Total quality management and competitive advantage of manufacturing organizations in the Steel industry Durban Metropolis

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DECLARATION ON PLAGIARISM

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Date: 19 August 2024

DEDICATION

This study is dedicated to all the manufacturing organizations in South Africa and all steel manufacturing organization through Africa. This study is also dedicated to organization which has adopted Total quality management in the organization.

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LIST OF ABBREVIATIONS

AIC	Akaike Information Criteria
AVE	Average Variance Extracted
CFA	Confirmatory Factor Analysis
CI	Continuous Improvement
CMIN	Minimum Discrepancy Function
DTI	Department of Trade and Industry
ECVI	Expected Cross-Validation Index
FMIN	Function Minimum Fit Function
GDP	Gross Domestic Product
IMD	International Institute for Management Development
ISO	International Organization for Standardization
KZN	KwaZulu-Natal
NPC	Non-Centrality Parameter
TQM	Total Quality Management
PDCA	Plan Do Check Act
RMR	Root Mean Square Residual
RMSEA	Root Mean Square Error of Approximation
R&D	Research and Development
SEM	Structural Equation Modeling
SPSS	Statistical Package for the Social Sciences
USA	United States of America

Appendices

ABSTRACT

This study investigated total quality management (TQM) and the competitive advantage of manufacturing organizations in the steel industry in the Durban Metropolis. While a few studies have touched on TQM and competitive advantage in Durban, they did not examine TQM and competitive advantage in steel manufacturing organizations in the city. The literature on the context of business competitiveness, total quality principles, process management and top management and other pertinent concepts was reviewed. Purposive sampling was employed to obtain a total of 100 participants from the 23 organizations in the Durban steel industry. A quantitative research design was adopted, with a questionnaire administered to gather data. The data were analyzed using confirmatory factor analysis (CFA), which was employed to prove or disprove the hypotheses, with the results presented in tables and graphs. The findings suggest that employee training, committed management, a customer-focused approach, sound relationships with suppliers, and clear goals would enable organizations in Durban's steel industry to improve their performance and thus gain a competitive edge. The study contributes to the body of knowledge on TQM in organizations and its impact in the steel manufacturing industry. Further research is recommended to explore the impact of the adoption of TQM among South African organizations.

Key words: Total Quality Management, Competitive advantage, Organization, Operation, Improvement, Customer Satisfaction, Productivity

Chapter 1
Introduction

1 Introduction

The steel industry makes a significant contribution to the South African economy that could be enhanced by improving its global competitiveness. Total quality management (TQM) has been found to positively influence innovation, with both regarded as key drivers of competitiveness. Against this background, the study examined the nature of the relationship, if any, between TQM and competitive advantage in this sector. Total quality management practices, including process management, commitment on the part of top management, a customer focus, supplier management, continuous improvement (CI), and people management were explored in relation to operational performance and competitive advantage (Javed & Idris, 2018).

While a few studies have touched on TQM and competitive advantage in Durban, these did not focus on steel manufacturing organizations. Durban was selected because the steel industry has a long production history in the city, and has developed specialized operations that have confronted challenges in recent times, including floods, civil unrest and the lockdowns resulting from the COVID-19 pandemic. The diversity of businesses in the Durban steel manufacturing industry also rendered it appropriate. The study's findings will assist organizations in the Durban steel industry to understand TQM's impact on competitive advantage and operational performance.

This chapter outlines the background to the study, the problem statement, the rationale for the study, and its significance and limitations, as well as its aim, research objectives and hypotheses.

1.1 Background and context of the study

Macsteel and Pipe is more than 90 years old making it one of the oldest steel manufacturing organizations operating today with a workforce of more 600 employees (Toga, 2017). Organizations in this sector manufacture multiple steel products such as steel pipes that transport large quantities of water, steel tools and materials to build steel structures like scaffolding. Other products such as steel support beams to hold up walls during mining are produced for the mining sector (Abbas, 2020).

A protracted economic downturn has challenged South Africa's steel sector for many years. Even before the COVID-19 pandemic, the local steel industry was impacted by decreased domestic demand. The primary causes were the decline in local infrastructure spending, a downturn in the global market, and lower-priced imports (West, 2023). As a result, the industry experienced a significant loss of jobs. As noted by West (2023), the African engineering and metals sector lost more than 49,000 jobs between 2007 and the second quarter of 2019, of which 38,000 were in the metals sector.

In order to remain competitive in the global market, organizations need to embrace innovative processes to create new products that meet customers' needs. They also need to identify strategies to streamline their operations (Toga, 2017). Competitive advantage can thus be

achieved when an organization creates superior customer value (Pérez, Geldes, Kunc, & Flores, 2019). Steel manufacturing organizations must offer higher quality products than their competitors on an on-going basis while maintaining high levels of efficiency and productivity.

Total quality management has long been a concept of interest in industry and has gained traction since the 1980s. It was first adopted in the northeast of England before spreading to other countries (Abbas, 2020). It has since been recognized as a factor that contributes to gaining and maintaining competitive advantage and improved performance (Psomas & Jaca, 2016). This management ideology promotes organizational commitment to customer satisfaction through ongoing innovation and improvement, resolving a lack of competitiveness (Abbas, 2020).

Given its widespread endorsement, it is important to establish if TQM supports or hinders innovation, and thus competitive performance. In today's competitive world, it is crucial that organizations embrace innovation and high-quality production in order to survive and prosper.

The Durban steel manufacturing industry, which provides a significant number of jobs and is an important contributor to the local and provincial economy, continues to be challenged by an adverse economic climate, and the aftermath of factors such as flooding, civil unrest and the COVID-19 pandemic. According to Kanazawa (2021), South Africa's steel industry suffers from a lack of growth and innovation which would enable it to gain a competitive edge. The use of TQM could assist it to achieve a competitive advantage.

1.2 Problem Statement

The South African steel industry contributes 1.5% of the country's Gross Domestic Product (GDP), with 190,000 tons of the steel manufactured exported. Durban has the largest shipping terminal in the country and the fourth largest in the southern hemisphere. The city is responsible for a substantial proportion of the steel produced in the country.

However, the steel manufacturing industry is confronting its worst crisis since the Great Recession, with many employees facing retrenchment and South African companies confronting the threat of closure (Toga, 2017). The world of business is constantly changing and increasing customer expectations, input prices, rates and costs mean that organizations are under constant pressure to optimize their performance. The South African steel manufacturing industry confronts significant challenges, including escalating operational costs and declining selling prices due to global competition (Dednam, 2020). The Department of Trade and Industry (DTI) warned that the COVID-19 lockdowns would result in this industry experiencing severe financial distress with potential plant closures and job losses.

Khoza, Mafini and Okoumba's (2022) study on the steel industry in South Africa focused on the International Organization for Standardization and its contribution to boosting product quality. However, it did not examine the impact of TQM practices on operational performance among these organizations. Given the contribution made by Durban's steel manufacturing organizations to GDP, there is a need to identify strategies to resolve the challenges confronting it (Ramaboea, 2021). These include logistics-related challenges following events such as floods and civil unrest that disrupted the supply of raw materials (Ramaboea, 2021). Furthermore, the lockdowns imposed as a result of the COVID-10 pandemic reduced per capita consumption and resulted in slow adoption of new technology. In order to survive and thrive, steel manufacturing organizations need to increase their competitive advantage by improving their quality assurance (Ibid). Competitive advantage means that an organization is able to produce quality goods or services at a cheaper rate than its rivals. It is against this background that this study examined the role of TQM in improving steel manufacturing organizations' performance and thus enabling them to gain a competitive edge.

1.3 Rationale for the study

The study was motivated by the recent challenges faced by organizations in the steel manufacturing industry. Organizational and employee development can be positively impacted by TQM. A focus on CI and quality management can promote long term success for organizations and enable customers to satisfy their needs. Application of TQM could enable organizations in the Durban steel industry to identify employee skills deficiencies, along with the necessary training, education or mentoring required to address them. It was anticipated that the study would assist in identifying the limitations, challenges and possible improvements with regard to TQM that would enable them to achieve a competitive advantage.

1.4 Significance

The study is significant in that it aimed to identify contemporary challenges that hinder TQM implementation and the achievement of competitive advantage in the Durban steel industry. As noted previously, this sector employs many people across South Africa and is a significant contributor to GDP. Tracing the link between the application of TQM and competitive advantage will assist it to enhance its growth and development. The study drew on recent literature on strategies to mitigate the challenges confronting South Africa's economy.

1.5 Limitations of the Study

A study's limitations are factors that are beyond the control of the researcher and may undermine its findings (Ross & Zaidi, 2019). Like any research, this study suffered from certain limitations. These included time and resource constraints, as well as the impact of COVID-19 and load shedding. Some organizations were reluctant to agree to their employees participating in the study as they work different shifts, while others were on short time. Language barriers between the researcher and participants were a further limitation. Furthermore, there is a paucity of recent research on the financial cost of implementing TQM. Locating relevant literature was time-consuming. Lastly, the use of Google Scholar was a limitation, as many sources were outdated.

1.6 Aim

The aim of this research was to examine the impact of TQM on the competitive advantage of manufacturing organizations in the Durban steel industry.

1.6.1 Research objectives

The following research objectives were set to achieve this aim:

- To determine the key factors that influence the TQM practices adopted by manufacturing organizations in the Durban steel industry.
- To determine the relationship between the adoption of TQM practices and the operational performance of manufacturing organizations in the Durban steel industry.
- To examine whether the management practices had an impact on the competitive advantage of manufacturing organizations in the Durban steel industry

1.6.2 Research questions

The following research questions were formulated to achieve the study's objectives:

- What are the key factors that influence the TQM practices adopted by manufacturing organizations in the Durban steel industry?
- What is the relationship between the adoption of TQM practices and the

operational performance of manufacturing organizations in the Durban steel industry?
- How do management practices impact the competitive advantage of manufacturing organizations in the Durban steel industry?

1.7 Hypotheses

The hypotheses were tested using the p-value approach. This assumes the null hypothesis to be accurate and applies a statistical test (Wesserstein & Lazar, 2016). If the p-value is less than or equal to 0.0500, the null hypothesis is rejected and the alternative hypothesis is accepted. If the p-value is more significant than 0.500, the results favor the null hypothesis (Ding & Guo, 2023). Four steps are employed. Step 1 specifies the null and alternative hypotheses. Using the data gathered, Step 2 assumes that the null hypothesis is true. Step 3 determines if the p-value agrees with the null or the alternative hypothesis.

In order to achieve objective 2 of the study, the following hypotheses were tested:

- Organizations in the steel industry have TQM practices (people management, process management, top management commitment, continuous commitment to customer focus and supplier management).

- The adoption of TQM practices in organizations in the steel industry has a positive relationship with their operational performance.

- The adoption of TQM has a positive impact on the competitive advantage of manufacturing organizations in the steel industry.

CHAPTER 2

Literature Review

2.1 Introduction

The previous chapter introduced the study by outlining the background of steel manufacturing organizations and the problems they experience. This chapter presents a literature review that focuses on the link between competitive advantage and TQM. Total quality management practices are a crucial element in manufacturing organizations' operations. The literature review focuses on relevant articles by experts in the field on TQM practices, and various concepts relevant to manufacturing organizations and competitive advantage, including operational performance. It also identifies the gaps in the literature that this study aimed to address.

2.2. Total Quality Management

Quality is defined as a series of attributes relating to accuracy and precision (Kumar, Raju, & Kumar, 2016). It pertains to what is most favored by society, and is anything regarded as the best. Quality is determined by the majority of population and how well it serves the population whether it be an item, product or service (Darney, Kapp, Andersen, Baum, Blanchard, Gerdts, Montagu, Chakraborty, & Powell, 2019). It thus refers to a customer's perception that a product or service best meets his or her needs (Ng, Wai and Simonsen, 2021). This means that quality leads to consumer satisfaction.

Total quality management is a system that harnesses training, techniques and integrated tools to create a culture in an organization that consistently supports customer satisfaction (Chen, Lee, & Wang, 2020). It aims to improve productivity and instill trust and commitment among all involved by achieving objectives and fulfilling clients' needs and desires. This quality system extends to the organization's values (Obeidat *et al*., 2018). It acts as a management system that focuses on CI through tools, including techniques and values (Abbas, 2020). The goal is to increase customer satisfaction through improved service and products with the least raw material (Qasrawi, Almahamid, & Qasrawi, 2017; Sui, Smith, Fagan, Rollo, & Prapavesissis, 2019).

Total quality management promotes innovation. It requires that managers regard organizations as people who are responsible for the implementation, development and refinement of TQM practices and quality activities. Management is responsible for the implementation of strategy and strategic objectives. It is tasked with ensuring that all levels work towards the achievement of organizational success by empowering employees with the best resources (Brits, 2018). Management is also responsible for bringing all organizational activities together, including design, customer service, marketing, engineering, finance, production and other elements to achieve the organizational objectives (Obeidat, Al-Sarayrah, Tarhini, Al-Dmour, & Al-Salti, 2016). Operational processes and employees come together to focus on operational performance improvement. Moreover, different TQM practices work together to enhance performance and achieve competitive advantage (Anil & Satish, 2016).

The main objective is to fully utilize organizational operations at the lowest cost while obtaining the highest quality (Toga, 2017; Nguyen & Nagase, 2019). Total quality management practices like process management and a customer focus create a fertile environment for organizational members' operational performance. This study hypothesized a significant and positive

relationship between a firm's financial performance and TQM. Activities such as employee training, quality control and leadership commitment enhance organizations' performance. These elements complement one other and depend on the type of innovation an organization implements. Total quality management creates a culture where all members work together to establish an innovative workplace, with all employees involved in decision-making and planning (Al-Saffar & Obeidat, 2020). Team spirit or morale develops a sense of belonging and being at home for employees in the work environment. The resultant unity enhances productivity.

Total quality management consistently aims to maximize an organization's competitiveness by improving the quality of products through CI, people, services, the environment and processes (Nguyen & Nagase, 2019). Organizations face challenges in outperforming their competitors and maintaining and managing quality are essential to achieve this goal (Singh, Darwish, & Potočnik, 2016). Many studies have been conducted on TQM across the globe, with a focus on its associated processes (process management, top management commitment, people management, supplier management, customer focus, and CI) that have been identified as enhancing competitive advantage (Javed & Idris, 2018).

The implementation of TQM can drive competitive advantage and achieve quality over time. Top management is responsible for ensuring that practices that promote TQM are implemented (Evans, 2017). To survive in the competitive business environment, organizations should have the capability to adjust strategy, and this should be harmonized with the environment (Pambrenia, Khatibia, Azama, & Thama, 2019).

Bajaj, Garg, Sethi and Dey's (2019) study focused on quantity and the competitive market in the global steel industry. However, it did not address the question of TQM. A study on the largest steel manufacturing companies in India examined how employee job satisfaction, morale and dissatisfied employees affect operational performance (Bhasin, 2018). However, it was limited to organizations in India and only included 100 respondents, limiting the findings' generalizability. Moreover, it had a strong customer focus and neglected other TQM elements.

Tjeku's (2006) research on steel organizations in South Africa examined job security and highlighted managers' role in promoting such security by providing training and development, coaching and mentoring, and promoting employee support for the organizational vision. It paid little attention to how TQM practices could support organizations in enhancing job security and achieving competitive advantage in the market. Furthermore, it was restricted to a single province, namely North West.

Sustainability is a crucial factor in the steel industry. A focused workforce that is satisfied with working conditions promotes sustainability (Mgiba, 2015).Leadership plays a significant role in the success of steel manufacturing organizations in South Africa. There are two main leadership styles: transformational and transactional. Transformational leadership works with everyone involved to determine if change is necessary. In contrast, transactional leadership relies on punishment or rewards to achieve optimal job performance from all employees (Khoza, Mafini, & Okoumba, 2022). In order to achieve a healthy competitive advantage, a business has to plan carefully to achieve productivity, focusing on production planning, lead time, quality management and maintenance of machinery and production processes (Madonsela, Mukwakungu, & Mbohwa, 2017).

Investment in machinery in order to improve efficiency and competitiveness is a common contemporary management strategy, while investment in human capital has decreased.

However, well-trained staff are required to operate such machinery (Madonsela, Mukwakungu, & Mbohwa, 2017). Tjeku (2006), Tsebe (2022), and Munyai, Mbohwa, Makinde, and Ramatsetse (2018) conducted studies on steel manufacturing organizations in South Africa. However, little attention was paid to TQM or the operating tools that could promote competitive advantage. To the best of the researcher's knowledge, no study has examined the implementation of TQM in steel manufacturing organizations in the Durban metropolis.

2.5 Total Quality Management Principles

Total quality management principles cover every aspect of the organization and aim to improve operational performance. The key elements are process management, top management commitment, people management, supplier management, customer focus and CI (Nguyen & Nagase, 2019). As shown in Figure 2.1 below, these principles form a 'Process Approach' group of TQM principles (Sinah *et al*., 2016).

Table 1:1 Process Approach TQM principles

TQM Principles	Definition
1. Process management	Managing and controlling processes.
2. Top management commitment	Directing managers and subordinates.
3. People management	Using people's abilities for the benefit of the organization.
4. Supplier management	Creating value from the mutual relationship between the organization and the supplier.
5. Customer focus	Putting customer needs and satisfaction first.
6. Continuous improvement	Continuously improving the goods and services that the organization offers.

Source: Sinah *et al.,* (2016).

The Process Approach principles are basic guidelines for managers to work with as a foundation to improve an organization's performance. They aim to improve operational performance through customer satisfaction while enhancing the organization's wealth.

The literature notes that the principles of TQM are categorized into two forms: soft and hard principles (Sinah *et al.*, 2016). Soft TQM principles contribute to organizational operational performance, while hard principles contribute to TQM elements that have no relationship with performance. Soft TQM principles consist of elements such as leadership, employees, education and training, including empowerment and employee development (Ershadi, Najafi, & Soleimani, 2019). The hard principles involve elements such as operating techniques and quality improvement tools (Ahmed & Idris, 2022) as well as continual improvement and a fact-based approach to making decisions. In contrast, leadership falls under soft principles and involve peoples with mutually beneficial supplier relationships and a focus on consumers.

2.3 History of TQM and Global Adoption

Walter A. Shewhart is credited with introducing the concept of quality control in the 1900s. In 1931, he published his method known as Economic Control of Quality of Manufactured Product. In 1951 Joseph Juran adopted Shewhart's methods of quality control in industrial engineering. Jeseph went on to publish his influential book, *Juran's Quality Control Handbook*. Post-world war II, US citizen Deming further developed Shewhart's methods.

Deming delivered a lecture in Japan on the rebuilding of organizations. Total quality management was developed in the 1950s when engineers working alongside the Japanese Union added quality control to their statistical quality. Japan's application of TQM was hailed as a significant contributor to the country's economic recovery as well as its industrial success following World War II. Impressed by Japan's ability to enter the global market, organizations worldwide adopted TQM in the 1970s and 1980s. As the need to enhance productivity, efficiency and quality increased, more modern methods emerged, including lean manufacturing and six Sigma which have replace TQM to address 21st century needs. However, TQM remains influential.

The South African steel manufacturing industry contributes R600 billion to GDP, constituting 15% of the total and it is a crucial sector in terms of economic growth. Globally, the sector employs more than eight million people and enjoys an overall estimated overall productivity rate of 65% (Organization for Economic Cooperation and Development [OECD], 2020; Statistics South Africa, 2018). The steel industry contributes significantly to the economy in countries on the African continent, including Egypt, Ethiopia Mozambique, Zambia, Tanzania, Kenya, Namibia, Uganda, the DRC and Ghana. However, South Africa's steel sector has witnessed a decline since 2010. This has been caused by a number of factors such as the competitive market, customer demands for competitive prices and structural issues. Organizations across the steel industry have been negatively affected, including steel mills, traders of steel and local manufacturing organizations (Schoeman, Oberholster, & Somerset, 2021; Van der Walt 2012).

2.4 Context of Business Competitiveness

Achieving a competitive edge in todays' business environment requires companies to make sense of an abundance of information. Companies and governments utilize competitive improvement to turn information into valuable intelligence that can inform market strategies and tactics, as well as encourage a culture of competition that fosters innovation (Smith & Jones, 2016). Although 'competitiveness' is a broad concept, it essentially refers to nations and businesses' ability to succeed in markets, which increases overall welfare. The International Institute for Management Development (IMD), cited by Smith and Jones (2016), defines competitiveness as the ability to add value and control quality and capacity during production while maintaining a product's attractiveness and reliability, and thus gaining consumer preference over similar products in the global market. According to Chong and Ali (2022), national competitiveness refers to a nation's capacity to develop, produce, distribute, and provide goods/services for international markets. The ability to broaden viewpoints and comprehend the competitive business environment is part of a competitive spirit. Companies should understand the issues thoroughly and accurately. Utilizing competitive improvement can assist organizations to fulfill objectives and goals by being aware of potential threats (Chong & Ali, 2022). It also enables possibilities to be identified. The business environment should be studied in its entirety, including competitors' strengths and weaknesses, new strategies and products, and how these factors affect a company's success or failure (Chong & Ali, 2022). Competitive intelligence aids in the development of novel and inventive business strategies that allow an organization to gain a competitive edge.

South African organizations need to improve their competitiveness in order to survive and thrive in the modern knowledge-based economy (Gechco, 2013). The Internet and e-commerce are opening up new possibilities in engineering, financial services and education as well as new platforms for export. However, rapid globalization and liberalization of markets impose

additional demands (Gechco, 2013). High-level competitive intelligence is required to comprehend standards, laws, customer preferences, competitive strategies and corporate practices. Thus, competitive intelligence is a fundamental component of the knowledge economy (Gechco, 2013). Given that it can be used to analyze and interpret the macro environment, it is a crucial tool to gain a competitive edge and evaluate if an entity (a firm, nation, organization, or area) will be a market leader or follower it also addresses uncertainty, which is a feature of global markets.

2.5.1 Process Management

Process management is a strategic management approach which governs organizations and coordinates processes using management methods and policies (Bruch & Bellgran, 2017). It aims to achieve flexibility at a low cost. This means that processes must be interconnected across inter-organizational boundaries (Qi, Hua, Wang, & Heung, 2017). Process management offers innovative ways of achieving customer satisfaction by reducing unnecessary processes (Upadhyai, Jain, Roy, & Pant, 2019). Operational systems depend on process management to ensure regular maintenance of equipment and inspection of processes.

Prajogo, Toy, Bhattacharya, Adegoke and Cheng (2018) note that managing time, execution, processes and relevant information is essential in process management. Information management is an integral part of this strategy (Prajogo, Toy, Bhattacharya Adegoke, & Cheng, 2018). However, Projogo *et al*. (2018) did not measure achievements in terms of market competitiveness. This system promotes flexible, efficient production and improves the quality of the final product through inspection (Simegnaw & Ayele, 2020). Organizations use process policies and procedures to decrease wastage and defective products and achieve cost-effective production (Abu-rumman, 2018). This calls for effective supervision (Bruch & Bellgran, 2017) as well as the appointment of highly trained, experienced and competent personnel (Kaur, Singh, & Singh, 2019). Every employee involved in the production process must be competent to complete tasks in accordance with the process management regulations and policies (Durairatnam, Chong, & Jusoh, 2019).

A foolproof design and stable production schedule are required for effective operations and performance (Pham, 2020). Sound process management promotes the integrity and quality of operations. It enhances a manufacturing organization's competitiveness by ensuring that products are up to par and satisfy clients' needs. Process planning also ensures that no harm comes to employees (Reason, 2016). A lack of proper planning and carelessness could result in injuries or loss of lives. Some organizations' production processes are characterized by extreme temperatures and pressure and hazardous chemicals (Reason, 2016). Specialized training and process management are required to ensure the safety of all involved (Tsang, Choy, Wu, Ho, Lam, & Koo, 2018). Procedures must be specifically tailored specifically for each job.

In summary, process management emphasizes proactive and preventive approaches through a set of TQM practices (Zhang, Wang, & Zhao, 2019).

2.5.2 Top Management's Commitment

According to Yusliza, Norazmi, Jabbour, Fernando, Fawehinmi and Seles (2019), top management's commitment is essential to improve firm performance. Management plays an important role in implementing sustainably strategies that involve organizational changes and resource commitment (Wijethilake & Lama, 2019). Management commitment demonstrates the organization's drive to achieve its objectives (Graves, Sarkis, & Gold, 2019). Committed management steers TQM by setting goals and values that enhance organizational performance and customer satisfaction (Yusliza *et al.,* 2019). A united front and healthy relationships are essential across the organization.

Management must have the capabilities, skills and knowledge to create a blueprint that guides the activities of all staff (Dubey, Gunasekaran, Childe, Papadopoulos, Hazen, & Roubaud, 2018). While Dubey *et al*. 2018) noted that management capabilities are important, the question arises as to whether existing operating techniques should be used or if new ones should be created. Organizations should have a strong, capable production, advertising and sales team to achieve their objectives (Obeidat *et al*., 2016) and clear communication channels should be established across all levels of management and staff (Gözükara, Çolakoğlu, & Şimşek, 2019). This is especially important in the steel manufacturing industry, which involves complex operations using TQM.

The production team must be able to communicate their opinions, issues and ideas (Graves, Sarkis, & Gold, 2019). Extensive data and research on TQM are essential prior to its adoption (Georgiev & Ohtaki, 2019). Wijethilake and Lama (2019) note that TQM guidelines should be respected by all staff. However, Wijethilake and Lama (2019) neglected the fact that specialized staff might rely on unique skills that might not be fully understood by management. Furthermore, they did not acknowledge that the TQM guidelines might not all be applicable to every sector in different locations.

Implementing TQM requires good leadership (Sriyakula, Umamb, & Jermsittiparsertc, 2019). Employees are enablers of success and TQM emphasizes the commitment of every part of the organization. All personnel must be included in awareness and training for successful TQM implementation (Yusliza *et al.,* 2019). As noted by Yusliza *et al*. (2019), top management's commitment ensures success. However, these authors do not state clearly how they can do so. Stakeholder buy-in is also important in ensuring that the implementation of the TQM system positively impacts the organization and that everyone benefits. This requires that staff be appropriately trained, that incentives be provided and that the necessary resources are made available (Al-Saffar & Obeidat, 2020).

Successful implementation of TQM calls for leadership not only to manage but to participate in day-to-day operations rather than observing supervisors doing all the work (Ali, Li, Khan, Shah, & Ullah, 2020). Employees and top management require training to produce quality technical and administrative work (El-Kassar & Singh, 2019). However, it is not clear what type of training each staff category requires or if all personnel should complete the same training. To

achieve a common goal, leadership must synergize employees with full commitment to a total quality setting that TQM calls for (Pham, 2020).

Top management's commitment is pivotal, as in TQM management drives the business forward and sets the goals for the organization (Islamgaleyev *et al*., 2020). Senior staff must consider the internal strategic management TQM process and principles. They also need to understand the purpose of staff participation programs that are part of the TQM approach (Pham, 2020). They are not just in charge of quality management, but also of ensuring that every person in the organization is active in the quality improvement process (Pham, 2020). Their primary role is quality planning attached to cost-effectiveness, setting quality goals and scheduling essential TQM elements to influence and improve other TQM factors. The most critical factor contributing to a successful TQM program is that it provides vision and direction to employees, enhances synergies, adds value, enhances the communication process, and improves information sharing and enlightenment (Pham, 2020).

A workplace where the staff can interact and address any issues constraining operations delivers exceptional work (Krajcsák, 2019). Working conditions should be improved and safety should be a top priority (Ali *et al.,* 2020). This will motivate employees to be committed to their work which will, in turn, enhance productivity (Graves, Sarkis, & Gold, 2019).

2.5.3 People Management

People engagement positively correlates with organizational performance and provides a competitive advantage (Bashar, Hasin, & Jahangir, 2020). Employees can be transformed by dealing with critical issues in TQM. Employees that are motivated, involved and feel a sense of ownership of the organization are more committed (Krajcsák, 2019). Workforce training provides staff with the skills and knowledge required to fulfil their roles (Al-Sarayrah, Obeidat, Al-Salti and Kattoua, 2016). Competent employees positively impact operational performance (Yusliza *et al*., 2019).

The global market requires innovative techniques and approaches; thus, regular education or training programs and coaching are necessary (El-Kassar & Singh, 2019). Training and education make for a more competent workforce that has higher levels of productivity, with fewer production defects and less wastage (Akhter, Malik, Khwaja, & Mehmood, 2018).

Job-related competencies or facilitated learning are planned learning programs (Krajcsák, 2019) that enable organizations to enhance job satisfaction as they increase employees' knowledge and skills and create productive staff (Obeidat *et al*., 2016). In turn, this promotes customer satisfaction (Abu-rumman, 2018). People are a business' most critical asset and labor is the most crucial component. Thus, employees should be treated fairly and fairly compensated for their work (Durairatnam, Chong, & Jusoh, 2019). A gap exists in the literature on whether organizations are treated fairly by their employees and if their cost to the organization can be measured (Al-Saffar & Obeidat, 2020). Management should thus focus on the commitment of everyone in the organization and give appropriate attention to TQM so the quality of products and services can improve to gain more customers and increase sales.

Effective implementation of TQM requires that every employee should be able to easily communicate his/her ideas and opinions and take part in decision-making (Yasa *et al.,* 2021). Customer opinion is another important factor (Al-Saffar & Obeidat, 2020). In order to enhance employee satisfaction, (Patel, 2019), organizations should resolve any issues and create a healthy workplace where employees feel they can deliver of their best (Pham, 2020).

A workplace that is clean, hygienic, and free from harmful gases, liquids, or surfaces (Smith & Plunkett, 2019) promotes employee satisfaction. Employees should receive training in health and safety and protective equipment should be provided when necessary (Tureckiová, 2018), including boots, helmets, safety vests and masks. They should also be trained to use the machinery they operate. This would boost commitment and morale in the workplace (Krajcsák, 2019) that promote competitiveness.

Training makes for a competent workforce that is able to swiftly respond to customer complaints (Gözükara *et al.,* 2019). Quality is everyone's responsibility and all employees are responsible for production; it is up to management to ensure that all employees are competent, can control quality and deliver high quality (Georgiev & Ohtaki, 2019). Looking after the workforce promotes employee satisfaction and loyalty (El-Kassar & Singh, 2019). The environment is the organization's location; it should be taken care of and be structurally stable, with machinery in good working order that is safe to use.

Amin *et al.* (2017) highlight the need for employees to be treated fairly and compensated well for their contribution, time and skills. However, their study did not investigate how organizations can measure the value of employees' contributions and how this can achieve successful performance. Quality measurement is achievable through the services and products supplied to consumers (Rodriguez, Valenzuela, & Ayuyao, 2018).

Employee motivation can be fostered through teamwork and total employee involvement to practice new skills and learn through opportunities which arise (Kesari & Verma, 2018). The company's success will depend on motivation and skills, and with an increase in the workforce's knowledge, the company will thrive (Evans, 2017). Incentives can be used as extrinsic motivation (Krajcsák, 2019). To promote a well-organized workplace, different teams should be created for quality, production and sales (Iqbal & Asrar-ul-Haq, 2018). Employees should be equipped with the tools and systems necessary to achieve a high level of performance (García, Rama, & Alonso, 2014). Training staff can minimize the misuse of tools and reduce wastage (El-Kassar & Singh, 2019).

Employees should also be encouraged to communicate effectively, take responsibility and tap into their innovative and more creative side (Tasie, 2016). Operational problems must be resolved in order to achieve CI and collective problem-solving should be encouraged (Graves *et al.,* 2019). Participating in meetings with management motivates employees to take responsibility for their work and to drive productivity, as they can voice their concerns or operating restrictions that are hindering the organization’s competitiveness in the market (Al-Saffar & Obeidat, 2020). Employee involvement as part of people management has a positive impact on operational performance in TQM. Indeed, it is one of the four elements contributing to financial and operational performance (Pambreni *et al*., 2019).

2.5.4 Supplier Management

Supplier management is crucial to manage operations and interactions with third-party vendors. Developing a good relationship with a vendor ensures that the service or product delivered meets the organization's quality standards (Yang & Zhang, 2017). Supplier management includes assessing suppliers' capabilities and strengths and establishing a long-term business relationship which benefits both parties (Kumar, Kumar, & Barman, 2018). It aims to minimize risk in stock procurement, thus reducing the risk of failure due to exposure to third parties (Chakraborty, Chattopadhyay, & Chakraborty, 2020). There are multiple tiers in supplier management, including the first tier and the lower tier/sub-supplier that organizations have to manage to protect their reputation and the quality of the goods supplied to them (Yan, Zhang, Zhu, & Fan, 2019).

Negative media coverage of third-party organizations can be harmful to all organizations involved. An example is vendors that use child labor. Lechler, Canzaniello and Hartmann (2019) investigated this issue, but did not offer solutions that would enable an organization to manage other organizations in order to preserve its image. Their study focused on organizations that were accused of using child labor to mine minerals (Lechler, Canzaniello, & Hartmann, 2019). These violations were not committed by the accused organizations, but by their suppliers (Lechler, Canzaniello, & Hartmann, 2019). However, human rights organizations found them guilty of failing to investigate their supplier's supplier and they were therefore held responsible (Lechler, Canzaniello, & Hartmann, 2019). The study highlighted that a supplier's failure to act in a professional manner and with integrity can ruin their supplied organization.

Chakraborty *et al.* (2020) noted that due to the fact that suppliers worldwide adopt unconventional practices, organizations need to research their suppliers and their sources before they conduct business with them. Unethical suppliers may face legal charges and this would tarnish their image and, by association, that of the organizations that do business with them (Kaur *et al.,* 2019). Lower tier suppliers' involvement triggers increasingly complex sustainable supplier management practices (Yan *et al.,* 2019).

Supplier management functions as a control mechanism in buyer-supplier relationships to prevent agency risk (Lechler, Canzaniello, & Hartmann, 2019). Organizations need to conduct periodic evaluations of their suppliers' performance and ethics (Kumar, Kumar, & Barman, 2018). Outsourcing is a longstanding practice that is common in low-wage countries like China, India and some African countries (Chakraborty, 2020). While Chakraborty (2020) examined outsourcing and how cost-oriented it is, the study did not delve deeply into how this can compromise supplier quality and integrity and thus operational performance and competitive advantage. In recent times, a number of suppliers have been accused of unfair labor practices and causing harm to the environment (Schmidt, Foerstl, & Schaltenbrand, 2017).

Lechler, Canzaniello, Wetzstein and Hartmann's (2020) research on vertical supplier contexts and first-tier suppliers concluded that first-tier suppliers implement sustainable supplier management and selection. In order to improve quality, suppliers should be selected based on the quality of the product they supply rather than on the price and relationship (Pham, 2020). They must also demonstrate adherence to ethical practices (Tsebe, 2022). Aside from these

considerations, the remaining TQM principles should be applied. While Pham emphasized the need to focus on the quality rather than the cost of suppliers' products (Kumar *et al.,* 2019), the study did not examine the outcome if a supplier were selected based on cost. This would mean that the final product would be cheaper, with positive implications for competitiveness. In the context of sustainable supplier management, more attention should be paid to horizontal strategic alliances (Lechler *et al.,* 2019) that occur when two competing organizations join hands in an attempt to enhance their capabilities and competitiveness (Nielson, Mujumber, Szwarc, & Saha, 2020). Establishing a long-term relationship with one supplier that the organization trusts has advantages (Deming, 2018).

Trust and loyalty are essential in the relationship between an organization and its supplier. They lay the foundation for a long-lasting partnership that caters for the expectations of both parties (Dubey, Gunasekaran, Childe, Papadopoulos, & Helo, 2018). The supplier must deliver at the agreed time and adhere to specifications. The organization may desire a specific ratio, size, location, packaging and time of delivery, which one supplier might not be able to meet (Yan *et al.,* 2019). Yan *et al*. (2019) focused on the crucial factors that should be taken into account in selecting a supplier, but failed to acknowledge that this might have cost implications, with negative impacts on the organization's competitiveness. Organizations should bring their suppliers on board by sharing their long-term goals with them (Deming, 2018). It should be borne in mind that dependable suppliers are harder to find than customers. Thus, supplier management should seek to promote healthy interdependence of suppliers (Pham, 2020).

2.5.5 Customer Focus

Customer focus refers to strategies that focus on what the customer desires and what the organization manufacturing the products needs to do to satisfy these desires (Islamgaleyev *et al.,* 2020). Producing and delivering services/products that satisfy customers is crucial to ensure long-term success and survival (Deming, 2018). An organization's customers are the most critical aspect of its business (Husain, Dayan, & Di Benedetto, 2021). Employees should be encouraged to investigate customers' reactions to their product/service and to respond to negative feedback (Al-Saffar & Obeidat, 2020). Customer focus is a core TQM practice that is essential for any manufacturing organization (Rureri, 2018).

Customers of steel manufacturing organizations make decisions collectively and are driven by rationality rather than emotional motives when making purchases (Islamgaleyev *et al.,* 2020). Business in the steel/metal industry is subject to seasonal fluctuations (Adebanjo, Teh, Ahmed, Atay, & Ractham, 2020) and quality management practices is essential (Gutierrez-Gutierrez, Barrales-Molina, & Kaynak, 2018) as a satisfied buyer will be a loyal future customer (Kalogiannidis, 2021).

Customer reactions to products can be classified into conscious and unconscious, rational and emotional, and satisfied and dissatisfied (Bajaj *et al.,* 2019). Potential customers have expectations of a particular product or service and meeting these is vital for customer satisfaction (Bajaj *et al*., 2019). While researchers have focused on the need to meet customer

expectations, there is limited research on the cost of doing so, which could result in over-commitment and the loss of competitive advantage, as pricing is vital to achieve competitiveness. Thus, organizations should establish a dedicated department that focuses on customers (Permana, Purba, & Rizkiyah, 2021). This will enable them to track customer expectations and achieve a healthy client base (Kalogiannidis, 2021).

A suggestion box is one way to enable customers to provide feedback on services and products (Saleh, Sweis, & Saleh, 2018). There is a need for research on alternative methods to achieve this in a dynamic and changing context (Yasa *et al.,* 2021). Any measure of customer service should be able to establish how an organization's products/services differ from its competitors (Cook, 2017) and what steps can be taken to improve them (Kalogiannidis, 2021). However, the cost of meeting customer expectations should always be borne in mind. Strong relationships need to be established with customers (Saleh *et al.,* 2018) and their responses to a product should be communicated to all employees so that they know how customers feel about their work.

Positive customer responses will boost staff's confidence and encourage them to maintain high standards (Barari, Ross, & Surachartkumtonkun, 2020). Negative feedback can be used to take action to turn the tide (Lepistö, Saunila, & Ukko, 2022). Communication can be by means of a suggestion box, competition, dedicated phone line or an app (Setiyaji, Alves, & Wijaya, 2022). It can occur face-to-face at a meeting between customers and a representative of the organization; or they can meet customers at a place where the company trades its products.

Customer complaints should be dealt with in a timeous manner as they point to a possible flaw in a product (Saleh *et al.,* 2018). When creating or developing a product or service, the needs and desires of internal and external customers need to be taken into account (Al-Saffar & Obeidat, 2020). Customers operate on the basis of first preference and improved quality could sway their opinion of a product (Cook, 2017). While Kalogiannidis (2021) highlights the need to build a close, trusting relationship in order to gain customers' loyalty, a further issue is overcoming consumers' preference for a cheaper product. Given the current challenging economic conditions, all consumers aim to save where they can while fulfilling their needs.

Product malfunction or issues with the product must be dealt with swiftly to prevent the loss of customers (Saleh *et al.,* 2018). Doing so will also prevent the problem from recurring. The objective should be to exceed customer expectations (Islamgaleyev *et al*., 2020).

Clients compare products by gathering information from various sources or drawing on their experiences. Their expectations are measured against their experiences (Islamgaleyev *et al*., 2020). Market research is of great importance as it helps to establish what customers demand and enables production of a product that satisfies such demand (Yasa *et al.,* 2021). Market researchers conduct interviews or administer questionnaires to the target market (Al-Saffar & Obeidat, 2020).

Customers' experiences determine their future decisions regarding products and services and the organizations they favor (Islamgaleyev *et al*., 2020). Market research also helps to identify improved production techniques and gaps in the market (Yasa *et al.,* 2021). In short, customer service is imperative for success (Cook, 2017).

2.5.6 Continuous Improvement

Continuous improvement aims to ensure an organization's success and progress (van Assen, 2021). It can be achieved by developing production processes that yield superior performance (Al-Saffar & Obeidat, 2020). Continuous improvement is a mechanism to achieve customer satisfaction by enhancing staff capabilities and skills in the short term to increase long-term returns and maintain gains (Madonsela, Mukwakungu, & Mbohwa, 2017). It is one of the most robust practices which an organization can implement to compete in the contemporary business environment (El-Kassar & Singh, 2019). Continuous improvement is challenging for organizations to implement and sustain as it has cost implications and organizations are wary of replacing machinery that works for a new machine which does the same thing but better (van Assen, 2021).

Successful organizations that embrace CI usually have a process-oriented focus, while those with less successful CI usually have a management-oriented focus (Medne & Lapina, 2019). Process-oriented management focuses on improvement over the long term (Sjödin, Parida, Kohtamäki, & Wincent, 2020). A culture of CI is built by training staff and encouraging them to work together (van Assen, 2021). Every person in the organization should participate in CI as everyone is responsible for improved performance and market competitiveness (Al- Saffar & Obeidat, 2020).

Total quality management's main concern is constant improvement in dynamic decision-making at all levels of planning (Sutrisno & Ardyan, 2020). Continuous improvement involves complete execution, and thus calls for improved programs, capital markets and customer relationships (Al-Saffar & Obeidat, 2020). Different methods like Six Sigma can also applied to improve systems in the manufacturing industry (Maged, Haridy, Kaytbay, & Bhuiyan, 2019), rather than systems that privilege improved output over time. The workforce is an important component of CI as it is systematically applied as a bottom-up approach (Medne & Lapina, 2019). It thus brings all staff together, regardless of their position in the organization to work towards a common goal (Costa, Lispi, Staudacher, Rossini, Kundu, & Cifone, 2019). This makes for a stable workforce that enhances performance, reduces production errors, and increases productivity; however, this requires that the workforce is motivated and trained (van Assen, 2021).

Madonsela *et al.* (2017) highlighted that regular training is necessary as the focus is on creating centralized production processes and constant improvement. However, the study did not explore other TQM practices to promote CI and was limited to South Africa's North West province. Customer service can improve an organization's performance (Jimoh, Oyewobi, Isa, & Waziri, 2019). Adequate resources should be made available to create a culture which encourages innovation and confidence among all staff while minimizing panic or rash decision-making during operations (Medne & Lapina, 2019). Internal CI strategies can be used by a group of managers to bring about change (Gamme & Lodgaard, 2019). Such strategies modify operational processes and how the organization conducts business (Jimoh *et al*., 2019).

Organizations also need to develop innovative strategies to use less energy, including green production for a clean manufacturing process (Qiu, Jie, Wang, & Zhao, 2019). Technical

knowledge is required to undertake such restructuring (Qiu *et al.,* 2019). Continuous improvement increases capabilities at the organizational level. Product innovation can be solidified through institutionalization, transferring new knowledge that helps enhance operational capabilities (Khan, Kaviani, Galli, & Ishtiaq, 2019) among staff and thus improves customer satisfaction (Al-Saffar & Obeidat, 2020). In short, TQM calls for CI to enhance efficiency, competitiveness, and performance among manufacturing as well as service organizations (Li, Papadopoulos & Zhang, 2016).

2.6 The Deming Cycle

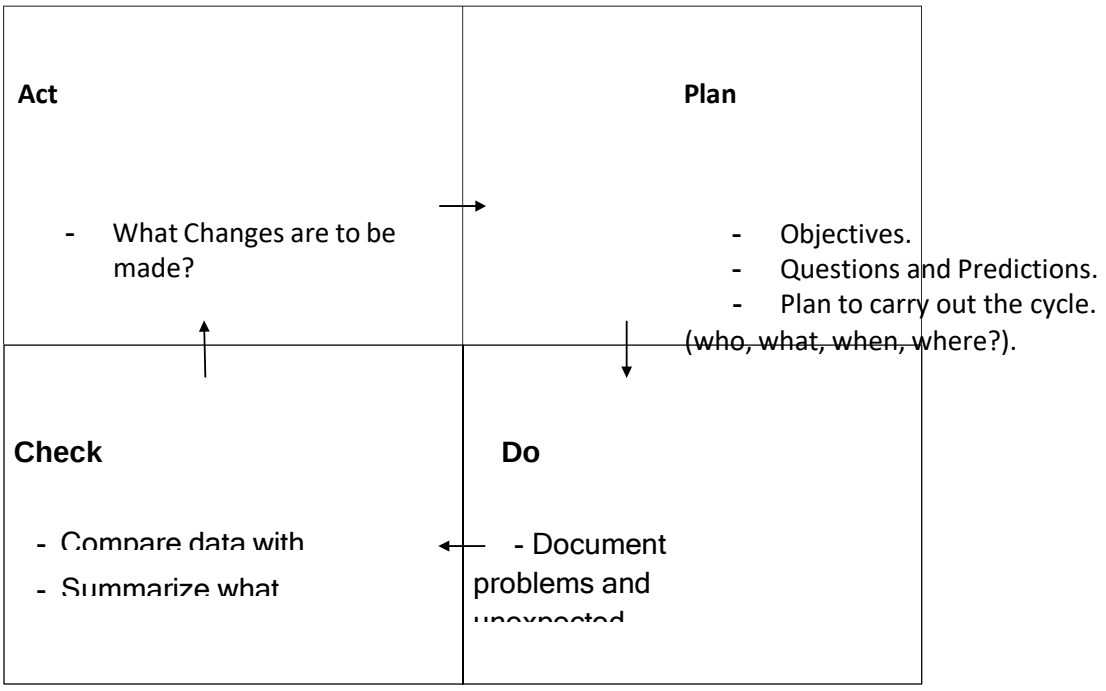
Employee performance is influenced by a number of factors. The Deming cycle can be used to promote CI (Dudin, Smirnova, Vysotskaya, Frolova, & Vilkova, 2017). Also referred to as the PDCA (Plan, Do, Check, Act) cycle, it consists of a set of four logically connected, repetitive steps that promote CI (Schmidt, 2019).

In the first step, Plan, an organization formulates its objectives. It should analyze how it can improve its chances of success and make predictions. The steps necessary to achieve the objectives should also be set out (Roldán-Molina *et al.,* 2021)

In the second step, Do, the organization sets and carries out the goals to achieve what it planned. Everything that occurs during this period should be documented, especially unexpected challenges and practices that are more impactful than expected (Schmidt, 2019).

In the third stage, Check, what took place in the previous stage is analyzed against the objectives set in the planning. The lessons learned should be recorded (Shyng, 2021).

In the last step, Act, the organization takes action based on the learnings from step 3. Flaws in the plan that occurred during step 2, Do, should be identified, and necessary changes should be made to achieve the organization's objectives in the following cycle (Roldán-Molina *et al.,* 2021).



Source: Adapted from Molina, Ordas, Fernandes and Mendez (2021)

Figure 1: The Deming Cycle

2.7 TQM and Competitive Advantage

Achieving a superior position over other organizations in a market/industry is referred to as a competitive advantage and such an organization is able to drive the market (Kwak *et al*., 2017). Competitive advantage is defined as the attractive competitive value of a product or service that outweighs the price charged by all competitors. From a customer's viewpoint, it is a firm's offer at a more attractive price than that of its competitors (Hosseini *et al*., 2018). Innovation is an essential tool to gain competitive advantage coupled with TQM that facilitates effective, efficient utilization of resources and an on-going quest to improve production processes (Distanont & Khongmalai, 2020). Innovation involves changes in products, services or processes that enhance customer satisfaction to achieve a competitive advantage (Kwak *et al*., 2017). There are two types of innovation, namely, process innovation and product innovation (Hafeez *et al*., 2018).

Development and sustainability of competitive advantage through achieving maximum efficiency, reduced costs and enhanced customer satisfaction is an objective of TQM (Gitangu, 2016). Gault (2018) defined innovation as a new, different way of operating. This can be achieved by identifying a unique way of producing, deploying better technology/machinery, or employing a different combination of the factors of production before a competitor does. Competitive advantage can only be achieved when the value that could be created is less than that created in an economic exchange (Chen *et al*., 2020). For manufacturing organizations to achieve competitive advantage, their product must be an innovative one that is better than that of their competitors (Quaye & Mensah, 2019).

Product innovation aims to maintain a product's core functionality but render the client experience more pleasurable by producing an appealing product of better quality. This may involve changing its design and packaging, although this should not increase the price (Toga, 2017). Examples include, a new bottle, or new taste, flavor, or size (Al-Saffar & Obeidat, 2020). Research and Development (R&D) is undertaken to achieve an advantage in the market (Kwak *et al*., 2017). The aim is to identify new technology, capital equipment, superior manufacturing processes or alternative raw material (Al-Saffar & Obeidat, 2020) that will produce a better quality product (Pérez *et al*., 2019). Process innovation involves improved operations, execution of significant tasks and improved technology, communication and knowledge in the organization (Distanont & Khongmalai, 2020).

Manufacturing organizations that seek to improve their product can do so by increasing the quality and quantity of their product, thereby enhancing customer satisfaction (Quaye & Mensah, 2019) and gaining an advantage in the market. In process innovation, new elements are introduced to a firm's production or service operations (Toga, 2017). This calls for the ability to modify or completely transform existing strategies (Chen *et al*., 2020). Internal resources such as software, equipment, and machinery are key to innovation. The organizational process must also be up to date and the firm must be willing to explore new techniques and embrace innovative ways of doing things (Hafeez *et al*., 2018).

Awareness of market conditions is one of the factors that organizations base their prices on. Pricing approaches differ depending on the nature of the organization and the nature of its business relationships (Quaye & Mensah, 2019). They are influenced by the management culture, market knowledge, intuition and experience over time. Achieving competitive

advantage calls for high-level, strategic decision-making (Toga, 2017) with the objective of offering high quality products at a competitive price. Products are sold at lower prices than those of competitors, or unique benefits such as rewards or discounts could be offered (Xuhua, Elikem, Akaba, Worwui-Brown, & David, 2019).

Sustainable competitive advantage requires every department to be on board and to commit to high levels of efficiency. Proponents of TQM assert that sustainable competitive advantage can only be achieved if the organization replicates its operations (Chen *et al*., 2020).

However, according to the resource-based view of an organization, this may be a difficult task (Chen *et al*., 2020). High levels of employee morale are vital to enhance efficiency (Chen *et al*., 2020). Total quality management improves employee morale by reducing information asymmetry, streamlining operations (Quaye & Mensah, 2019) and ensuring on-going monitoring of maintenance of equipment and machinery.

(Yasa, Alsaudb, lmaghrabic, Almaghrabic and Othmand 2021) note that customers' perceptions of services and goods determine the value attached to them. Customer satisfaction occurs when consumers feel that the goods and services they purchase are value for money and are happy to repeat the purchase (Chen *et al*., 2020). Consumer satisfaction is based on the relationship between the product/services customers receive and the investment they make in it. Their evaluation of the outcome results in content or discontent with an organization's products and services (Yasa *et al*., 2021).
Several researchers have investigation TQM's impact on customer satisfaction it. For example, Alfalah (2017) found that universities in the UK experienced increased customer satisfaction following the adoption of TQM. Obeidat *et al.,* (2016) also found that that TQM enhances consumer satisfaction. South Africa organizations have expressed mixed feelings with regard to TQM's focus on customers. Customers are hard to please and consumer trends change on a continuous basis, making it challenging for organizations to keep pace (Islamgaleyev *et al.,* 2020). Customers seek quicker responses to their demands and more varieties to choose from (Al-Saffar & Obeidat, 2020). Furthermore, they expect to be able to purchase high quality goods at low prices (Alfalah, 2017). It is easier to lose customers than to win them as it only takes one negative experience for a customer to switch their loyalty from one organization to another. Organizations thus need to be aware of the factors that influence customer content and discontent and commit to producing products and services that satisfy them. Competitive advantage is achieved by means of effective production management and market attraction (Xuhua *et al*., 2019).

Competitive advantage is achieved when an organization provides customers with better value for their money, and goods/services of superior quantity and quality to those of its competitors (Xuhua *et al*., 2019). Satisfied customers are likely to purchase again and to share their positive experience with other customers (Tukirana *et al*., 2021). The adoption of TQM enhances customer satisfaction by increasing productivity, reducing costs, and achieving competitive advantage and high returns (Fernandes *et al*., 2017). It creates an improved working environment which encourages CI and creative thinking to solve problems (Alfalah, 2017). Organizations use CI to achieve competitive advantage, while TQM facilitates innovation that also improves an organization's market position.

2.8 TQM and Operational Performance

Operational performance can be defined as the way in which an organization operates and the input and output of every staff member (Trattner *et al*., 2019). It is the measured outcome accomplished by the organization, team, person or process (Mahfouz, 2019). In manufacturing, operational performance is defined as the inventory produced, the speed of new product introduction, the quality of the product and the dependability of delivery (Nabass & Abdallah, 2018).

Operational performance in manufacturing concerns the time, cost, delivery reliability and quality operations within manufacturing companies (Garza-Reyes *et al*., 2018). It is the combination of employee efforts to achieve the goals set by management and has thus been described as the "output of the firm's operations or achievements of its goals" (Maqsood, 2019). Flexibility is not an operational outcome but a manufacturing capability; it is therefore not part of operational performance (Trattner *et al.*, 2019).

The different dimensions of operational performance include financial performance, quality performance, delivery performance and flexibility performance (Santos *et al*., 2018). Organizations measure financial performance to determine their performance in relation to fixed and variable production costs. This enables them to maintain mass cost at a stable rate with no wastage and defects during production (Nabass & Adballah, 2018). The other measure is quality performance that is enhanced by the adoption of innovative production methods and training of internal staff to improve their production capabilities (Ganbold *et al*., 2020). Delivery performance refers to customer demands and how the organization meets them, as well as the time taken to deliver an order (Afum *et al*., 2020). Flexibility performance contributes to the firm's ability to produce varied products by focusing on rapid reconfiguration of products and internal process robustness (Nabass & Adballah, 2018).

Organizations usually examine operational performance from an economic perspective; for example, financial statements (Ranasinghe *et al*., 2018). It is commonly measured against set goals and targeted objectives, which are used to measure the input required to achieve them (Kaydos, 2020). Employees are critical to operational performance. For an organization to achieve a positive outcome, it requires a competent workforce with high levels of morale (Yasa *et al*., 2021).

Operational performance can be measured from a customer perspective in terms of personal satisfaction and social contribution, and from a spiritual, learning and growth perspective (Ranasinghe *et al*., 2018). An integrated approach is necessary for an organization to achieve stability and enhance its capabilities to improve its performance. Such an approach aims to increase stakeholders and customers' evaluation of organizational performance on an on-going basis (Evans, 2017). Operational performance is measured in terms of different outcomes such as return on assets, sales representing product market performance, total shareholders' return, and economic value added in the organization. Financial performance reflects the organization's profit and return on investments (Pham, 2020).

The literature identifies strategic, tactical and operational factors as critical elements of operational performance (Al-Doori, 2019). It is measured by calculating customer-focused results, product and process results, workforce-focused results, and financial and market results (Pham, 2020). The implementation of a quality-based strategy may result in an organization's financial performance being indirectly affected by non-financial performance measures. Manufacturing organizations are positively impacted by the disclosure of non-financial performance measures in annual reports and an emphasis on quality strategies and information

in non-financial performance (Omran *et al*., 2019). Researchers and organizations use financial measures and statements to explain operational performance.

Organizations have utilized financial and non-financial performance measures for a more comprehensive assessment (Zain & Shafii, 2018). Measurement of financial performance is fundamental when measuring management's success and the methods used in the organization such as TQM. Outlining the impact of technologies and investments and implementation of strategies justifies financial performance (Pham, 2020). Financial performance is measured using subjective data with two sets of indicators: market results (market share growth, market share and new customer growth) and profitability (sales growth, profit growth, and revenue growth) (Pham, 2020). Customer satisfaction, process improvements, capacity utilization and product service quality are among the financial and non-financial performance indicators. Competitive advantage and sustainability are significantly and positively affected by the implementation of non-financial performance measures (Tortorella *et al*., 2019).

There is an interconnection between operational performance and TQM practices. Such practices involve supplier management, top management commitment, customer focus, process management, people management and CI (Silva *et al*., 2022). Operational management measures the organization's performance using tools that illustrate the effectiveness of each practice. It is significant as it consists of many elements which have to work together and positively affect one another. The relationship between a TQM principle and operational performance must be significant and positive for the organization to achieve positive operational outcomes. Reinforcing the implementation of TQM practices enhances manufacturing organizations' learning capacity (Tortorella *et al.,* 2019). Improved operational performance can significantly impact organizational learning capability through the application of TQM practices (Tortorella *et al*., 2019).

Non-financial performance is an essential component in relation to TQM practices' impact on operational performance. The non-financial measures of operational performance are productivity, service quality, delivery lead-time, and the cost of scrap and rework (Gan *et al*., 2020). Employee satisfaction and customer satisfaction are the two quality measurements of operational performance in TQM (Kurdi *et al*., 2020). In determining the quality of a product or a service, internal standards are used to assess the experience. Customer expectation is defined by a number of factors, including reliability, quality of service, range of products, value for money, price, reliable information, and uniqueness of comfort (Mukarromah *et al*., 2021). Quality is perceived as a customer's judgement of an entity's services as superior or excellent (Tukirana *et al*., 2021). If the quality of the products is less than expected, he/she is unlikely to be happy or satisfied (Tukirana *et al*., 2021).

It takes time and hard work for an organization to achieve superior operational performance, which is indirectly associated with its financial performance (Sharma & Modgil, 2020). The main objective is to enhance the efficiency of everyday operations and costs. Operational performance indicates how efficient an organization can be, revealing the amount of finished goods from raw material and how much waste is acquired in the process (Sharma & Modgil, 2020).

The relationship between productivity and operational performance in manufacturing firms can sometimes be confusing (Prakash *et al*., 2017). Both terms are difficult to define as they have many dimensions. While numerous traits are employed to define productivity, the precise definition depends on the framework. As illustrated in Table 2.2, studies suggest that productivity

can be defined using ratios.

Table 2.2 Examples of definitions of productivity

		Ratio definition
Productivity	=	Output units / Input units
Productivity	=	Actual output / Expected resource consumption
Productivity	=	Total revenue / Cost plus mark-up
Productivity	=	Value added / Production factor input

Source: Adopted from Prakash *et al.* (2017).

The above definitions of productivity employ different ratios from production output to input units, product demand, and return on sales. The ratios present the connection between the final product produced and the resources converted to produce it (Prakash *et al.* (2017). The literature suggests that, in manufacturing, productivity is defined as a final product's relationship with the resources that were converted to produce it (Putri *et al*., 2017), while performance is defined as mathematical measures that aim to enhance productivity (Yarin *et al*., 2022).

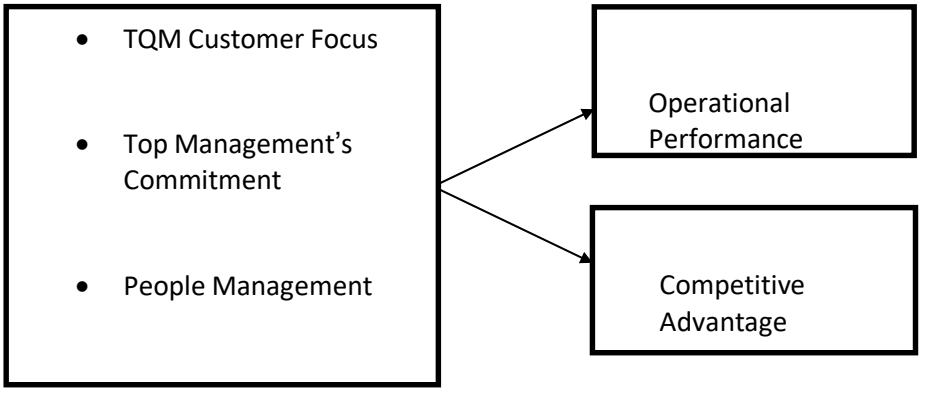
This would mean that an increase in production portrays a productivity improvement. Studies show that productivity is the standard of production maintained over a specific period or the changes made over a period (Sureka *et al*., 2020). Although various relationships can enhance productivity, an organization's conversion technique can complicate its measurement (Prakash *et al.*, 2017). Total quality management elements are precursors of performance in an organization. Bouranta *et al*. (2017) confirmed that they improve performance and are crucial to success. Studies show that that customer focus, top management commitment and supplier management are significant factors that enable TQM to enhance productivity (Putri *et al*., 2017). All TQM practices are important to achieve successful, positive performance and productivity. These principles include a factual approach, process approach, decision making and mutually beneficial supplier relationships (Sinha *et al*., 2016). The business arena is very competitive and is constantly changing. For an organization to succeed, it has to improve its productivity (Agus & Selvaraj, 2020).

Previous studies suggested that operations management's most crucial area is likely productivity (Tortorella *et al*., 2019). Productivity enhancement initiatives are necessary to drive profitability and achieve long-term growth and cost competitiveness (Song *et al*., 2017). However, few studies have been conducted on steel manufacturing organizations' production and productivity performance following the implementation of the TQM strategy, especially in Africa. This study aimed to empirically investigate technically-oriented and people-oriented TQM practices as strategies to enhance productivity and production performance (Agus & Selvaraj, 2020). While Munyai, Mbohwa, Makinde, and Ramatsetse (2018) examined a model that improves productivity in steel manufacturing organizations in South Africa, the study did not reflect on how TQM affects their productivity. The research examined how greater investment in machinery than human capital promotes CI. Toga (2017) focused on the

relationship between TQM and innovation in steel manufacturing organizations, but did not show how TQM impacts organizational performance.

2.10 TQM Conceptual framework

TQM IS THE INDEPENDENT VARIABLE AND COMPETITIVE ADVANTAGE THE DEPENDENT VARIABLE. IMPROVEMENT OF TQM MAY IMPROVE COMPETITIVE ADVANTAGE.



Source: Researcher's compilation (2023)

Figure 2: Total quality management concept

2.11 Knowledge gaps

There is a paucity of research on the underlying mechanisms of TQM and its impact on organizations in South Africa in relation to comparative advantage. While much research has been conducted on comparative advantage, the precise mechanisms that give rise to challenges in manufacturing organizations need to be identified. Furthermore, the findings of previous studies are sometimes contradictory.

Furthermore, there is limited research on emerging technologies, which may facilitate successful implementation of TQM and an understanding of comparative advantage. The world is constantly changing and organizations have resorted to new technology such as artificial intelligence to streamline operations. However, there is limited research on this issue in Durban's steel manufacturing industry.

2.12 Chapter Reflection and Conclusion

The literature review revealed gaps that need to be addressed. Chief among these is the relationship between TQM principles and competitive advantage in Durban's steel industry. Organizations in this industry are confronted by many challenges, with some having closed or downsized, retrenching many employees. It is against this background that this study aimed to paint a clear picture of TQM's impact on manufacturing organizations in the steel industry and its relationship with competitive advantage. It also sought to determine if an alternative approach is required to gain a competitive advantage. The study thus examined how each TQM practice facilitates competitive advantage and thus customer satisfaction. It also investigated how operational performance affects the implementation of TQM with a focus on productivity and efficiency.

CHAPTER 3

Research Methodology

3.1 Introduction

Researchers conduct research by following a specific path that is known as the research methodology (Sileyew, 2019). A research methodology sets out the procedures to be employed to determine the study population and to guide sampling, measurements and data collection and analysis with the aim of producing reliable, valid data and results that are free from bias and credible.

3.2 Study Type/Design

3.2.1 Quantitative

Quantitative research involves gathering and interpreting numerical data to predict and describe control factors of interests (Sureshchandar, 2023). In quantitative research, connections between the factors are examined to help predict outcomes in large populations. According to Sureschchandar (2023), predetermined theories are tested to arrive at conclusions. Quantitative data analysis aims to uncover trends across data sets. The quantitative approach is commonly used in accounting and economics. The goal is to establish the relationship between the dependent and independent variables in a population.

Given that quantitative research employs large samples, it produces broad, neutral outcomes free from bias. Data collection is faster than is the case with qualitative research as a mobile or digital platform can be used to simultaneously collect data from hundreds of participants. Quantitative research methods are easy to manage and run, making them cost effective. A single survey can be administered rather than interviewing a group of participants. These factors motivated the researcher to select a quantitative research method for this study.

3.2.3 Study Design

While qualitative research employs research instruments like interviews to gather data from a small sample, making this kind of research more time-consuming (Sureshchandar, 2023), quantitative approaches use questionnaires (Tolson, 2017) and cover larger samples. They are thus cost effective and less time-consuming, while the findings are more reliable and un- biased (Boomfield & Fisher, 2019; Toga, 2017; Abadbullah, 2019). It is for these reasons that this study employed a quantitative research approach.

3.3 Target Population

The KwaZulu-Natal Top Business Portfolio (2020) lists 23 steel manufacturing organizations with a significant number of employees. The steel manufacturing industry in Durban is estimated to employ 500 of the approximately 25 000 people employed in this industry nationwide (Khoza, Mafini, & Okoumba, 2022). The results of this research can only be generalized to steel manufacturing organizations. The study focused on TQM that is considered to be employee driven, as employees are crucial in enhancing capabilities (Toga, 2018). While some studies focus on top management, the study participants included quality managers, managers, sales managers, supervisors and general workers in order to obtain a more comprehensive understanding. The sample included ten groups of 10 respondents, with at least one quality manager or supervisor included in each group.

3.3.1 Inclusion and Exclusion Criteria

The inclusion criteria were steel manufacturing industry employees in Durban over the age of 18, which is the legal working age in South Africa. The exclusion criteria included anyone who works outside the steel manufacturing industry

3.4 Sampling

Sampling involves selecting a subset of the population of interest to the study. There are two sampling methods: probability and non-probability (Yang, Kim, & Song, 2020). In probability sampling, every member of the population has an equal chance of being selected. It consists of four sampling techniques: random, systematic, cluster and stratified sampling (Teeroovengadum & Nunkoo, 2018). In non-probability sampling, the members of different classes of a large population do not have an equal chance of being selected, as the research applies certain criteria in order to achieve the study's objectives. An example of a non-probability sample is purposive sampling.

The KwaZulu-Natal Business Portfolio (2020) lists 23 steel manufacturing organizations in the province, with a total of 500 employees. Given the large population, three sampling techniques were employed, namely, purposive, stratified and random sampling. Purposive sampling was used to select managers and supervisors to ensure that there was at least one supervisor and manager in each group of ten respondents. Thereafter, stratified sampling was applied to achieve the required population. The last step was random sampling to select a sample of 100 employees.

According to Talip (2022), a sample is a small portion of the population which is selected to participate in a study. The sample size can be calculated using Raosoft software. It uses four factors to calculate the sample size, namely, the margin of error at 8.8%, a confidence level at 95%, the population portion at 50% and the population size which was 500. This is illustrated in Figure 3 below.

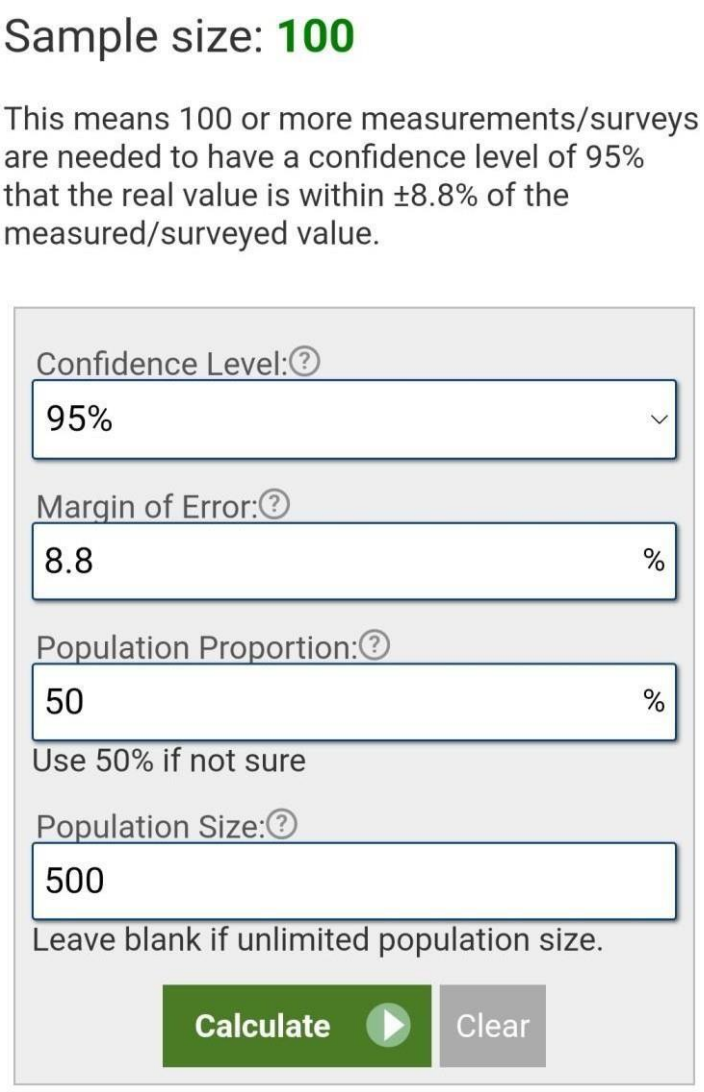


Figure 3: Sample size calculated

Source: Adapted from Talip (2022) Sample size calculator

3.4.1 Random sampling

According to Noor, Tajik and Golzar (2022), simple random sampling is extensively used in scientific research. It uses a population of the same or similar nature with participants randomly selected (Bhardwaj, 2019). Simple random sampling is the "simplest and most common method of selecting a sample, in which the sample is selected unit by unit, with equal probability of selection for each unit at each draw" (Singh, 2003). This technique ensures that each participant has a fair and equal chance of being selected to participate in a research study (Thomas, 2020). It is also a flexible method While the individuals involved should share specific characteristics set by the researcher, they can differ in other ways, such as being tall and young, fit and short, poor and unfit, or unfit and wealthy (Cohen *et al*., 2018). From a population of 500 employees, random selection was conducted until 100 participants were reached.

3.4.2 Stratified sampling

In stratified sampling, also known quota and proportional sampling (Stone, 2017), the population is divided into homogenous groups (strata). Characteristics and attributes such as gender, age or level of education are applied to form each stratum. Strata can be selected then compared with one another. According to Stone (2017), this is an effective technique to evaluate data from various groups. Stratified random sampling was employed to select participants from the 23 steel manufacturing companies in Durban regardless of their size, level of production, resource availability and comparative advantage.

3.4.3 Purposive sampling

This sampling technique enables a researcher to apply his/her expertise to select participants with the experience and knowledge required to achieve the study's objectives and answer the research questions (Sharma, 2017; Sekaran & Bougie, 2016). It is a simple, time and cost-effective method The researcher confronted challenges in contacting steel manufacturing organizations in the area of Durban, which were hard hit by a number of crises, including the COVID-19 pandemic, floods in 2020 and 2021, and civil unrest. Nonetheless, a sample of 100 participants from 23 organizations was achieved.

3.5 Data Collection Instruments

Data collection tool/instruments are the technique used to gather information from the participants in a study. In this instance, the instrument was designed to measure the two factors of competitive advantage which were the independent and dependent variables.

3.6 Data collection method

A questionnaire was administered to gather data. A questionnaire can contain open-ended or closed-ended questions. Closed-ended questions provided quantitative data while open-ended questions provided qualitative data. The research instrument had four sections. Section A solicited information about the firm and respondent's characteristics, including the respondent's gender, age, highest level of education, job title, number of years he/she had worked in the organization, and the number of times he/she had attended manufacturing training.

Section B was designed to achieve objective one and answer research questions one and two. It comprised six sub-sections that covered TQM practices, namely, customer focus, top management commitment, and people management. Continuous improvement formed part of organizational process management and supplier quality management. Forty questions were posed to measure TQM practices. Customer focus had seven, top management commitment six, people management eight, CI six, organizational process management seven and supplier quality management six.

Section C of the questionnaire that focused on innovation and was adopted from Toga (2017) contained eight questions. It was designed to address the study's second objective and answer the second research question. The questions aimed to determine if the organization had a competitive advantage.

Lastly, Section D that focused on organizational performance was adopted from Shrestha (2021). Designed to achieve objective three and answer research question three, it contained ten questions.

The instrument used a 5-point Likert scale ranging from strongly disagree, to disagree, neutral, agree and strongly agree, to enable statistical analysis.

Gatekeepers' letters were emailed to the ten organizations involved in the study. The email included the questionnaire, consent letter, gatekeeper's letter and information about the study. The consent forms were also distributed to the participants. Each of the organizations was asked to distribute the questionnaire to ten of its employees, representing the following categories: management, quality assurance/quality control department, supervisor, general worker and others. The category 'other' represented those in sales and procurement, and office staff who were included to gauge the level of TQM implementation within the organization since TQM in its true form embraces all aspects of the organization and its entire workforce, as well as its customers and suppliers (Toga, 2017). The email sent to gatekeepers contained the questionnaire in Word format, which respondents could complete on a computer or print and complete, then scan and return to the office. However, despite allowing reasonable time and numerous follow-up telephone calls, the response rate was low, with only ten of the 100 questionnaires completed and returned via email. The researcher then personally distributed hard copies of the questionnaire to the organizations. In-person interaction and the hard copies which respondents were more comfortable with yielded 90 completed questionnaires.

3.7 Pretesting the questionnaire

The questionnaire was pre-tested with ten postgraduate students in the Accounting Department at the Durban University of Technology. Participants received a gatekeeper's letter, the full questionnaire with four sections, the consent form, information letter and ethical clearance. The purpose was to determine the relevance of the questionnaire and make any necessary refinements. All ten participants said they felt the questionnaire was straightforward and would assist in achieving the research objectives and answering the research questions. Four felt the questions needed to be shorter. Three were of the view that the language could be simplified so that everyone, regardless of level of education, could understand and complete it. These comments were addressed, and the necessary changes were made to the questionnaire to render it more suitable. The questionnaire produced desirable Cronbach Alpha measures, with customer focus at .794, top management commitment .832, people management. 858, CI .818, organizational process management .824, supplier quality management .797, innovation .913 and operational performance .920, pointing to the reliability of the results.

3.8 Preliminary Model Results

Table 3.1 Reliability Measures

	Cronbach Alpha	rho_A	Average Variance Extracted (AVE)
Customer Focus	.794	.757	60.89
Top Management Commitment	.832	.807	72.22
People Management	.858	.808	65.10
Continuous Improvement	.818	.774	52.56
Organizational Process Management	.824	.798	69.39
Supplier Quality Management	.797	.824	50.03
Innovation	.913	.875	62.42
Operational Performance	.920	.836	68.76

Source: Administered Questionnaire (2023), AMOS version 27

Table 3.1 above presents the results of the three tests used to test the reliability of the data, namely, the Cronbach Alpha, rho A and the Average Variance Extracted (AVE). Cronbach Alpha is used to determine if a set of units in a group are closely related and their internal consistency. The Cronbach's value should be between 0.6 and 1.0 to be considered of high reliability and acceptable range (Amirrudin, Nasution, & Suprahar, 2021). Rho A is a reliability calculator that produces indices for each formative construct, with the index set to 1. The construct must be between 0.7 and 0.9 to be deemed acceptable and reliable. Average Variance Extracted measures the amount of variance captured by a construct due to measurement error; an AVE of least 0.50 or higher is highly recommended (Shrestha, 2021).

The Cronbach Alpha results in the table show that the constructs' values were within the acceptable range and were considered highly reliable, except operational performance with a value of .920. All eight constructs had a rho value of between 0.7 and 0.9. Turning to AVE, all eight constructs had a value more than .50, with the lowest value being 50.56 and the highest 72.22.

3.9 Reliability and Validity

Validity concerns whether a questionnaire accurately measures what it was designed to measure (Bryman, 2016). (Bakker & Wang, 2020). Construct validity is the accumulation of evidence that matches the researcher's predicted outcome (Bakker & Wang, 2020). The two sub-types of construct validity are convergent validity and discriminant validity (Clark & Watson, 2019). The researcher should seek the opinion of experts in the particular field on the validity of the tool to be used to collect data. This ensures the appropriateness of the research method (Hussain,

Konar, & Ali, 2016).

Reliability refers to consistency over time. In other words, the questionnaire should produce the same results in the same situation at a different point in time (Souza, Alexandre, & Guirardllo, 2017). Consistency was measured using the Cronbach coefficient alpha that uses a coefficient with values from 0 to 1. The closer the coefficient to 1, the greater the internal consistency. The Cronbach alpha coefficient increases as the number of participants increases, as well as the data collected (Ravinder & Saraswathi, 2020). The four types of reliability measures are test-retest, interrater and parallel forms reliability, and internal consistency (Salgado & Moscoso, 2019). Test-retest reliability measures the consistency of the results. The test is repeated at different times, with the expectation of obtaining the same constant results. Many factors may influence the data to shift slightly. Participants may have been in a different mood or have different understanding at the two response points (Noble, Scheinost, & Constable, 2019). The test is conducted on the same participants.

Interrater reliability measures the agreement between two people assessing or observing the same thing. This is carried out following data collection, with a scoring method used to categorize one or more variables (Salgado & Moscoso, 2019). The advantage of this method is that people are subjective and have different perceptions of situations. The test is conducted on the same participants by two observers. Two different data sets are collected and the correlation between them is calculated. The expectation is that a similar score/rating is received. The more observers there are, the more reliable the data is. Correlation data is similar (Li, Lv, Tseng, & Sun, 2018).

This study employed a single method to collect data, unlike other studies that use interviews and a questionnaire, calling for more complex measures to assess reliability (Rowley, Larson, Newton, & Hurwitz, 2020).

Internal consistency measures the same construct multiple times to identify the correlation between items. Given that it is only applied once to one set of data, there is no need to involve other researchers (Bergmann, Krewer, Muller, & Jahn, 2022). Two methods are commonly used to measure internal consistency. Average inter-item reliability involves calculation of the correlation between two pairs of the population and calculating the average (Li, Lv, Tseng, & Sun, 2018). In split-half reliability, the entire set of respondents is split into half, with correlation calculated between them.

3.10 Recruitment procedure

The participants were grouped into categories: quality managers, managers, sales managers, supervisors and general workers. The steel manufacturing organizations' contact details are publicly available online. The researcher sent emails and called the organizations telephonically to invite them to participate in the research study. Internal communication platforms were used to make contact with employees. Those who agreed to participate were invited to a meeting at the workplace on a date that was convenient to all where participants received a consent form

to sign and return and a questionnaire to complete.

3.11 Data analysis

Data analysis was carried out using confirmatory factor analysis (CFA), a statistical technique that is used to verify the factor structure of a set of observed variables. This allows the researcher to test the hypothesis that a relationship exists in relation to the observed data (Orcan, 2018).

The hypotheses were tested by identifying the TQM practices adopted by manufacturing organizations in the Durban steel industry; the relationship between the adoption of TQM practices and the operational performance of manufacturing organizations in the Durban steel industry; and whether the adoption of TQM practices had an impact on the competitive advantage of manufacturing organizations in the Durban steel industry.

Descriptive and inferential statistical procedures were used to analyze the data using SPSS. Descriptive statistics describe the features of a data set by generating summaries of data samples that explain the data content. Data variability, central frequency and frequency distribution are the three main types of descriptive statistics. The inferential statistical procedure draws data from samples and makes inferences about the target population. The three steps in the procedure are: 1. Define the population, 2, Draw a representative sample from the population. 3 Use analysis that incorporates the sampling error.

3.12 Ethical Considerations

All researchers should abide by ethical standards. No deception of any kind was employed and the participants' identities remained confidential. All participants were informed that their participation was voluntary and that their name be would not be published. The data obtained was dealt with professionally and appropriately, with participants treated professionally with transparency and honesty. Their confidentiality and anonymity were maintained. The data will be stored a safe space for five years and then destroyed.

3.13 Chapter Reflection

The chapter described the research concept and the methodology used to conduct this study. A quantitative method was employed, with a questionnaire used to gather data from 100 participants. The chapter outlined the study population, sampling techniques and the composition of the sample, and CFA that was employed to analyze the data.

The following chapter presents and analyzes the data and discusses the findings.

Chapter 4

Results presentation, analysis and discussion

4.1 Introduction

The primary purpose of this study was to assess the impact of TQM on steel manufacturing organizations in Durban. This chapter analyzes the quantitative data collected by means of a questionnaire that was divided into four sections. Section A gathered demographic information on the respondents. A Likert scale was used in Section B to weigh and measure each variable relating to TQM practices and to the practices adopted by manufacturing organizations in Durban's steel industry. Section C employed a Likert scale with five options used to measure and determine the relationship between the adoption of TQM practices and the steel manufacturing organizations' performance. Lastly, Section D assessed the impact of adopting TQM practices on the competitive advantage of organizations in the steel manufacturing industry in Durban.

4.2 Demographic Analysis

Six categories of demographic data elicited from the survey respondents are discussed, including their gender, age group, job title, the length of time they had been employed in the organization, their level of education, the number of times they had attended quality training. The participants also completed the survey on the organization they were employed by to provide data to test the hypotheses.

4.3 Reliability of measurement scales

Reliability refers to the repeatability or consistency of one's measurement (Rose & Johnson, 2020). A scale is reliable if it consistently reports similar findings.

4.4 Respondents' profile

The study involved 100 respondents from organizations in the Durban steel industry. Participants in different roles were targeted to grasp the different aspects of these organizations and obtain a comprehensive understanding of the factors influencing TQM's implementation.

4.4.1 Respondents' gender

Table 4.1: Gender of respondents

Gender	Frequency	Percent
Female	30	30
Male	70	70
Total	100	100

Source: Administered Questionnaire (2023). Author's compilation

The statistical analysis revealed that 70% of the participants are male and 30% female. This implies that male employees dominate the steel industry in Durban.

4.4.2 Respondents' Age Group

Table 4.2: Age of respondents

Age	Frequency	Percentage
18-29	40	40
30-49	38	38
50 and above	22	22
Total	100	100

Source: Administered Questionnaire (2023). Author's compilation

The statistical analysis revealed that 40% of the respondents were aged 18-29, and 38% 30-49, while those aged 50 and above represented 22%. Thus, the majority of the staff is still relatively young. In turn, this implies the need for training. The 38% of staff aged 30-49 are assets to their organizations, and their qualifications, training and experience making them suitable to lead or mentor younger employees.

4.4.3 Respondents' education

Table 4.3: Respondents' Education

Education	Frequency	Percentage
Secondary School	53	53
Technical College	23	23
University	19	19
Other	4	4
Total	100	100

Source: Administered Questionnaire (2023). Author's compilation

The steel sector has created many jobs. However, technological advances have meant that

machines now perform the hard labor previously undertaken by people (Career Counselling for Working Professionals, 2022). Since the Industrial Revolution, these machines have drastically reduced the amount of manual labor required and have also made the steel industry considerably safer. The results revealed that 53% of the respondents had completed secondary school, 23% held a qualification from a technical college and 19% had a degree or diploma from a university, while 4% indicated 'other' qualifications.

The first profession that comes to mind when considering qualifications for the steel industry is engineering. There are opportunities for mechanical, computer, and production engineers (Career Counselling for Working Professionals, 2022).

4.4.4 Respondents' Job title

Table 4.4: Job title

Job title	Frequency	Percentage
General worker	53	53
Supervisor	11	11
Other	36	36
Total	100	100

Source: Administered Questionnaire (2023). Author's compilation

Table 4.4 above shows that 53% of respondents were general workers. This was expected as manufacturing organizations undertake much general production work. Supervisors represented 11% of the respondents, while 36% were in other categories.

4.4.5 Employment duration

Table 4.5: Period employed

Duration	Frequency	Percentage
0-2 Years	26	26
3-5 Years	38	38
6-9 Years	26	26
10 Years and above	8	8
Total	100	100

Source: Administered Questionnaire (2023). Author's compilation

The table illustrates that 26% of the respondents had been employed in their organization for less than two years, 38% for 3-5 years, 26% for 6-9 years and 8% for ten years or more. This suggests a high number of new recruits, but also a sizeable number of experienced employees, opening opportunities to build career paths within the organization.

4.4.6 Respondents' Training

Table 4.6: Training Received

Duration	Frequency	Percentage
0 Never	8	8
1-2 times	41	41
3-5 times	27	27
6 times and more	24	24
	100	100

Source: Administered Questionnaire (2023). Author's compilation

McCoy (2023) observes that employees in the steel industry are required to work in multidisciplinary teams and have a wide range of skills and expertise. This calls for thorough training. The data show that 8% of the respondents had received no training, and 41% had attended 1-2 training sessions, which suggests that they had basic understanding but still lacked skills. The 27% of the respondents that reported having attended 3-5 training sessions are likely to possess advanced knowledge and be capable of working independently. Lastly, 24% of the respondents had undergone training six or more times. Such employees are crucial to the operation of the organization, and are likely to be in supervisory positions.

4.5 Data Tabulation

The levels of training imply that some steel manufacturing companies might experience difficulties in implementing TQM principles. A lack of or low levels of training could result in errors that reduce product quality, jeopardizing their chances of achieving a competitive advantage.

4.6 Descriptive Statistics

Table 4.7: Descriptive statistics

Questionnaire Items	Mean	Std. Deviation	Skewness	Kurtosis	Minimum	Maximum
Gender	1.30	.461	.886	-1.240	1	2
Age	1.68	.601	.266	-.613	1	3
Education	1.76	.933	.881	-.426	1	4

Job Title	1.86	.954	.358	-1.663	1	4
Experience	2.18	.914	.280	-.776	1	4
Training	2.72	1.045	.316	-.757	1	5

Source: Administered Questionnaire (2023). SPSS version 27

Table 4.7 presents the descriptive statistics generated by the first section of the questionnaire. The mean for gender is 1.30, with standard deviation of .461 and skewness at 886. Age has a mean of 1.68, standard deviation of .461 and skewness of .266. Education shows a mean of 1.76, standard deviation of .933 and skewness of .881. The mean of job title is 1.86, with standard deviation of .954 and skewness of 881. Experience recorded a mean of 2.18, standard deviation of .914 and skewness of .280. Lastly, training has a mean value of 2.72, standard deviation of 1.045, and skewness of .316.

The analysis suggests that organizations in the Durban steel manufacturing industry need to prioritize employee experience. This has a greater impact than retention and turnover; it also impacts their competitiveness. The industry is a dangerous working environment and the more experienced employees are, the less likely they are to make mistakes, which impact TQM outcomes. Educational level that incorporates training goes hand-in-hand with experience and all are crucial for organizational success.

The study identified the barriers to the implementation of TQM in Durban steel manufacturing organizations by focusing on key factors such as training, experience, age, job title and gender as well as the TQM practices adopted by these organizations. The aim was to propose a conceptual model to address the challenges faced by this sector. Bubshit and Al-Anazi's (1999) study on Saudi Arabian ISO-certified organizations analyzed the weight of five quality parameters. The study concluded that the model is a reliable and valid instrument. According to Ramchander and Nadar (2021), organizations in Durban have adopted a mixed approach to implementing ISO principles, resulting in negative engagement with clients.

Fully adhering to TQM calls for effective communication throughout the organization, from top management to the production team (Mbhele, 2022). On-going staff development and training is also essential to equip the workforce with knowledge and skills. Mbhele (2022) noted that the implementation of TQM principles among manufacturing organizations in Durban was negatively impacted by the COVID-19 pandemic and floods. Adoption of TQM and Information Systems (IS) is crucial to achieve high levels of customer satisfaction and boost the quality of products/services, which, in turn, enhance an organization's competitive advantage.

4.7 TQM practices adopted by manufacturing organizations in the steel industry

Table 4.8: Customer Focus

Variable	Obs	Mean	Std. Dev.	Min		Max
CF1	100	4.32	.5482755	2		5
CF2	100	4.52	.5021167	4		5
CF3	100	4.49	.5221362	3		5
CF4	100	4.49	.5772628	3		5
CF5	100	4.38	.5822284	3		5

CF6	100	4.28	.7396423	2		5
CF7	100	4.44	.5741925	3		5

Source: Administered Questionnaire (2023). SPSS version 27

The questionnaire included seven questions that aimed to determine the extent to which TQM practices were implemented in the respondents' organizations. A five-point 5 Likert scale was employed, with 5 representing strongly agree, 4 agree, 3 neutral, 2 disagree and 1 strongly disagree. The maximum response for all questions was strongly agree (5). The minimum response for questions 1 and 6 was 2 (disagree), with a minimum of 3 (neutral) with regard to questions 3, 4, 5 and 7, and 4 (agree) for question 2. The mean range is 4.28 - 4.52, with an average of 4.42. Total quality management calls for all departments to continuously improve a company's goods and services in order to deliver a high quality product to customers. Thus, all employees should be focused on TQM.

Table 4.9: Top Management Commitment

Variable	Obs	Mean	Std. Dev.	Min	Max
TMC1	100	4.23	.5835281	2	5
TMC2	100	4.21	.6860073	2	5
TMC3	100	4.24	.8055364	2	5
TMC4	100	4.31	.6771151	2	5
TMC5	100	4.32	.7089614	2	5
TMC6	100	4.29	.7425727	2	5

Source: Administered Questionnaire (2023). SPSS version 27

This section had six questions. Table 4.9 above shows that the mean range is 4.21- 4.32, demonstrating the importance of top management's commitment to TQM. Many senior managers are unaware of the value, implications, and effects of TQM initiatives. Furthermore, they confront heavy demands on their time, effort, and attention. In order for their organization to remain competitive, they need to play an active role in promoting TQM.

Table 4.10: People Management

Variable	Obs	Mean	Std. Dev.	Min	Max
PM1	100	4.31	.5807519	3	5
PM2	100	4.27	.7365631	2	5
PM3	100	4.28	.6678777	2	5
PM4	100	4.14	.9103224	2	5
PM5	100	4.11	.8749603	1	5
PM6	100	4.31	.8127146	1	5
PM7	100	4.04	.7774603	1	5
PM8	100	4.13	.7474536	2	5

Source: Administered Questionnaire (2023). SPSS version 27

The section on people management contained eight questions. The minimum response for questions 5,6 and 7 was strongly disagree (1), while it was 2 (disagree) for questions

2,3,4, and 8 and 3 (neutral) in relation to question 1. The mean range is 4.04 – 4.31, i.e., between agree and strongly agree. As leaders, management need to lead by example. Given the power relationships between higher-ranked managers and other employees, a human resources plan should be formulated with comprises people management policies. There has been growing interest in human resource management since the 1990s due to its positive effects on organizations and employees.

Table 4.11: Continuous Improvement

Variable	Obs	Mean	Std. Dev.	Min	Max
CI1	100	4.17	.7114504	2	5
CI2	100	4.26	.6907762	1	5
CI3	100	4.44	.5915226	3	5
CI4	100	4.43	.6552816	2	5
CI5	100	4.33	.7393008	2	5
CI6	100	4.45	.6571287	2	5

Source: Administered Questionnaire (2023). SPSS version 27

The section of the questionnaire on CI that is part of TQM practices contained six questions. Table 4.11 illustrates that the minimum response for questions 1, 4, 5 and 6 was disagree (2), while the minimum for question 2 was 1 (strongly disagree) and it was neutral (3) for question 3. The mean range is 4.17 – 4.45. This implies organizational commitment to CI. However, the true test lies in how CI is implemented rather than adherence to the concept. Management should avoid getting caught up in the details and instead focus on the overall concept in order to maximize the benefits and minimize the drawbacks. Staff should also be encouraged to devise innovative, efficient production routines rather than blindly adhering to a predetermined schedule.

Table 4.12: Organizational Performance Management

Variable	Obs	Mean	Std. Dev.	Min	Max
OPM1	100	4.33	.6521913	2	5
OPM2	100	4.22	.6753974	2	5
OPM3	100	4.22	.7327822	2	5
OPM4	100	4.19	.6771151	2	5
OPM5	100	4.33	.7114504	2	5
OPM6	100	4.31	.691872	2	5
OPM7	100	4.27	.6794977	2	5

Source: Administered Questionnaire (2023). SPSS version 27

The section on organizational performance management contained seven questions. The maximum response was for all questions was 5 (strongly agree), while the minimum response for all seven was 2 (disagree). The mean range is 4.19 – 4.33, illustrating that at least 83.8% of the responses were agree and strongly agree.

Table 4.13: Supplier Quality Management

Variable	Obs	Mean	Std. Dev.	Min	Max
SQM1	100	4.15	.6415732	2	5
SQM2	100	4.36	.6279677	2	5
SQM3	100	4.34	.7137891	2	5
SQM4	100	4.43	.6396811	3	5
SQM5	100	4.34	.7137891	2	5

SQM6	100	4.32	.7369059	2	5

Source: Administered Questionnaire (2023). SPSS version 27

There were six questions on supplier quality management. The maximum response for all the questions was strongly agree (5) with a minimum response for questions 1, 2, 3, 5 and 6 of 2 (disagree) and a minimum response of 3 (neutral) for question 4. The mean range is 4.15 – 4.43; this means that at least 83% of the responses were agree or strongly agree.

Table 4.14: Operational Performance

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Operation 1	100	2	5	3.99	.859
Operation 2	100	2	5	4.06	.789
Operation 3	100	2	5	4.03	.846
Operation 4	100	2	5	3.90	.882
Operation 5	100	2	5	4.05	.845
Operation 6	100	1	5	3.90	.798
Operation 7	100	1	5	3.92	.872
Operation 8	100	1	5	3.84	.873
Operation 9	100	1	5	3.93	.856
Operation 10	100	1	5	3.73	.874

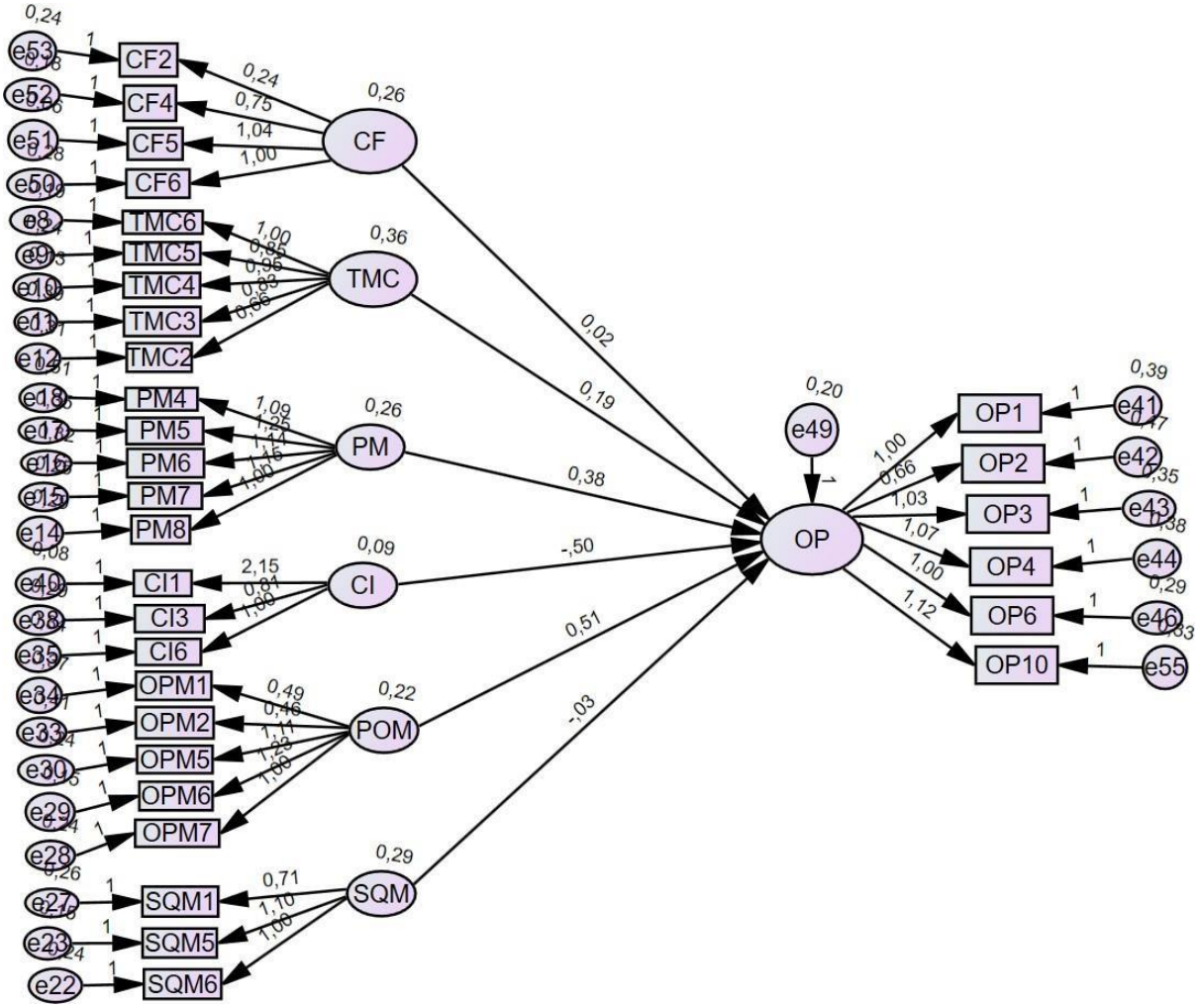
Source: Administered Questionnaire (2023). SPSS version 27

Table 4.14 on operational performance shows that half the minimum responses were 1 (strongly disagree) and the other half were 2 (disagree). The maximum response for all the questions was 5. The mean range is small at 3.79 - 4.06. The lowest standard deviation is .789 and the highest is .882. The maximum demonstrates employee competitiveness and operational capacity to deliver. Consistent operational performance is an important prerequisite to achieve competitive advantage and a vital aspect of TQM, especially in the Durban steel manufacturing industry.

4.8 MODEL RESULTS FROM AMOS

The relationship between the adoption of TQM practices and organizational performance

Figure 4: Structural equation modelling (SEM)



Source: Administered Questionnaire (2023). AMOS version 27

Figure 4 above displays the results pertaining to the six TQM practices, namely, customer focus, top management commitment, people management, CI, organizational process management and supplier quality management, and the relationship between them and operational performance. It illustrates the correlation between each TQM practice and operational performance as well as the disturbance term/late variable which is the circle with e49 over OP in the oval. This term is not measured directly.

Table 4.15: Chi-Squared Goodness of Fit Test Non-Centrality Parameter (NCP)

Model	NCP	LO 90	HI 90
Default model	666,220	572,417	767,686
Saturated model	,000	,000	,000
Independence model	1545,201	1410,206	1687,698

Source: Administered Questionnaire (2023). AMOS version 27

Kyriazos (2018) notes that the non-centrality parameter indicates the difference between central distribution and non-central distribution. The non-central chi-square distribution requires two parameters, the degrees of freedom and the non-centrality parameter. The non-centrality parameter is the sum of the squared means of the normality distributed quantities. There is a scientific application in thermodynamics and the signal process indicates the NCP. To determine if the measure was a non-central distribution, the two different values acquired in the study displayed in Table 4.15 are LO (90) 572.4 and HI (90) 767.68. The NPC value is 666.22; this implies good convergence as in lies between 500-1 000 with perfect convergence being 1 000 centimeters.

Table 4.16: Chi-Squared Goodness of Fit Test Function Minimum Fit Function (FMIN)

Model	FMIN	F0	LO 90	HI 90
Default model	1,653	1,329	1,782	1,754
Saturated model	,000	,000	,000	,000
Independence model	20,305	15,608	14,245	17,047

Source: Administered Questionnaire (2023). AMOS version 27

Shpley, Douma (2020) stated the FMIN measures two times which the different likelihood log using likelihood. FMIN is a function of observed and models-implied summary statistics, so it can be calculated using model parameters. The likelihood of data under the target model (Ho), and the likelihood of data under saturated model (h1). FMIN is not itself a log-likelihood or a likelihood or likelihood ratio, just a short cut software developer used to calculate the LRT statistics from complete-data summary. Statistics rather that calculating and summing the N log likelihood for both H0 and H1 models, then calculating the difference of the sums. The value closer to 0 is considered a perfect fit in table 4.15 the value 1.329 is considered the closest to 0 in the model.

Table 4.17: Expected Cross-Validation Index (ECVI)

Model	ECVI	LO 90	HI 90	MECVI
Default model	1.2426	1.1479	1.3451	1.3083
Saturated model	10,020	10,020	10,020	14,806
Independence model	20,931	19,568	22,371	21,230

Source: Administered Questionnaire (2023). AMOS version 27

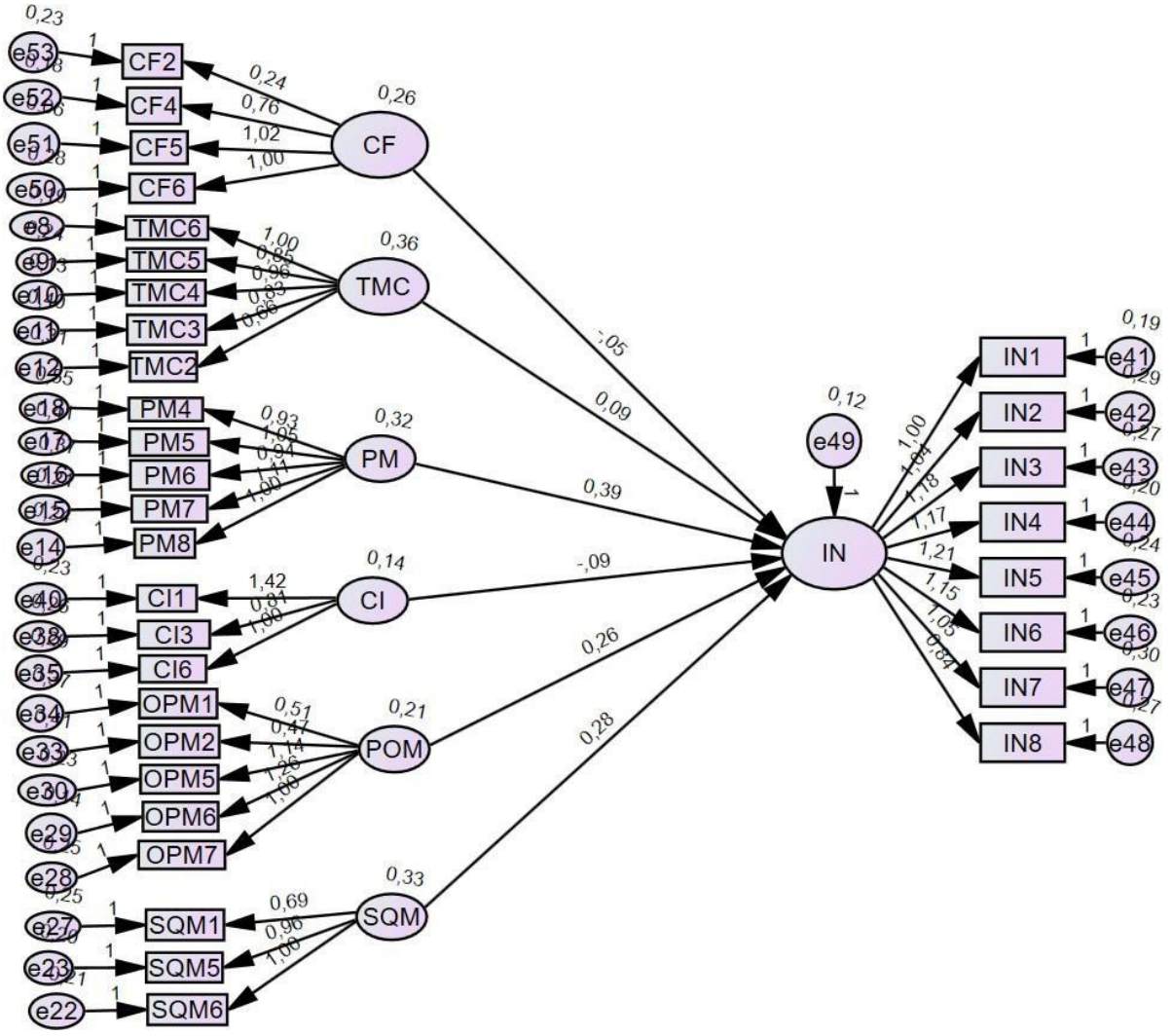
Yang (2018) states that the ECVI measures the predicted future of a model using simple transformation of chi-square similar to AIC (accepting the constant scale factor). As an approximation of the goodness of fit, the estimated model would achieve validation in another model sample of the same size. It is essential to compare one model with another and accepting the smaller value makes for a perfect fit. Table 4.17 above shows an ECVI value of 1.2426.

The chi-squared goodness of fit test examines the data to determine its exact fit over the model. The results show that the data is of poor fit, which is an indication of the data not matching the expected outcome. The table is affected by sample size; the larger the sample, the harder it is to fit. This was expected since this study employed a larger sample. It is advised that more than one statistic from different tables should be examined rather than relying on a single table. A statistic of .958 was generated for Global Financial Integrity. This is regarded as a fit model as a value of 0.900 and above is considered as the benchmark for Global Financial Integrity by Asquire Global Financial Solutions.

The adjusted goodness of fit index has a value of .518; this means the model does not fit with the data but is close as it is over .500. The TLI has a value of .953 and the CFI one of .969. This indicated that the data and the model fit and that the majority of the data met the minimum requirements of .900, implying data and model fit.

The impact of the adoption of TQM practices on competitive advantage

Figure 5: SEM Model



Source: Administered Questionnaire (2023). AMOS version 27

The SEM Model above shows the effect of TQM practices on innovation. Customer focus has a negative unstandardized path regression rate of -.05, and a variance of .26 to innovation. Top management commitment has a variance of 0.36 and an unstandardized path regression rate of 0.09 to innovation. People management has a variance of 0.32 and an unstandardized path regression rate of 0.39 to innovation. Continuous improvement has a variance of 0.14 and a negative unstandardized path regression rate of - .09 to innovation. Process organizational management has a variance of 0.21 and an unstandardized path regression rate of 0.26 to innovation. Supplier quality management has a variance of 0.33 and an unstandardized path regression rate of 0.28 to innovation. It is imperative for organizations to prioritize efficient supplier quality management in order to minimize risks, guarantee product safety, and maintain the highest standards of quality. The first step in addressing challenges in relation to supplier management optimization is to determine what causes them. Thereafter, management controls should be put in place to prevent their re-occurrence and reduce their impact.

Issues relating to supplier quality management can arise as a result of scorecard flaws,

inaccurate risk assessments, poor data management by suppliers, poor supplier communication, and a lack of ability to report issues and changes. The disturbance/area term, an unmeasured term named e49, has a variance of 0.12, and the unstandardized path regression rate to innovation is 1. According to Granbold et al., (2020) today's managers are obsessed with processes. Similar challenges have been encountered by researchers who have found it difficult to characterize organizational functioning in terms other than static, heavily aggregated ones.

4.8.2 Minimum Discrepancy Function (CMIN)

Table 4.18: Fit Model Chi-Square

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	817	189,651	474	,063	3,887
Saturated model	561	,000	0		
Independence model	33	2328,525	528	,000	44,410

Source: Administered Questionnaire (2023). AMOS version 27

Tables 4.18 displays the fit model which describes the relationship between a response variable and one or more predictor variables. The chi-squared goodness of fit test is not statistically significant as the p label value is 0.063, which is above 0.05. The test examines the exact fit of the data over the model. The results point to a good fit, which is an indication of the data matching the expected outcome. The table is affected by sample size; the larger the sample, the harder it is to fit. The result was expected as the study had a large sample. It is advisable to examine more than one statistic from different tables rather than relying on a single table.

4.8.3 Root Mean Square Residual (RMR)

Table 4.19: Root Mean Square Residual, Goodness of Fit index

Model	RMR	GFI	AGFI	PGFI
Default model	,1043	,9641	,8575	,8542
Saturated model	,000	1,000		
Independence model	,188	,199	,149	,187

Source: Administered Questionnaire (2023). AMOS version 27

Yang (2018) shows how far prediction falls from measured true values. In terms of the Euclidean distance, the smaller the value the better, and a value of 0 is deemed as the perfect fit. Table 4.20 displays a value off 0.1043 which is close to 0, making it a good fit. The goodness of fit index is used to calculate the minimum discrepancy function necessary to achieve a perfect fit under maximum likelihood conditions. A perfect fit is considered to be 1 or ≤1. Table 4.20 above shows that the GFI is 0.964, which is close to 1, and therefore considered as a good fit.

4.8.4 Baseline Comparisons

Table 4.20: Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,9616	,9172	,9273	,974	,976
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

Source: Administered Questionnaire (2023). AMOS version 27

Table 4.20 focuses on NFI, RFI, IFI, TLI, and CFI. The CFI compares the study's model with the existing model to establish baseline comparisons. The table measures and assures that the indicator variables in the model are correlated.

4.8.5 Parsimony-Adjusted Measures

Table 4.21: Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	,849	,853	,868
Saturated model	,000	,000	,000
Independence model	1,000	,000	,000

Source: Administered Questionnaire (2023). AMOS version 27

Falk and Muthukrishna (2023) note that parsimony-adjusted measures refer to relative fit indices that are adjusted for the majority of indices discussed. The more complex the model, the lower the fit index, as a simpler explanation of a phenomenon is generally favored over a complex one. A good fit for the test is considered to be >0.5. Table 4.21 shows a PRATIO with a value of 0.849.

4.8.6 Non-centrality Parameter (NCP)

Table 4.22: Goodness of fit test NCP

Model	NCP	LO 90	HI 90
Default model	420,651	340,158	508,949
Saturated model	,000	,000	,000
Independence model	1800,525	1654,747	1953,790

Source: Administered Questionnaire (2023). AMOS version 27

Kyriazos (2018) states that the non-centrality parameter indicates the difference between central distribution and non-central distribution. The non-central chi-square distribution requires two parameters, the degrees of freedom and the non-centrality parameter. The non-centrality parameter is the sum of the squared means of the normality distributed quantities. There is a scientific application in thermodynamics and the signal process indicates the NCP. To determine if the measure is a non-central distribution the two different values acquired in the study displayed in Table 4.22 are LO (90) 340.15 and HI (90) 508.94. The NPC value of 420.65

is not a perfect fit, but is acceptable as it implies that the difference between the distribution is too large and is close to the acceptable value.

4.8.7 Root Mean Square Error of Approximation (RMSEA)

Table 4.23: Root Mean Square Error of approximation (RMSEA)

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,055	,085	,104	,075
Independence model	,186	,178	,193	,000

Source: Administered Questionnaire (2023). AMOS version 27

Kyriazos (2018) notes that the root mean square error of approximation indicates excellent, good and mediocre fit. The GFI value of .9461 is considered as a fit model as .900 is the benchmark for a fit model. AGFI has a value of .8575; this meets the minimum fit of close to .900 and above .500. RMSEA shows a value of .055. The TLI has a value of .974 and the CFI has a value of .976. This indicates that the data and the model fit and that the majority of the data met the minimum requirements, exceeding .900.

4.8.8 Akaike Information Criteria (AIC)

Table 4.24: Akaike Information Criteria

Model	AIC	BCC	BIC	CAIC
Default model	106,651	115,666	129,301	138,301
Saturated model	1122,000	1708,892	2583,500	3144,500
Independence model	2394,525	2429,048	2480,496	2513,496

Source: Administered Questionnaire (2023). AMOS version 27

Shipley and Douma (2020) observe that AIC is used to measure the quality of a statistical model. It is a score represented by a single number that is used to determine if the model is the best fit for the data set. The relative number only has value when compared with another model's AIC. The difference is not tested, but can be used to compare non-tested models. Chi-square is preferred, probably because of its inferential (testable) properties. Table 4.24 above displays a AIC value of 106.65.

4.8.9 Hoelter's Indices

Table 4.25: Hoelter's Indices

Model	HOELTER .05	HOELTER .01
Default model	159	121
Independence model	215	156

Source: Administered Questionnaire (2023). AMOS version 27

Erenler (2020) states that Hoelter's indices are used to measure if the chi-square is significant. The measure does not specify a significance level to be used to determine the critical N. Hoelter's critical N is measured at significance levels of .05 and .01 to judge if the sample size is adequate. It is deemed adequate if Hoelter's N>200. Hoelter's N under 75 is considered unacceptably low to accept the model by Chi-square. The model presents a value of N.05 at 159 and N.01 at 121, which renders the critical N acceptable.

Covariance: (Group number 1 - Default model)

Table 4.26: Covariance

			Estimate	S.E.	C.R.	P	Label
TMC	<-->	CF	,170	,046	3,682	***	
TMC	<-->	PM	,268	,056	4,812	***	
PM	<-->	CI	,130	,038	3,415	***	
POM	<-->	CI	,114	,034	3,296	***	
SQM	<-->	POM	,204	,048	4,282	***	
PM	<-->	CF	,153	,043	3,531	***	
CI	<-->	CF	,104	,034	3,037	,002	
POM	<-->	CF	,151	,042	3,610	***	
SQM	<-->	CF	,130	,043	3,006	,003	
TMC	<-->	CI	,148	,041	3,568	***	
TMC	<-->	POM	,178	,044	3,989	***	
TMC	<-->	SQM	,242	,053	4,540	***	
PM	<-->	POM	,162	,042	3,846	***	
SQM	<-->	CI	,122	,038	3,251	,001	
PM	<-->	SQM	,223	,051	4,366	***	

Source: Administered Questionnaire (2023). AMOS version 27

4.9 Chapter Summary

This chapter presented the study's results. The first section set out the descriptive data on the sample selected to participate in the study and the reliability of the data. The second section presented the findings that answered the first research question and achieved the first objective. The third section presented data that achieved objective 2 and answered question 2, testing the hypothesis. The fourth section answered the third question and achieve the study's third objective.

CHAPTER 5

Summary of the results

5.1 Introduction

This chapter recaps the entire study, discusses its findings on TQM, competitive advantage and operational management in the steel industry in Durban and presents the outcomes of the hypothesis testing. It offers recommendations based on the findings and suggestions for future research. Lastly, the chapter discusses the study's limitations and its contributions to the body of knowledge.

5.2 MAIN RESEARCH OUTCOMES

This study investigated the role of the TQM practices of customer focus, top management commitment, organizational process management, supplier quality management and people management in influencing competitive advantage in the Durban steel industry. There is high demand for this sector's products and it is becoming more competitive, calling for innovative practices. These organizations have implemented TQM practices in order to respond to the challenges they confront.

The analysis of the data obtained from the participants revealed that organizations in the Durban steel industry have implemented TQM. This has enhanced their operational capabilities, while their adoption of innovative practices has increased their competitiveness. Studies on the relationship between TQM and innovation have produced contradictory results, with most tending to aggregate firms in different industries. However, different sectors confront different challenges and opportunities that arise from TQM. This study focused on organizations in the steel industry in Durban and whether TQM could enable them to gain a competitive advantage.

5.2.1 To identify the TQM practices adopted by manufacturing organizations in the steel industry

The data obtained from the questionnaire indicated that steel organizations in Durban have adopted TQM, enabling them to survive the turbulent times arising from the COVID-19 pandemic and economic recession. Total quality management is performance-oriented, and its main objective is to improve an organization through employee training, management commitment, a customer-focused approach, a focus on relationships with suppliers and sound people management.

5.2.2 To determine the relationship between the adoption of TQM practices and the organizational performance of manufacturing organizations in the steel industry

Total quality management practices involve every employee in a firm to create a culture that prioritizes customer satisfaction. Employee training is thus a crucial component of a larger TQM

strategy that aims to boost competitiveness. This reduces or eliminates errors and builds a creative atmosphere that encourages innovative solutions. Collaboration, communication, and on-going learning are therefore valued. The TQM principles apply to multiple departments that contribute diverse skills to the creation and delivery of quality goods or services. Management plays the vital role of facilitator and is tasked with hiring relevant staff, providing thorough training, and setting precise, achievable goals.

5.2.3 To examine the impact of adopting TQM practices on the competitive advantage of manufacturing organizations in the steel industry

Through TQM capacity development, the steel manufacturing sector in Durban has witnessed a sharp increase in production. It has become the world's top producer of sponge iron and the third-largest producer of crude steel (after China, Japan, and India). However, challenges remain and the sector needs to sharpen its focus and increase its share of major export markets. While growth opportunities exist for iron and steel exports, it is essential to target them strategically. Research shows that the steel industry in Durban lags behind its international competitors in terms of technological and economic effectiveness. Solving the sector's fundamental structural and operational challenges may require employee upskilling as well as operational improvements. Effective implementation of TQM, which is one of the most popular and successful modern management techniques, could assist in this regard.

5.3 Hypothesis Testing

5.3.1 Hypothesis 1

Organizations in the Durban steel industry have adopted TQM practices (people management, process management, top management commitment, continuous commitment to customer focus and supplier management).

To test hypothesis 1, the researcher ran SPSS. Table 4.8 showed that in terms of the seven questions on customer focus, the maximum response was 5 (agree), and the minimum was 2 (disagree). The average mean was 4.42, meaning that respondents agree with the question, 11.6% do not strongly agree with the question. Organizations have adopted the practice of customer focus. Table 4.9 focused on the six questions on top management commitment. The minimum response was disagree (2), and the maximum was strongly agree (5) for all the questions. The mean range was 4.21 - 4.32, showing that at least 84.2% of the respondents agreed and strongly agreed that the Durban steel manufacturing organizations are characterized by top management commitment.

There were eight questions on people management. All eight had a maximum response of 5 (strongly agree), with a minimum of 1 (strongly disagree) for questions 5, 6 and 7, 2 (disagree) for questions 2, 3 ,4, and 8 and 3 (neutral) for question 1. The mean range was 4.04 – 4.31, i.e., between agree and strongly agree. This means that at least 80.8% of the respondents agreed and strongly agreed that the steel manufacturing organizations have adopted the TQM practice of people management. Table 4.11 presents the results pertaining to the six questions on CI.

The maximum response for all six was 5 (strongly agree) with the minimum for questions 1, 4, 5 and 6 at 2 (disagree), 1 (strongly disagree) for question 2, and 3 (neutral) for question 3. The mean range was 4.17 – 4.45; thus, 83.4% of the respondents agreed or strongly agreed that the organizations in the steel industry in Durban had adopted CI.

Table 4.11 on organizational process management, a TQM practice, shows that the maximum response was 5 (strongly agree), while the minimum response was 2 (disagree), respectively, for all seven questions. The mean range of 4.19 – 4.33 means that at least 83.8% of the respondents agreed and strongly agreed that organizational process management was adopted in the steel manufacturing organizations. Table 4.12 presents the results on the six questions on supplier quality management. It reveals that the maximum response for all the questions was 5 (strongly agree). The minimum response for questions 1, 2, 3, 5 and 6 was 2 (disagree), while that for question 4 was 3 (neutral). The mean range is 4.15 – 4.43, implying that at least 83% of the respondents agreed and strongly agreed that the steel manufacturing organizations embraced supplier quality management.

5.3.2 Hypothesis 2

The adoption of TQM practices in organizations in the steel industry has a positive relationship with the operational performance of manufacturing organizations in the steelindustry.

Table 5.1: Covariance Estimates, S.E., C.R., P label

			Estimate	S.E.	C.R.	P label
OP	<---	TMC	,185	,047	3,854	***
OP	<---	PM	,380	,130	2,920	,004
OP	<---	CI	-,497	,226	-2,195	,028
OP	<---	POM	,513	,151	3,389	***
OP	<---	SQM	-,028	,110	-,254	,799
OP	<---	CF	,020	,112	,179	,858
TMC6	<---	TMC	1,000			
TMC5	<---	TMC	,854	,115	7,408	***
TMC4	<---	TMC	,947	,110	8,603	***
TMC3	<---	TMC	,831	,134	6,189	***
TMC2	<---	TMC	,655	,116	5,673	***
PM8	<---	PM	1,000			
PM7	<---	PM	1,151	,183	6,306	***
PM6	<---	PM	1,136	,188	6,036	***
PM5	<---	PM	1,251	,204	6,145	***
PM4	<---	PM	1,093	,206	5,308	***
SQM6	<---	SQM	1,000			
SQM5	<---	SQM	1,095	,204	5,371	***
SQM1	<---	SQM	,715	,137	5,207	***
OPM7	<---	POM	1,000			

OPM6	<---	POM	1,225	,194	6,321	***
OPM5	<---	POM	1,106	,183	6,029	***
OPM2	<---	POM	,456	,162	2,820	,005
OPM1	<---	POM	,492	,157	3,139	,002
CI6	<---	CI	1,000			
CI3	<---	CI	,811	,260	3,120	,002
B CI1	<---	CI	2,151	,852	2,524	,012
OP1	<---	OP	1,000			
OP2	<---	OP	,664	,152	4,368	***
OP3	<---	OP	1,029	,169	6,087	***
OP4	<---	OP	1,073	,176	6,088	***
OP6	<---	OP	1,001	,160	6,246	***
CF6	<---	CF	1,000			
CF5	<---	CF	1,036	,170	6,080	***
CF4	<---	CF	,752	,125	6,000	***
CF2	<---	CF	,235	,106	2,228	,026

			Estimate	S.E.	C.R.	P label
OP10	<---	OP	1,120	,176	6,351	***

Source: Administered Questionnaire (2023). AMOS version 27

To test hypothesis 2 the researcher ran the chi-squared of fit test using Amos to establish if it was more than the critical value. The researcher rejects the null hypothesis as the Chi-Square goodness-of-fit- test alone did not expose a relationship. The null hypothesis assumes that there is no relationship between the independent variables. However, if the Chi-Square goodness of-fit test exceeds the critical value as it did in this test, it is assumed there is a strong relationship between the two variables. Therefore, the alternative hypothesis is accepted, the variables are dependent and the assumption of no relationship between the variables can be rejected. The above estimates table is mixed positive data and negative outcomes, showing statistically significant outcomes (Andrade, 2019). Top management commitment to operational performance had a negative P value, proving statistically significant. This means that hypothesis 1 null was rejected, as the results favored the alternative hypothesis. People management on operational performance had a positive P value of 004, proving it statistically significant. Thus, in terms of hypothesis 2, the null was rejected in support of the alternative hypothesis. Continuous improvement in operational performance had a positive P value of .028, making it statistically significant. This favors hypothesis 3, but with slightly low results. Process organizational management had a negative P value, which meant that it was statistically significant. Supplier quality management on operational performance had a positive P value of .799, proving statistically significant. The results of hypothesis 4 were in favor and were close to 1.0. Organizations that prioritize their customers fulfil customers' desires, thus enhancing consumer satisfaction.

Customer focus on operational performance had a positive P value of .858, proving it statistically significant. Top management commitment (questions 2, 3, 4 and 5) had a negative P value, proving to be statistically significant. People management on people management questions 4, 5, 6, 7 and 8 had a negative P value, proving to be statistically significant. An organization's top management has a significant influence on it. The literature notes a positive relationship between top management commitment and market orientation (Jaworski & Kohli, 1993) and thus client interactions. Supplier management on supplier management questions 1 and 5 had a negative P value, proving to be statistically insignificant. Process organizational management on process organizational management questions 1 and 2 had a positive P value proving insignificant, and POM on POM questions 5 and 6 had a negative P value, proving to be statistically significant. Continuous improvement on continuous improvement questions 1 and 3 had a positive P value, proving insignificant; operational performance on operational performance questions 2, 3, 4 and 6 had a negative P value, which proved statistically significant. Customer focus on customer focus questions 4 and 5 had a negative P value, proving statistically significant, with the positive P value of .026 for question 2 being insignificant. Operational performance on operational performance had a negative P value that was statistically significant. The chi-goodness-of-fit test using Amos was also run to prove the hypothesis true or untrue.

The NCP displayed a value of 666.22, proving good convergence as the value is between 500 and 1000. The second chi- squared goodness of fit test was the FMIN, which proves the likelihood of H0 and H1. The closer the value is to 0, the most reliable it is. The test displayed a value of 1.329, favoring H1.

5.3.3 Hypothesis 3

The adoption of TQM has a positive impact on the competitive advantage of manufacturing organizations in the steel industry.

Table 5.2: Regression weights

			Estimate	S.E.	C.R.	P	Label
IN	<---	TMC	-,068	,029	-2,345	,035	
IN	<---	PM	,550	,285	1,931	,053	
IN	<---	CI	-,217	,274	-,791	,429	
IN	<---	POM	,418	,073	5,752	***	
IN	<---	SQM	,193	,049	3,937	***	
IN	<---	CF	-,144	,131	-1,104	,270	
TMC6	<---	TMC	1,000				
TMC5	<---	TMC	,863	,118	7,314	***	
TMC4	<---	TMC	,958	,110	8,742	***	
TMC3	<---	TMC	,919	,136	6,775	***	
TMC2	<---	TMC	,723	,117	6,186	***	
PM8	<---	PM	1,000				
PM7	<---	PM	1,099	,158	6,940	***	
PM6	<---	PM	1,040	,165	6,309	***	
PM5	<---	PM	1,225	,178	6,879	***	

			Estimate	S.E.	C.R.	P	Label
PM4	<---	PM	1,073	,184	5,824	***	
SQM6	<---	SQM	1,000				
SQM5	<---	SQM	,979	,133	7,345	***	
SQM1	<---	SQM	,722	,120	6,032	***	
OPM7	<---	POM	1,000				
OPM6	<---	POM	,935	,162	5,782	***	
OPM5	<---	POM	,823	,164	5,009	***	
OPM2	<---	POM	,748	,156	4,803	***	
OPM1	<---	POM	,758	,151	5,033	***	
CI6	<---	CI	1,000				
CI3	<---	CI	,678	,209	3,241	,001	
CI1	<---	CI	1,656	,355	4,659	***	
IN1	<---	IN	1,000				
IN2	<---	IN	1,041	,138	7,526	***	
IN3	<---	IN	1,184	,144	8,195	***	
IN4	<---	IN	1,169	,133	8,768	***	
IN5	<---	IN	1,215	,142	8,534	***	
IN6	<---	IN	1,147	,137	8,343	***	
IN7	<---	IN	1,053	,141	7,493	***	
IN8	<---	IN	,843	,125	6,726	***	
CF6	<---	CF	1,000				
CF5	<---	CF	,899	,129	6,977	***	

			Estimate	S.E.	C.R.	P	Label
CF4	<---	CF	,753	,119	6,310	***	
CF2	<---	CF	,273	,102	2,679	,007	

Source: Administered Questionnaire (2023). AMOS version 27

To test hypothesis 3, the researcher ran the chi-squared goodness-of-fit test using Amos to establish if it is more than the critical value. The researcher rejects the null hypothesis as the Chi-Square goodness-of-fit test alone does not expose a relationship. The null hypothesis assumes that there is no relationship between the independent variables. However, if the Chi-Square goodness of-fit test exceeds the critical value as it did in this test, it is assumed that there is a strong relationship between the two variables. Therefore, the alternative hypothesis is accepted, the variables are dependent and the assumption of no relationship between the variables can be rejected. The above table displays the estimate value, S.E, C.R and P label to show the effect between the variables. Top management commitment on innovation has a negative estimate value of -.068 and a P label of .035, which is statistically significant. People management on innovation has a positive estimate of .550 and a P label of .053 and is statistically significant. Continuous improvement on innovation has a negative estimate value of -.217 and a positive P label of .429, which is statistically significant. Process organizational management on innovation has an estimate value of .418 and a negative P label; this proved to be statistically significant. Supplier quality management has a positive value of .193 and a negative P label that is statistically significant. Customer focus has a negative value of - .114 and a positive P label of .270, proving to be statistically significant. The remainder of the factors displayed in the table do not affect innovation directly but do so indirectly. They impact TQM practices that affect innovation, making them statistically significant. A number of studies have examined the role played by TQM in improving organizations' performance, increasing their competitiveness and differentiating themselves from their competitors.

5.4 RECOMMENDATIONS

Given the positive gains that TQM brings to organizations, it is recommended that steel manufacturing organizations in Durban adopt TQM in its entirety. This will streamline their processes and procedures and enable them to grow. Working closely with staff will enable management to ensure that the organization adopts the most appropriate processes to achieve its goals and objectives. This calls for top management to fully commit to promoting the organization's interests. Implementation of TQM will also give employees a voice and encourage them to work with management to find solutions to problems, creating a more. positive and healthy work environment.

Effective people management makes it easier to assign responsibilities and helps organizations to achieve their objectives. It creates order and ensures that the right people are in the right positions. Staff training will maximize results.

In order to produce quality products, organizations also need to align themselves with suppliers that are reliable and consistent. Steel manufacturing organizations need to find suppliers that operate ethically and with whom they can form a long-term working relationship. They need to work hand-in-hand to achieve both parties' objectives and manage the cost and quality of their product.

Furthermore, steel manufacturing organizations should focus on customers who are the ultimate key in achieving their main objective which is to sell their product and grow their customer base. This requires that they understand their customers' needs and desires. A focus on customers enhances consumer satisfaction, rendering it easier to gain favor with customers in the market. It should always be borne in mind that one upset customer can have a negative ripple effect and that customer loyalty is hard to come by and easy to lose.

Lastly, given CI's importance to an organization, staff require regular training to upskill them and promote improved ways of operating. Staff training also reduces the time it takes to produce a product, and minimizes waste and errors, thus saving on costs. It promotes consistency in product quality and output, that in turn renders an organization more competitive.

5.5 Limitations of the Study

A study's limitations are generally beyond the control of the researcher. They refer to weaknesses in the research design that may undermine the veracity of the findings (Ross & Zaidi 2019). Like any other research, this study suffered from limitations. However, the researcher ensured reliability and validity in achieving the research objectives.

The study suffered from time constraints and a lack of resources. Given that it focused solely on steel manufacturing organizations in the Durban metropolis in KZN, different results could be obtained in the same industry in other South African regions.

The study was conducted at a very difficult time when South Africa had just experienced the COVID-19 pandemic and Durban was hard hit by civil unrest and flooding. As a result, a number of organizations closed or downsized, leaving a handful of potential participants.

Some organizations were reluctant to participate as they feared it would distract employees from their work. Language barriers also limited participation by individual employees.

Lastly, this study did not examine the financial costs of implementing TQM or the financial gains that could result from its adoption.

5.6 CONTRIBUTION OF THE STUDY

The study makes a significant contribution to understanding the implementation of TQM in steel manufacturing organizations and its impact on overall organizational performance.

By focusing on the six principles of TQM, it enhanced understanding of the impact of each when

used effectively.

Lastly, given that the study found that TQM positively impacts organizations, it has the practical effect of encouraging organizations to adopt TQM in order to improve their operational efficiency and gain a competitive edge.

5.7 SUGGESTIONS FOR FUTURE RESEARCH

Building on the foundation laid by this study, it is suggested that future research focus on the province of KZN as a whole or the entire country in order to generalize the findings.

Research should be conducted in various locations that face different challenges and operate under different circumstances in order to compare the findings with those produced by this study.

It is suggested that the research instruments used by future studies are translated into various languages in order to include a wider pool of participants.

Lastly, the financial costs and gains of implementing TQM could be investigated in future research.

5.8 SUMMARY

The aim of this study was to examine TQM's impact on the competitive advantage of manufacturing organizations in the Durban steel industry. Relevant objectives and research questions were formulated to address this topic. The literature review focused on six TQM principles, namely people management, customer focus, CI, supplier management, operating process management and top management commitment. Previous studies that focused on these principles were reviewed in order to establish TQM's impact on manufacturing organizations. The relationship between the adoption of TQM practices and the operational performance of manufacturing organizations in the Durban steel industry was also explored to identify key factors that influence organizational operations. Furthermore, TQM's impact on competitive advantage among steel manufacturing organizations was examined to identify the advantages resulting from the adoption of the six practices.

The study adopted a quantitative approach, with a questionnaire designed to gather data to answer the research questions. Three types of sampling techniques were utilized to identify 100 participants. Hypotheses were developed to answer the research questions and achieve the aim of the study. Amos was utilized to analyze the data, with the findings presented as SEM diagrams, chi-square goodness-of-fit test tables, critical values and p values.

The study found that TQM has a positive impact when implemented in steel manufacturing organizations in Durban. It improves operational output as well as financial prospects and assists organizations in gaining a competitive advantage in the market. Based on the findings, it is recommended that other manufacturing organizations adopt TQM and focus on training and

educating staff and building long-lasting relationships with their suppliers. Top management should be involved in all aspects of the organization in order to foster clear communication and customer focus should be a major concern in order to gain favor with clients and achieve competitive advantage.

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Appendix A: Akaike information criteria table

Model	AIC	BCC	BIC	CAIC
Default model	208.521	140.221	182.553	292.721
Saturated model	992,000	1465,791	2284,164	2780,164
Independence model	2072,201	2101,813	2152,961	2183,961

Appendix B: Informed Consent form

LETTER OF INFORMATION

Dear Sir/Madam

Thank you for showing interest towards this research study it is highly appreciated. You are invited to take part in the study titled: Total Quality Management and competitive advantage of manufacturing organisations in the steel industry in Durban Metropolis. This study seeks to identify the impact of total quality management and competitive advantage in manufacturing organization in steel industry.

Your participation is voluntary; you may withdraw at any stage without any negative repercussions. There will be no monetary benefits for participating in the study. The study will be conducted physically so your work site at a secure and safe area where confidentiality and anonymity can be ensured. Data acquire from the study will be stored on laptop and researcher's Microsoft account. Only the researcher will have access to the laptop and Microsoft account this data will be stored in a locked folder named research the data will be stored for 5 years and be permanently deleted after 5 years.

Please complete the questionnaire by selecting the option that reflects your response to the statement/question. Thank you.

Principal Investigator/s/researcher: Ncazelo Mphiliseni Mncwabe, Master's in Management Accounting

Co-Investigator/s/supervisor/s: Dr Ferina Marimuthu, Miss Sharon Zunckel

Brief Introduction and Purpose of the Study: Total Quality Management (TQM) has been very successful when organisation around the world have implemented the strategy. The steel manufacturing industry in South Africa has been facing its worst crisis since the recession with the threat of shutdown and retrenchments for most steelmakers. The study aims to identify Total quality management organisations in the steel industry and see the relationship between practices on organisational performances and to find the competitive advantage in organisations. The study is conducted to see the advantage of applying total quality management and the impact it has in the steel industry.

Outline of the Procedures: A quantitative approach will be utilized in form of a questionnaire. The questionnaire will be completed by yourself, estimated time to take about 20 minutes.

Risks: There are no risk, harm or any discomforts to you for taking part in this study.

Injury: No injury outcome is expected from participation of the study.

Benefits: You as participants will assist current companies as well as future company on identifying which practices are most affective in organisations and which bring about a competitive advantage as to help them better themselves by adopting those.

Remuneration: There will be no remuneration of any sorts for taking part in the study for you.

Costs of the Study: It will cost you nothing to take part of the study, it will not require you to make any payment of any sorts as taking part in the study is free of charge.

Confidentiality: Data from the study will only be used for this study and not any other. Only the research team will have access to the study. No names will be required of participating so there will be no way of identifying a participant to achieve high level of confidentiality.

Results: Results of the study and any major finds resulting from the study will be disseminated to you via Email.

Persons to contact in the Event of Any Problems or Queries:(Dr Ferina Marimuthu) Please contact the researcher (tel no. 0783424943), my supervisor (tel no. 0832357820) or the Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the Director: Research and Postgraduate Support Dr L Linganiso on 031 373 2577 or researchdirector@dut.ac.za.

Appendix C: Consent letter

CONSENT

Full Title of the Study: Total Quality Management and competitive advantage of manufacturing organisations in the steel industry in Durban Metropolis

Names of Researcher/s: Ncazelo Mphiliseni Mncwabe

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Ncazelo Mncwabe about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number:_____,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

_____	_____	_____	_____
Full Name of Participant	**Date**	**Time**	**Signature / Right Thumbprint**

I,_____(name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

_____	_____	_____
Full Name of Researcher	**Date**	**Signature**
_____	_____	_____
Full Name of Witness (If applicable)	**Date**	**Signature**
_____	_____	_____
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

Appendix D: Data Table

Iteration		Negative eigenvalues	Condition #	Smallest eigenvalue	Diameter	F	NTries	Ratio
0	E	14		-,528	9999,000	2017,564	0	9999,000
1	E	8		-,153	3,702	1480,328	20	,344
2	E	1		-,062	1,722	1196,641	4	,741
3	E	0	1809,541		,732	1135,148	5	,856
4	E	0	94,902		,779	1127,844	5	,000
5	E	0	133,220		,857	1101,632	2	,000
6	E	0	167,435		,574	1094,979	1	1,122
7	E	0	424,973		,272	1094,302	1	1,119
8	e	0	676,429		,202	1094,232	1	1,050
9	e	0	1044,963		,056	1094,220	1	1,050
10	e	0	1097,822		,017	1094,220	1	1,010
11	e	0	1105,312		,000	1094,220	1	1,000

The impact of the adoption of TQM practices on competitive advantage

Appendix E: Ethical clearance letter

Faculty Research Office
Durban University of Technology
Date 1 June 2021

Student: Ncazelo Mphiliseni Mncwabe
Student Number: 21509107
Degree: Masters in Financial Accounting
Email: 21509107@dut4life.ac.za
Supervisor: Dr F Marimuthu
Supervisor email: ferinas@dut.ac.za

Dear Mr Mncwabe

ETHICAL APPROVAL: LEVEL 2

I am pleased to inform you that the Faculty Research Ethics Committee (FREC) following feedback from two reviewers has granted preliminary permission for you to conduct your research 'Total quality management and competitive advantage of g manufacture organisations in the steel industry in Durban Metropolis'.

When ethics approval is granted:
You are required to present the letter at your research site(s) for permission t gather data. Please also note that your research instruments must be accompanied by the letter of

information and the letter of consent for each participant, as per your research proposal.

This ethics clearance is valid from the date of provisional approval on this letter for one year. A student must apply for recertification 3 months before the date of this expiry.

Recertification is required every year until after corrections are made, after examination, and the thesis is submitted to the Faculty Registrar.

A summary of your key research findings must be submitted to the FRC on completion of your studies.

Kindest regards. Yours

sincerely

[redacted]

Dr Mogiveny Rajkoomar FREC Chair
Faculty of Accounting and Informatics
Durban University of Technology Ritson Campus
Durban, South Africa

Appendix F: Data collection instrument questionnaire

Questionnaire

This survey is on Total quality management and competitive advantage of manufacturing organisations in the steels industry in Durban and surrounds. The main purpose of the study is to examine factors or the effect that Total Quality management and competitive advantage may have on the organisation.

Section A

Please mark the relevant box to you below with a **(X).**

1. Gender

A. Male ☐

B. Female ☐

2. How old are you?

A. 18-29 ☐

B. 30-49 ☐

C. 50 and above ☐

3. What is your highest level of education?

   A. Secondary School ☐

   B. Technical college ☐

   C. University ☐

   D. Other ☐

4. What is your job title/role in the company?

   A. General worker ☐

   B. Supervisor ☐

   C. Other (Please specify) ☐

---

5. How long have you worked in the company?

A. 0-2 years ☐

B. 3-5 years ☐

C. 6-9 years ☐

D. 10 years and above ☐

6. How many times have you attended manufacturing/ operating training organised by the company?

A. 0 times (Never) ☐

B. 1-2 times ☐

C. 3-4 times ☐

D. 5 times and above ☐

Section B

Customer focus

Please mark with a **(X)** in the appropriate column.

	Attributes	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
CF1	Customer expectations are always communicated to employees.					
CF2	Customer complaints relating to product and quality are given top priority.					
CF3	Our customers freely communicate with us to maintain close relationship.					
CF4	All customer complaints are dealt with and resolved effectively.					
CF5	Customer satisfaction is measured regularly to ensure demand is met.					

CF6	Company conducts feedback exercises to obtain information about client satisfaction?					
CF7	Customers can have their products tailored to their required specifications.					

Top Management Commitment

Please mark with a **(X)** in the appropriate column.

	Attributes	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
TMC1	All Managers in top management encourage and participate in continuous improvement initiatives.					
TMC2	Employees communicate their ideas freely to management and management does the same.					
TMC3	Top management view cost as more important in comparison to the quality of products.					
TMC4	Management show initiative by participating in quality meeting and contribution with ideas.					
TMC5	Management provides adequate resources for improvement of production quality.					
TMC6	Top management ensure that suppliers and employees are aware of the company's long-term plans.					

People Management

Please mark with a **(X)** in the appropriate column.

	Attributes	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
PM1	Every employee is responsible for the quality of product.					
PM2	Formal processes are used to find out employees' opinions and views.					

PM3	All Employees are encouraged to update their knowledge and skills.					
PM4	Employees are given no authority towards making decision about their jobs.					
PM5	Feedback on employee satisfaction is regularly sought.					
PM6	Both individual and teamwork contributions are rewarded accordingly.					
PM7	All employees receive an encouraging culture of learning, career development, improvement and change.					
PM8	Employees in all departments are united by common purpose with no barriers.					

Continuous Improvement

Please mark with a **(X)** in the appropriate column.

	Attributes	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
CI1	The research and development (R&D) department is continuously working on the development and improvement of the products.					
CI2	New and modified production methods are being used to produce products with new and modified equipment.					
CI3	Safety, health and environment issues are a priority.					
CI4	Your company has an established continuous improvement strategy for its quality system.					
CI5	Every person in workplace is encouraged to participate on improvement programs to improve their skills.					
CI6	Company continuously works to establish better quality system for its operations and processes.					

Organisation Process Management

Please mark with a **(X)** in the appropriate column.

	Attributes	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
OPM1	Proper procedures are established to perform different jobs.					
OPM2	Performance of production processes is monitored.					
OPM3	Problems in the technical processes have decreased.					
OPM4	Production processes are capable of producing products according to design specifications.					
OPM5	Our production processes are the most up-to-date in our industry.					
OPM6	Development and innovation of production processes are emphasised.					
OPM7	Our firm quickly changed its processes, techniques and technology before competition does whenever it is required.					

Supplier Quality management

Please mark with a **(X)** in the appropriate column.

	Attributes	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
SQM1	Performance of the suppliers is evaluated periodically.					
SQM2	Suppliers are encouraged to develop long-term partnerships with the organisation.					
SQM3	Suppliers know long term objectives of the organisation.					
SQM4	Raw material from supplier is always of adequate standard good quality.					
SQM5	Supplier supply of material in always on time.					

SQM6	Suppliers supplied material is of the best quality in the market.					

Section C

Innovation

Please mark with a **(X)** in the appropriate column.

	Attributes	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
IN1	Our company is always ahead of competitor in producing new product (new introduction in market).					
IN2	The new products produced by our firm significantly differ from our existing products. The level of newness is high.					
IN3	Our firm has introduced a number of new products to the market in the last 3 years.					
IN4	When introducing new products, our firm does so in the shortest possible time compared to others in the industry.					
IN5	Our firm has introduced new or significantly improved machinery and/ or equipment for producing products.					
IN6	Our firm has introduced new or significantly modified productive processes for producing products.					
IN7	Our processes are the most up-to-date in our industry.					
IN8	Our firm quickly change its processes technique and technology faster than competition when required.					

Adopted; Mainford Toga (2017). The relationship between Total quality Management and innovation in the south African Foundry/Steel Industry.

Section D

Operational Performance

Please mark with a **(X)** in the appropriate column.

	Attributes	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
OP1	Customer expectations are sometimes met.					
OP2	Customer expectations are always met.					
OP3	Defects in production are less than 1%.					
OP4	Defects in productions are less than 5%.					
OP5	Sales have improved by more than 5%.					
OP6	Sales have improved by more than 10%.					
OP7	Production achieved exceed planned production by 10% - 20%.					
OP8	Production achieved exceed planned production by 21% - 30%.					
OP9	Profit has improved by 1-10%.					
OP10	Profit in organisation has improved by 11% - 20%.					

Adapted: Fuzi Abusa (2011) TQM implementation and its impact on organisational performance in developing countries: a case study in Libya.

End of Questionnaire

Thank you for participating in this study your time and effort is highly appreciated.

Appendix G: Editor's language letter

62 Ferguson Road Glenwood DURBAN 4001
Tel: 072 442 7896
Email:
deanne.collins30@gmail.com

18 August 2024

This serves to confirm that I have edited the dissertation, "Total quality management and competitive advantage of manufacturing organizations in the Steel industry Durban Metropolis", by Ncazelo Mncwabe, student number 21509107.

DISCLAIMER: The editor cannot be held responsible for any errors introduced due to changes being made to the document after the editing is complete.

Yours sincerely,

[redacted]

(Ms) Deanne Collins (MA)

Appendix H: Turnitin report

Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

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CHAPTER 1

Introduction to the study

1.1 Introduction

Despite the fact that the study is focused on "Total quality management and competitive advantage of manufacturing organizations in the Steel industry Durban Metropolis," we must make every effort to maintain the industry by fostering South Africa's global competitiveness. Total quality management (TQM) has positively influenced innovation, and with both innovating and implementing TQM, there has been a rise in the number of manufacturing firms that are able to compete globally. Consequently, the goal of the study is to investigate the nature of their relationship, if any. Process management, top-level management commitment, customer focus, supplier management, continuous improvement, and people management are the components of TQM techniques. These will be compared to generational performance and/or competitive advantage (Javed and Idris, 2018).

Very few publications discuss TQM and competitive advantage in Durban in the context of my research. Therefore, there is a gap in the research if these studies have not yet looked at TQM and competitive advantage in the steel manufacturing businesses in Durban. The choice of Durban as the location was made because of the city's long history of producing steel and its development of numerous specialized enterprises that have faced numerous difficulties, including lockdowns, floods, and looting. This study investigates its composition, mainly based on TQM and cooperative advantage. The diversity of businesses in the Durban steel manufacturing industry contributes to the understanding of competitiveness. Also, it shapes the dynamics of TQM in the sustainability of the steel industry's role players.

The goal of the study is to evaluate these firms' viability as they proceed through the manufacturing process in the Durban steel sector. Organizations in the Durban steel sector can benefit from knowledge about the effects of Total Quality Management (TQM) on operational performance and competitive advantage once the study is completed. This chapter provides comprehensive background information and explains the rationale behind the study's importance on Durban's steel manufacturing companies. The background of the study, the problem statement, the justification for the investigation, its significance, its limitations, its aim, its objectives, and its research hypotheses will all be explored in this chapter.

Total quality management and competitive advantage of manufacturing organisations in the Steel industry Durban Metropolis.

ORIGINALITY REPORT

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