industry, which is of economic significance to the country. An existing TQM questionnaire was used and a total of 200 employees were targeted. The questionnaire had a seven-factor structure with acceptable Cronbach Alpha co-efficients. Overall, there was a significant number of employees who agree that total quality management is not practiced within their work areas and leading to a high number of quality related customer complaints. Management and employees are encouraged to be visibly involved in the development of a TQM transformation. TQM requires support from management, long-term strategic decision-making and motivated personnel.

1. INTRODUCTION

Total Quality Management is a management approach that originated in the 1950s and has steadily become more popular since the early 1980s. According to Murray (2016), Total Quality Management (TQM) is an approach that seeks to improve quality and performance which will meet or exceed customer expectations. This can be achieved by integrating all quality-related functions and processes throughout the company. TQM looks at the overall quality measures used by the organisation including managing quality design and development, quality control and maintenance, quality improvement, and quality assurance (Murray, 2016). The costs of poor quality are the costs that result from products not meeting customer specifications, or which do not meet the designer's design intent. These costs are categorized into internal failure costs, including scrap and rework. It also includes appraisal costs (inspection) and prevention costs (systems and procedures). External costs include the cost of rework, inspection, and warranty

investigations, which result after the product has left the manufacturing facility (Jacobs & Chase, 2006).

This study was limited to the use of TQM practices in the supply chain function. Over the past decade, there has been an increasing emphasis on supply chain management as a vehicle through which firms can achieve competitive advantage in markets (Kearney, 2013). As stated in literature, it is not actually individual companies that compete with each other nowadays; the competition is between rival supply chains. Therefore, management of supply chains in a business environment has a major financial impact on all the parties involved in the value chain (Kearney, 2013). The study was carried out in a petrochemical organisation that operates production facilities in South Africa and supplies a range of chemicals to local and international markets. Its competitive advantage lies in its people and its unique technology and products. The manufacturing of good quality products is not only dependent on the technology and operating equipment used, it is also dependent on the operators and effective management of the whole supply chain.

The following section establishes the theoretical base for the constructs of total quality management and supply chain performance measures.

2. LITERATURE REVIEW

2.1 Supply chain performance

Business organisations need to capitalize on Supply Chain (SC) capabilities and resources to bring products and services to the market faster, at the lowest possible cost, with the appropriate product and service features and the best overall value (Gunasekaran *et al*., 2001:71). Performance measures are important to the effectiveness of SC. Supply Chain Performance Measures (SCPM) serve as an indicator of how well the SC system is functioning. Measuring SC performance can facilitate a greater understanding of the SC and improve its overall performance (Charan *et al*., 2008:512).

2.1.1 Supply chain management

The broader definition of supply chain management (SCM) determined by the Global Supply Chain Forum is generally accepted as a norm (Cooper *et al*., 1997:2, Lambert *et al*., 1998:2):

"Supply Chain Management (SCM) is the integration of key business processes from end user through original suppliers that provides products, services, and information that adds value for customers and other stakeholders"

Supply Chain Management (SCM) is the design of the firm's customer relationship, order fulfillment and supplier relationship processes and the synchronization of these processes of its suppliers and customers in order to match the flow of services, materials and information with customer demand. The purpose of SCM is to design the Supply Chain (SC) and to synchronize the key processes of the firm's suppliers and customers, so as to match the flow of services, materials and information with customer demand (Krajewski *et al*., 2007).

The term SC is used to describe the flow of goods from the very first process encountered in the production of a product right through to the final sale to the end consumer. SCM can be used to describe a number of concepts in the processes inside a manufacturing organisation; purchasing and supply management occurring within dyadic relationships; the total chain; and finally, a total firm network. (Bruce *et al*., 2004:151)

A good working definition of an SC is that described by Stevens (Stevens, 1989:3):

"A system whose constituent parts include material suppliers, production facilities, distribution services and customers linked together via the feed forward flow of materials and the feedback flow of information".

Supply Chain Operations Reference model (SCOR) which was defined in the Supply Chain Council (2005), defined an SC as follows (Supply Chain Council, 2005):

"The supply chain encompasses every effort involved in producing and delivering a final product, from the supplier's supplier to the customer's customer. Five basic processes– plan, source, make, deliver and return – broadly define these efforts, which include managing supply and demand, sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, and delivery to the customer."

Supply Chain Council (2005) defined that there are four basic processes in the SC: plan, source, delivery and return. Plan refers to processes that balance aggregate demand and delivery requirements. Sources are processes that transform a product to a finished state to meet planned or actual demand. Delivery is a process in which the finished goods are delivered to a customer. Return is defined as processes associated with returning or receiving returned products. (Iskanius, 2006; Supply Chain Council, 2005)

Management of supply chains is called Supply Chain Management. SCM is a substantially more extensive concept than logistics. SCM is defined as management of upstream and downstream business relationships together with suppliers and customers. SCM aims at producing large customer value with smaller total costs for the whole SC. (Christopher, 1998) SCM encompasses co-operation of various functions between suppliers and customers. Most essential divisions of SCM are those of managing business relations and managing customers.

2.1.2 Supply chain performance measurement

Sambasivan (2009:347) defines measure as a more objective or concrete attribute that is observed and measured and metric as an abstract, higher-level latent attribute that can have many measures. Because SC is a network of firms that includes material suppliers, production facilities, distribution services and customers linked together via the flow of materials, information and funds (Gunasekaran *et al*., 2001:71), the measures have been classified as follows: funds flow (cost and profitability), internal process flow (production level flexibility, order fulfilment and quality), material flow (inventory and internal time performance), sales and services flow (delivery performance, customer responsiveness and customer satisfaction), information flow and partner relationship process flow (supplier evaluation and sharing of information with suppliers and customers).

According to Beamon (1999:275), a supply chain measurement system must place emphasis on three separate types of performance measures: Resource measures (generally costs); Output measures (generally customer responsiveness); and Flexibility measures (Ability to respond to a changing environment). Each of these three types of performance measures has different goals and purpose. Resource measures include: inventory levels, personnel requirements, equipment utilization, energy usage, and cost. Output measures include: customer responsiveness, quality, and the quantity of final product produced. Flexibility measures are a system's ability to accommodate volume and schedule fluctuations from suppliers, manufacturers, and customers (Beamon, 1999).

Many authors have classified performance measuring system (PMS) in different ways. A basic classification offered by Cagnazzo *et al*. (2010:164) consists of grouping PMS

models into: Balanced models; Quality models; Questionnaire-based models; Hierarchical models; and Support models.

Balanced Model: Balanced models consider the presence of both financial and non-financial indicators. In these models several separate performance measures which correspond to diverse perspectives (financial, customer, etc.) are considered independently. Some of the important existing models are Performance Measurement Matrix; Balanced Scorecard (BSC); and Performance Prism.

Quality Models: These are frameworks in which a great deal of importance is attributed to Quality. An example of quality model is the Business Excellence Model (EFQM-Model) (EFQM, 1999).

Questionnaire-based Models: These are frameworks based on questionnaires. The Performance Measurement Questionnaire (PMQ) and TOPP System (a research program studying productivity issues in Norwegian manufacturing industry) (Rolstadås, 1998:991) are examples.

Hierarchical Models: SCPM models that are strictly hierarchical (or strictly vertical), characterised by cost and non-cost performance on different levels of aggregation are classified as hierarchical models. Frameworks where there is a clear hierarchy of indicators are: Performance Pyramid; Advanced Manufacturing Business Implementation Tool for Europe (AMBITE); The European Network for Advanced Performance Study (ENAPS) approach; and Integrated Dynamic Performance Measurement System (IDPMS).

Support Models: Frameworks that do not build a performance measurement system but help in the identification of the factors that influence performance indicators are classified as support models. These models are: Quantitative Model for Performance Measurement System (QMPMS); and Model for Predictive Performance Measurement System (MPPMS) (Cagnazzo *et al*., 2010:164).

The focus of this study was on quality management which is discussed below..

2.1.3 Quality

There is much published work on quality as a performance measure in supply chains Beamon (1999:275). Quality is most often defined as the ability of a product or service to consistently meet or exceed customer expectations. Lillrank (2002:691) classifies quality definitions found in the literature to be divided into four categories: excellence, value for money, conformity to requirements and meeting or exceeding customer requirements. Lillrank (2002) further emphasises that excellence-based definitions include the idea that products or services may include elements that are perceived as superior, which are often very subjective, hard to measure and confuse quality with product segments or grades. The most widely used definitions from the American Society for Quality and more recently ISO 9000 - 2000, are based on customer satisfaction, which may be achieved not only through conformance to requirements but through some inherent characteristics of the product or service, and the way it is presented and delivered to the customers (Barnes, 2009).

Bendell *et a*l. (1995:44) argue that the importance of quality as an objective is now widely recognised throughout the world. As a result of increasing customer demands and the removal of barriers of trade, inefficient suppliers or suppliers of low quality goods or

services will find it difficult to survive. According to Stevenson (2002:403), the degree to which a product or service successfully satisfies its intended purpose has four determinants, which are listed below:

- design;
- how well it conforms to the design;
- ease of use; and
- service after delivery

According to Peters (1999:6), quality management originated from two ideas about how to run organisations better. The first idea revolved around customers. If companies could determine what its customers like, they could deliver it the same way every time. Customers will come back to purchase such products and services, and will also tell others about these products and services. The second idea that companies need to explore is efficiency. If companies can figure out the most efficient way to produce a product or service and stop wasting time, materials, replacing poor quality goods or delivering unsatisfactory service, that company will be more successful. Quality falls under the umbrella of total quality management which is discussed below.

2.1.4 Total quality management

Total quality management (TQM) as defined by Mohrman *et al*. (1995:26) as an approach to managing organisations, which emphasises the continuous improvement of quality and customer satisfaction. It entails the application of systematic tools and approaches for managing organisational processes with these ends in mind (continuous improvement of quality and customer satisfaction), and involves the establishment of structures such as quality improvement teams for maintaining focus and enacting organisational improvement processes.
Lau and Tang (2009:410) define TQM as the management philosophy and company practices that aim to harness the human and material resources of an organisation in the most effective way to achieve the objectives of the organisation. TQM is further explained as a management-led process to obtain the involvement of all employees, in the continuous improvement of the performance of all activities, as part of the normal business to meet the needs and satisfaction of both the internal and external customers. Anjard (1998:238) further explains TQM as a visionary, cultural movement which represents recognition of a management philosophy that encourages employees to share responsibility for delivering quality services and products. Lau and Anderson (1997:85) explain what each abbreviated letter in TQM means as follows:

- The T-component of TQM: TQM implies a total, company-wide commitment to quality and calls for everyone, including suppliers, to be responsible for quality and involved in all the efforts to maintain or upgrade their work.

- The Q-component of TQM: The major goal of quality management is to meet and exceed customer expectations. Internal customers are as important as external customers. Continuous improvement should be integrated into the management of all systems and processes. Effective training should also teach and empower all employees to understand and solve quality related problems.

- The M-component of TQM: The broad nature of TQM efforts requires commitment of top management to the process. Top management is responsible for creating clear and visible values and to integrate these values into strategic business plans. TQM

requires that all employees are to be involved and as a result it is important to re-shape the organisational culture that supports it.

Karia and Asaari (2006:30) define TQM practices (what an organisation does to demonstrate its commitment to TQM) as a set of practical measures such as:

- continuous improvement;
- meeting customer requirements;
- reducing re-work;
- long-range thinking;
- increased employee involvement and teamwork;
- process re-design , competitive benchmarking;
- team-based problem solving;
- continuous monitoring of results; and
- close relationship with suppliers.

The above involves the combined efforts of all members of the organisation – from senior management to shop-floor employees. Mohrman *et al.* (1995:26) emphasise that the key to TQM is the definition of quality as meeting customer requirements, and a belief that the organisational capability to deliver quality is enhanced by continuously improving the capacity of the work processes of the organisation to deliver value to customers.
TQM has been widely implemented throughout the world. Many firms have arrived at the conclusion that effective TQM implementation can improve their competitive abilities and provide strategic advantages in the marketplace (Gharakhani *et al*., 2013:46). Several studies have shown that the adoption of TQM practices enable firms to compete globally (Talib, Rahman & Qureshi, 2010; Nayab, 2011). Total quality has developed to what it is today along with other business management philosophies. It is a diversified way to see the growth of the whole business. TQM posits certain numerical and non-numerical goals for a company. Reaching these goals is typically not easy. It requires support from management, long-term strategic decision-making and motivated personnel (Talib, Rahman & Qureshi, 2010). In general, product or service quality measures are essential to find out information that is really important to customers about each product or service. This information can help to drive the new product design process, which fit the customers' requirements (Cameran, Moizer & Pettinicchio, 2010:421). Moreover, measuring product and service quality is identifying information on what customers want as well as what dimensions of products or services need to be measured and controlled.

3. PROBLEM INVESTIGATED

Supply chain managers face issues on a daily basis which require direct attention and quick response. With the supply chain being at the core of business operations, these issues can directly affect the company in substantial ways. There is a high cost due to inconsistencies in quality of the intermediate and final products and this affects the whole supply chain, including the relationship with the customers. The pressure on manufacturers to produce high-quality products that are safe is therefore an increasing challenge. The number of product recall cases is growing each day. Poor quality products cause business disruption, financial loss, costly lawsuits, and long-lasting damage to the brand and corporate image of organisation that is dependent upon supply chain performance. A brand or even the organisation's reputation can be damaged irreparably. There was a concern in the organisation about the inconsistency of the quality of the final products, which did not only lead to an increasing number of customer complaints, but also a high amount of off-spec products that had to be re-worked.

Utilizing total quality management practices in a petrochemical organisation is important as this sector forms a significant part of a country's economic system especially in the supply of fuels and chemicals. Implementing TQM practices can assist the organisation by improving business as a whole. Some of the benefits can lie in the continuous improvement of processes and products, and enhanced efficiency of people and machines leading to improved quality (Nayab, 2011). Nayab (2011) goes further to emphasize that the major thrust of TQM would be to achieve productivity and process efficiency by identifying and eliminating problems in work processes and systems. TQM would address key problem areas such as mistakes in work processes, redundant processes, unnecessary tasks, and duplicate efforts. TQM interventions would therefore also help with predicting and pre-empting such mistakes and unproductive activities. Improving process efficiency would bring about many benefits to the organisation in terms of costs and time. Current research appears to fail in measuring the extent of the use TQM practices to reduce cost of poor quality in this particular industry.
Below is the discussion of the objectives of the study.

4. RESEARCH OBJECTIVES

The research objectives are divided into primary and secondary objectives.

4.1 Primary objective

The primary objective of this study is to investigate the extent of the use of total quality management practices in a supply chain of a petrochemical organisation.

4.2 Secondary Objectives

To achieve the primary objective, the following secondary objectives include a need:

- to conceptualize quality and TQM;
- to empirically assess the use of TQM practices using a standard TQM questionnaire;
- to determine the factor structures and internal consistencies TQM questionnaires within the petrochemical organization; and
- to make managerial recommendations.

5. RESEARCH METHOD

The empirical research used to achieve the objectives of this study is based on a descriptive research approach. This type of research is used when there is a clear statement of the research problem and detailed information needs (Barbie & Mouton, 2015). Bhattacherjee (2012) indicates that such formalized studies are used to achieve research objectives that involve characteristics associated with a subject population, estimates of the proportions of a population that have these characteristics, and the discovery of associations amongst different variables. A positivist or quantitative research design was therefore identified as relevant to study the use of TQM practices in a petrochemical industry.

Saunders *et al*., (2012) indicate that the research methods used in this type of research design are structured and quantitative in nature. Quantitative research seeks to quantify data as compared to qualitative research that is unstructured, exploratory in nature and based on small samples from the population (Barbie & Mouton, 2015). Thus, the quantitative research paradigm is based on positivism, therefore measuring social constructs objectively, with the aim of testing certain research objectives based on the statistical analyses of a set of theoretical variables. Cameron and Price (2009:213) emphasize that quantitative data present significant practical advantages as it allows one to draw conclusions related to a wider group and data, in addition, it can be statistically

analyzed. In view of the above considerations, the quantitative approach was selected as the most suitable for the purposes of this research.

5.1 Participants

The participants could be defined as an available sample of employees working in the supply chain departments of a petrochemical organisation. A random sample of 200 employees were targeted from a population of 583 employees. Workers from all levels; ranging from professional to skilled, were included in the study population.
Permission was given by the managing director of the organisation to use the employees for the study. An e-mail was sent out to all line managers requesting their co-operation in the completion of the questionnaires.
All the participants were briefed about the purpose of the study and why they are requested to participate. They were also assured that their identities would remain confidential. They were also informed that their participation was voluntary and that they were free to withdraw from the study if they so desire at any time. Thus, the participants were free from any stress on account of their participation in the study.

5.2 Measuring Instrument

A biographical questionnaire regarding participants' age, gender, race, education and years employed was included in the measuring battery. The questionnaire was based on Total Quality Management (TQM). It was adopted unchanged from Zhang, Waszink & Wijngaard, (2000) based on variables which include top management support, customer focus, supplier focus, employee empowerment, training and development, teamwork, process improvement, communication and strategy.. Employee involvement and empowerment were analyzed to determine if the concept of TQM was embraced. In order for the organisation to meet customers' changing needs, it is important to have continuous improvement, which is a pivotal aspect of TQM. Because there is no business without customers, customer focus and satisfaction were also measured. A five-point Likert-scale was used as a measuring system throughout, with the following scores: not satisfactory (1), somewhat satisfactory (2), unsure (3), satisfactory (4) and very satisfactory (5).
The use of the interval scaling method enables the use of traditional statistical analyses methods, which are discussed below.

5.3 Statistical Analysis

In this study the data were captured and analyzed using the SPSS and STATISTICA statistical programs. The instrument was previously tested and validated on 212 Chinese manufacturing companies (Zhang *et al*, 2000). The results yielded nine factors and the reliability co-efficients were all above 0.838, indicating that the constructs were reliable. Exploratory factor analysis was used in this study to examine constructed equivalence and to enhance the reliability results of the questionnaire. The number of factors was determined by the principal component analysis. Subsequently components extraction was used to estimate the number of factors followed by principal axis factoring extraction using a rotation method of direct Oblimin with Kaiser normalization and/or Varimax. Descriptive statistics (e.g. means and standard deviations) were used to analyze data. Cronbach alpha co-efficients were used to determine the internal consistency of the instrument.
Pearson product-moment correlation co-efficients were used to specify the relationship between the variables. T-tests and ANOVA were employed to determine differences between the groups in the sample. Effect size (Cohen, 1988:15; Steyn, 1999:12) was used in addition to statistical significance to determine the significance of relationships. Effect sizes served to indicate whether the results obtained were practically significant.

6. RESULTS AND FINDINGS

A total of 166 usable questionnaires were received. Table 1 represents a numeric dispersion of the sample.

Table 1: Biographical profile of the respondents

Item	Category	Frequency	Percentage
Gender	Male	126	75.9
	Female	40	24.1
Age Group (years)	≤20	1	0.6
	21 – 30	37	22.3
	31 – 40	85	51.2
	41 – 59	42	25.3
	≥60	1	0.6
Race	Black	88	53.0
	White	64	38.6
	Coloured	6	3.6
	Indian	7	4.2
	Other	1	0.6
Level of Employment	Junior	59	35.5
	Middle	83	50.0
	Senior	23	13.9
	Top	1	0.6
Duration of Employment (years)	0 – 2	12	7.2
	3 - 5	33	19.9
	6 - 10	33	19.9
	>10	88	53.0
Qualification	Below Matric	5	3.0
	Matric	59	35.5
	Diploma / Degree	84	50.6
	Post-graduate	18	10.8

Source: Compiled by the author from survey results

The sample consisted of 166 subjects with 126 males (75.9%) representing the majority of the sample and 40 (24.1%) females comprising the minority of the sample. Regarding age, the table depicts that the largest group was 85 (51.2%) of the sample that indicated that they were between 31 and 40 years of age. The second largest group was 42 (25.3%) of the subjects that indicated that they were between the ages of 41 and 59 years. The 37 (22.3%) subjects in the 3rd largest group were between the ages of 21 and 30 years. There was only one person below 20 years and only one person above 60 years.

Regarding their race, the largest group was those 88 (53%) subjects of the sample who indicated that they were Blacks. The second largest group (38.6%) was Whites whilst the Indians and Coloureds were 4.2% and 3.6% respectively. The majority of respondents were middle managers (50.0%) followed by junior employees (37.7%) and senior management (13.9%). Regarding qualification, majority (50.6%) of the respondents had either a diploma or a degree followed by those who only had matric. About 10.8% of the respondents had a post-graduate qualification while the minority (3%) did not have matric.

One of the main objectives of this study was to measure the extent of the use of TQM practices. The results are shown in Table 2 below.
About 27% of the respondents stated that there were no clear quality goals identified by top management whilst some (20%) disagree with the statement that top level managers view quality as more important than cost. Almost 58% of the participants agreed that the

organisation receives a lot of customer complaints related to quality. About a third of the employees mentioned that they were not empowered to take corrective decisions on the spot without looking up to managers for their approval. Another third stated that they were not provided with training in quality principles.
About half (46%) of the respondents said that there were no rewards or incentives for quality improvements. Some employees stated that meeting and exceeding customer expectation were not accorded a higher strategic priority than short-term production target. About a third disagreed that there was emphasis on team based problem solving approach rather than individual/department based approach. Overall there was a significant number of employees who agree that total quality management is not practiced within their work areas and that leads to a high number of quality- related customer complaints.

Table 2: Results of the Total Quality Management questionnaire

		% of all who **disagree**	% neutral	% of all who **agree**
	TOP MANAGEMENT SUPPORT			
C1	There are clear quality goals identified by top management	27%	11%	63%
C2	Top management often discusses the importance of quality	14%	16%	70%
C3	Top level managers view quality as more important than cost	20%	22%	58%
	CUSTOMER FOCUS			
C4	Customers feedback is used to determine customer requirements	7%	15%	78%
C5	Customer feedback is used as the basis for measuring quality	9%	18%	73%
C6	We have a lot of customer complaints related to quality	25%	16%	58%
	SUPPLIER FOCUS			
C7	Quality and not price is the prime criteria in supplier selection	21%	36%	43%
C8	Suppliers are treated as customers whose feedback is important in the quest for improvement	15%	27%	57%
C9	Long term relationship is encouraged with suppliers	9%	23%	68%
	EMPLOYEE EMPOWERMENT			
C10	My manager trust me in carrying out my actions	16%	15%	69%
C11	Employees are empowered to take corrective decisions on the spot without looking up to managers for their approval	32%	22%	46%
C12	I can decide the best way to do my wok	23%	15%	62%
C13	I have all the required resources to execute my job properly	23%	20%	57%
	TRAINING AND DEVELOPMENT			
C14	Employees are encouraged to participate in education and training within the organisation	32%	15%	53%
C15	Employee training is provided in quality principles	33%	24%	43%
C16	Senior managers allocate adequate resources towards effort to improve quality	30%	30%	40%
C17	There are rewards for quality improvements	46%	20%	34%
C18	Financial incentives are used to reward quality improvements	45%	22%	34%
C19	Non-financial incentives are used to reward quality improvements	32%	36%	33%

Table 2 continued

	TEAMWORK			
C20	There is emphasis on team based problem solving approach rather than individual/department based approach	34%	21%	45%
C21	People in the work unit share responsibility for the success and failure of their work	41%	16%	43%
C22	Work decisions are made through consensus	35%	24%	41%
	PROCESS IMPROVEMENT			
C23	We use statistical control charts to control processes	20%	20%	60%
C24	We use inspection for quality control	13%	19%	69%
C25	We have a program to find wasted time and costs in all internal processes	28%	32%	40%
	COMMUNICATION			
C26	Management provide regular customer/ supplier feedback	27%	28%	45%

C27	The quality management system contributes to collection and integration of information used for decision making	21%	27%	52%
C28	The organisation practices continuous improvement in communication between employees and managers	26%	19%	55%
	STRATEGY			
C29	Meeting and exceeding customer expectation is accorded a higher strategic priority than short-term production target	22%	27%	51%
C30	Leaders in the organisation try to plan ahead for technological and organisational changes that might affect the future performance	22%	18%	60%

Source: Compiled by the author from survey results

Further analysis of the data could only be done once the proposed dimensions of total quality management had been confirmed. Factor analysis was used to investigate the construct validity of the scales in the questionnaire. The Kaiser-Maier-Olkin test as well as Bartlett's test of sphericity were obtained in order to evaluate sampling adequacy. KMO takes values between 0 and 1, with small values meaning that overall the variables have too little in common to warrant factor analysis. Values above 0.70 are usually considered to be acceptable.

The KMO value for the TQM questionnaire was 0.858. Bartlett's sphericity was significant. A number of factor solutions were again investigated considering guidelines such as the Kaizer criterion (Eigen values larger than unity), the screed plot, the amount of variance explained by the factors, as well as the clarity and size of the factor loadings.
For the TQM questionnaire, seven factors were identified, explaining 68.3% of variance. The factors were named as follows:

Factor 1: Reward and Training
Factor 2: Supplier Focus
Factor 3: Empowerment
Factor 4: Top Management Support
Factor 5: Process Improvement
Factor 6: Customer Focus
Factor 7: Teamwork

Following the identification and labelling of the factors, the internal consistency (reliability) of the sub-scale scores were calculated and evaluated by means of Cronbach's Alpha. The value of Alpha, the item-total correlations as well as the average inter-item correlation were taken into account. Factor reliability of the identified dimensions of TQM is presented in Table 3.

Table 3: Results of the factor reliability for the dimensions of TQM

Factor	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Reward and Training	.88	.882	9
Supplier Focus	.79	.79	3
Empowerment	.75	.75	3
Top Management Support	.79	.80	3
Process Improvement	.80	.81	4
Customer Focus	.84	.84	2
Teamwork	.65	.66	5

Source: Compiled by the author from survey results

The reliability of six of the factors was well above 0.7 indicating strong reliability but the teamwork dimension gave a factor reliability of only 0.648. The factor with a value of 0.65 was also retained as it is also deemed acceptable in social sciences (Field, 2009:675). It can therefore be concluded that the TQM questionnaire as utilized in this research is a valid and reliable measuring instrument.Lastly, the subscale scores were calculated, using the mean score on the items per factor. Results are presented in Table 4. Subsequent analyses were performed using these factor scores.

Table 4: Descriptive statistics of the dimensions of TQM

Factor	Mean	Minimum	Maximum	Range	Variance
Reward and Training	3.13	2.77	3.48	.70	.06
Supplier Focus	3.62	3.32	3.92	.59	.09
Empowerment	3.40	3.17	3.51	.34	.04
Top Management Support	3.69	3.57	3.84	.27	.02
Process Improvement	3.48	3.10	3.86	.76	.09
Customer Focus	4.01	3.98	4.04	.06	.00
Teamwork	3.22	2.97	3.56	.59	.06

Source: Compiled by the author from survey results

The results of the product-moment correlation co-efficients between the dimensions are reported in Table 5.

Table 5: Correlation co-efficients for TQM dimensions

	Reward and training	Supplier focus	Empowerment	Top management support	Process improvement	Customer focus	Teamwork
Reward and training	1.00	.38*	.52**	.56**	.56**	.35**	.68**
Supplier focus	.38**	1.00	.32**	.30**	.39**	.46**	.28**
Empowerment	.52**	.31**	1.00	.42**	.38**	.35**	.50**
Top management support	.56**	.30**	.42**	1.00	.48**	.42**	.53**
Process improvement	.56**	.39**	.38**	.48**	1.00	.39**	.53**
Customer focus	.35**	.46**	.35**	.42**	.39**	1.00	.39**
Teamwork	.68**	.28**	.50**	.53**	.53**	.39**	1.00

Source: Compiled by the author from survey results

The other objective of this study was to compare the findings based on the demographic differences. This was achieved by using the T-test and ANOVA tools to establish if there were any significant differences in the responses based on the biographical information of the participants. The results are discussed below.

- **T-test and ANOVA**

The results of the t-test and ANOVA is summarised as follows:

- Gender: The questionnaire was completed by 126 males and 40 females. The p-values were greater than 0.05 indicating the participants answered the questions in a significantly similar manner statistically.

- Age group: The p-value for Teamwork was below 0.05 indicating that there was a statistically significant difference in the way the different age groups responded to the questions. This is confirmed by the ANOVA results. A medium practically visible difference was seen between the 31 – 40 and 41 – 59 age groups. For all the other dimensions with p-values above 0.05; there were no significant differences in the responses by different age groups
- Race: The p-values were greater than 0.05 indicating the participants answered the questions in a significantly similar manner statistically.

- Level of employment: The p-value for top management support was below 0.05 indicating a significant difference in the way different levels of employment responded. The effect sizes indicated that there was some medium-practically visible difference in the way the various levels responded to this dimension.
- Duration of employment: According to the p-Value of 0.03 and the ANOVA results, a significant difference was only observed for the dimension of teamwork.
- Qualification: The p-Values and ANOVA results indicated that significant differences were only observed for the responses to reward and training; supplier focus and customer focus dimensions.

7. CONCLUSIONS AND RECOMMENDATIONS

The study indicated that most respondents in the organisation understand the concept of quality and embraces it. The impact of quality on customer satisfaction was clearly understood by the majority. However a lot of quality-related customer complaints were received and that showed that continuous improvement within the organisation should be a priority.
It was evident that TQM practices have been implemented to a large extent in the organisation, but there were also areas where they were not. A few responses indicated that in some areas, top management does not view quality as more important than cost.

Quality is defined as how well a product does what it is supposed to do – how closely and reliably it satisfies the specifications to which it is built. Managers must be quality conscious and understand the link between high-quality goods and/or services, and competitive advantage. Thus, the focus of the quality viewpoint is the customer, who ultimately defines quality in the marketplace.
Providing high-quality products is not an end in itself. Successfully offering high-quality goods and services to the customer will typically result in important benefits to the organisation, namely a positive organisation image, lower costs and higher market share, and decreased product unsuitability.
Total quality has developed to what it is today along with other business management philosophies. It is a diversified way to see the growth of the whole business. TQM posits certain numerical and non-numerical goals for an organisation. Reaching these goals is typically not easy. It requires support from management, long-term strategic decision-making and motivated personnel.
The operation process should identify the cost, quality and time that enable the organisation to deliver a superior product and service to its targeted current customers. To continue to be at the leading edge, the organisation must continually analyze and systematically improve their business processes measures. Therefore, attention must be given for continuous process improvement to meet the customers' requirements and increase their market share. Customer focus, as an element of TOM, refers to the degree to which a company continuously satisfies customer needs and meet expectations. Customer focus should be meticulously applied as a means of strengthening the relationship with customers and improving quality rather than just being reactive to customer complaints.

Training and development of the employees is required to ensure competent people in the long run. It is important to communicate with everyone in the organisation; empowerment and delegation are largely about giving each employee a sense of responsibility for manufacturing a product or for performing a service to satisfy customers.

8. RECOMMENDATIONS FOR FUTURE RESEARCH

The findings obtained in this study could be replicated with larger sample groups in order to draw conclusions about the factor-structure and TQM questionnaire in the South African context.
Participants in different demographic groups responded differently to certain dimensions.. Possible reasons for this could be established by further research.

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