ASSESSMENT OF LEAN MANUFACTURING PRACTICES AND STRATEGIC SUSTAINABILITY IN TOYOTA SOUTH AFRICA MOTORS

by

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DECLARATION

I, the undersigned certify that the dissertation is original work by me, that it has not been or will not be submitted to any other university for a similar or other degree award, and that it I will not be submitted to any other institution for a similar or other degree award.

Mr Sanele Lungani Kheswa

DEDICATION

I dedicate this dissertation to my loveable wife, Nondumiso Kheswa, my six kids, Khethelo, Amahle, Bandile, Simthandile, Sinazo and Khanyisa, who have always been in my mind during my studies and allowed me to receive an education. They have supported me throughout my career and academic endeavours.

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ABSTRACT

The popularity of lean manufacturing mostly stems from empirical evidence that it enhances a company's competitiveness and quality by reducing any form of waste. However, a wide range of factors, compounded by a lack of training in essential components of lean, not achieving daily target in terms of defects per unit, straight delivery rate, run ratio, operation ratio in production lines, delay of parts from the inventory, developing personnel, and managerial support on the shop floor, make the application of lean principles extremely difficult. These difficulties have influenced South Africa's manufacturing industry, which contracted the capacity of manufacturing units in the entire Sub-Saharan African region. The purpose of this study was to assess lean manufacturing practices (LMPs) and the extent to which Toyota South Africa Motors (TSAM) utilises innovative strategies to improve their quality and sustainability in a highly competitive environment. The research methodology is mixed method in nature using a survey questionnaire as the primary instrument for data collection. A sample of 44 top management staff was chosen from a population of the 50 top management and other selected staff using random sampling, of these 44, 35 participated. The researcher followed five stages in the qualitative data analysis process. SPSS software version 27 was used to critically analyse the quantitative data to answer the research aims and objectives. Management was found to be aware of the elements that influence quality in TSAM. The staff members cited lack of training, lack of management support, and failure to follow standardised work as the most important factors affecting lean. Selected staff also raised the issue of sacrificing quality over volume as a key issue.

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LIST OF ACRONYMS

CEO	Chief Executive Officer
CPU	Central Processing Unit
DPU	Defect per Unit
GDP	Gross Domestic Product
HRM	Human Resource Management
ICT	Information and Communication Technology
IDC	Industrial Development Cooperation
ISM	Interpretive Structural Modelling
JIT	Just-in-time
KPI	Key Performance Indicators
KZN	KwaZulu Natal
LMP	Lean Manufacturing Practices
MICMAC	Matrice d'Impacts Croisés Multiplication Appliqués à UN Classement
OPR	Overall Performance Rate
POUS	Point-of-use-storage

QC	Quality Cycle
RR	Run Ratio
SCM	Supply Chain Management
SDR	Straight Delivery Rate
SMED	Single-Minute Exchange of Die
SMME	Small Medium and Enterprises
SPC	Statistical Process Controls
SPSS	Statistics Package for Social Scientist
TPM	Total Production Maintenance
TPS	Toyota Production System
TQM	Total Quality Management
UK	United Kingdom
UNIDO	United Nations Industrial Development Organisation
USA	United States of America
WIP	Work in Progress
OT	Overtime

CHAPTER ONE

BACKGROUND OF THE STUDY

1.1 Introduction

According to a report by the United Nations Industrial Development Organization (2014), "South Africa's weak manufacturing growth has hurt growth in sub-Saharan Africa." Statistics South Africa (2016) pointed out that South Africans have been concerned about deindustrialization over the past 20 years and that imported goods are increasingly replacing locally produced goods. As a result, South Africa's manufacturing future is being questioned and challenged. This is occurring against a backdrop of relentless government intervention aimed at stemming the tide of deindustrialization while positioning the manufacturing sector in a more favourable and expansive environment. According to the Industrial Development Cooperation (2015), manufacturing is the lifeblood of any country's economic growth and critical to job creation. However, South Africa's manufacturing sector's contribution to real GDP growth was 1.5 percent in 2014, the lowest in the last five years. Private sector fixed investment declined by 3.4 percent in real terms. Real manufacturing fixed investment declined 0.5 percent in 2014. The manufacturers' confidence index fell 12 points to 30 in the first quarter of 2015. According to a survey of manufacturers, seven out of ten were dissatisfied with current business performance.

According to Dondofema *et al.* (2017), South Africa's weaknesses in successfully implementing lean require introspection and self-assessment, which are necessary to diagnose and outline areas of success in light of evidence of success in the United States of America (USA), Japan, India, and Germany, where lean manufacturing is being applied. The study by Singh, Garg, and Deshmukh (2010) (cited in Sitharam 2017) states that previous research acknowledges that manufacturing companies can achieve significant improvements by adopting lean practices, which reached an alarming all-time high of 59 percent in 2020. Currently at Toyota South Africa Motors (TSAM), when the demand is high, lean and Toyota Production System (TPS) methodologies are ignored and only volume is prioritized, which contributes to defect

flow out of the process, a scrap rate that is too high, failure to meet operation ratio (OPR) and straight delivery rate (SDR) targets, and in some cases, recalls. Downtime on the production line, delay of parts, members not achieving target time, machine breakdown, and no feed from the lines behind are the factors that affect the daily target, resulting in a delay on the last line, which is the OPR line.

The purpose of this study is to examine lean manufacturing practices (LMP) and the extent to which TSAM employs innovative strategies to improve quality and sustainability. According to the United States Department of Commerce (2016), time and cost have traditionally been used as productivity measures in manufacturing, but sustainability has become more important. The science for measuring sustainability in manufacturing is not yet as developed as that for time and cost. As the productivity and agility of manufacturing systems improves, so does the need for better understanding and control of their sustainability-related impacts.

Olawale and Garwe (2010) and Dlamini (2017) agree that the best manufacturing strategies in businesses should include elements such as a structured strategic planning process that incorporates company management, anticipating new technology, a link between manufacturing and business strategy, and communication of the manufacturing strategy to firm employees.

Qualitative and quantitative methods are the two approaches used for research methodology. "Quantitative research methods are research methods that deal with numbers and anything measurable in a systematic way to study phenomena and their relationships," while qualitative research is defined as an approach that focuses on words rather than numbers when collecting and analysing data (Creswell 2009). A mixed methodology was used for this study. The population for this study was TSAM's top management employees. A probability sampling method was used for this study. Probability sampling involves selecting individual items from a set of components using a systematic, technological, or mechanical process rather than intentionally or deliberately, similar to the lottery process (Kothari 2004). Consequently, the choice of this sampling method is justified. The research will make an important contribution to the areas of operations and quality and will support the strategic sustainability of TSAM by creating more jobs.

1.2 Context of the research

Lean manufacturing is simply a method of production that reduces waste and, as a result, adds value. It cannot, however, be overstated that lean, or TPS, is more than just a toolkit. It includes far more than just lean tools and practices, such as the Kanban system, 5S, and 5Whys, amongst others. It is, instead, analogous to TPS, a complex system in which every component contributes to the overall success. Furthermore, it is a well-known change philosophy (Singh and Modgil 2020). Ruben *et a*l. (2017) are of the same view that the term "lean manufacturing" derives from TPS, a company dedicated to continuously reducing waste in the manufacturing environment.

The Toyota Corporation has made lean manufacturing a huge success, and its concepts have been copied by major corporations all over the world. Many small businesses, however, have been unable to capitalize on these concepts for a variety of reasons. TSAM is facing a number of challenges, including defect flow out of the process, scrap rate, straight delivery rate (SDR), operation run ratio (OPR), volume loss to other affiliates, or even recalls. As a result, TSAM must employ effective and efficient methods that have the potential to improve product quality and competitiveness. Although LMPs originated in Japan, there is a need to implement them in South Africa because they present numerous opportunities (Stevenson 2015).

In light of this background, there is arguably a need to assess LMPs to find out best practices, challenges, and strategies for improving productivity for TSAM. Wiles and Watts (2014) argue that to respond to a competitive environment, manufacturing organizations need to focus on strategic initiatives that improve productivity and quality. Several continuous improvement and lean models have been introduced to management sciences that focus on improvements in quality, processes, waste reduction, and efficiency in production lines (Wiles and Watts 2014). This research will aim to examine LMPs at TSAM.

1.3 Research problem and aims

1.3.1 Problem statement

According to Hufkie (2021), motorized manufacturing is the most important industrial sector in South Africa. Currently, the main challenges in the manufacturing sector are the quality of the product that does not meet the global standard, defective products that affect the image of the organization, recalls, and the lead time, where customers do not receive their orders on time, which contributes more to customers opting to utilize alternatives. Given the fact that Toyota is highly rated in the utilization of lean, the study's purpose is to examine lean manufacturing practices (LMP) and the extent to which TSAM uses innovative strategies to enhance quality and its sustainability.

According to Trading Economics (2020), the sector's competitiveness in the manufacturing sector has been further hampered by other challenges, including currency volatility, equipment, a poor rate of productivity improvement, poor planning, no support from management, electricity shortages, and skills constraints due to no proper training and employee's lack of willingness to adapt to new technology, which has led to deindustrialization. As a result of deindustrialization, South Africa's future in manufacturing is being questioned and scrutinized. This has contributed to South African youth unemployment, which reached its highest level of 59 percent in the first quarter of 2020. Rodrik (2016) defines deindustrialization as the reduction of industrial activity or capacity in a region or economy.

The automotive sector is the most vital in South Africa. Vehicle assembly and component manufacturers generate, directly or indirectly, a third of the value added in the domestic corporate sector. Because the industrial sector is the most important in the South African economy, the automobile and component manufacturing sectors are essential to the country's socioeconomic prosperity and development toward a more sustainable future (Wong *et al.* 2014).

1.3.2 Aim of the study

This study aims to examine Lean Manufacturing Practices and the extent to which TSAM uses innovative strategies to enhance quality and sustainability.

1.3.3 Objectives of the study

The study also addresses the following objectives:

- To assess what strategic factors are in place to sustain the business and stay competitive in the market?
- To determine what measures are in place to ensure high quality product is achieved?
- What can TSAM recommend as best lean/TPS practices and strategic sustainability in other small and large manufacturing sectors?

1.4 Research questions

The goal of this study is to find answers to the following research questions:

- What limitations, challenges and good practices of lean that can be identified in TSAM?
- What are the quality measures that TSAM has implemented to improve product quality and competitiveness?
- What can TSAM recommend as best lean practices in other small and large manufacturing sectors?

1.5 Research Methodology

This study's methodology, as well as the methods utilized to gather data based on the questions posed for the study, are presented and justified in Chapter 3. The research methodology utilized in this study to compile data for the specific and general survey questionnaires is described in the chapter. It describes the methodology utilized in the research as well as the tools used to gather data.

1.5.1 Research Design

The study applied a mixed method of both qualitative and quantitative approach to obtain the required data. The quantitative methodology focused on obtaining the data through observation and a survey questionnaire. Jankowicz's (2006) study (cited in Makhomu 2012) states that a research technique is an orderly process for collecting and evaluating data to obtain information from it. In this study, 44 survey questionnaires were distributed among top management and stuff in Toyota South Africa Motors. This study aims to examine Lean Manufacturing Practices and the extent to which TSAM uses innovative strategies to enhance quality and sustainability. There are three ways to research methodology: the qualitative method, the quantitative method, and the mixed method. Quantitative research techniques involve the systematic analysis of events and their interactions using numbers and everything that can be measured. Qualitative research is an approach that puts emphasis on words rather than numbers when collecting and analyzing data (Creswell 2009). .

1.5.2 Target population

A target population is a group of people who are included in a study and must be determined before a sample is obtained (Berg and Lune 2012). In this study, the target population was fifty (50) top management staff in four departments at TSAM. The study focused only on TSAM, and survey questionnaires were distributed via email among the sample group.

1.5.3 Sampling method

The two most popular sampling techniques or tactics are non-probability sampling and probability sampling, which are separated into different sample groups. The probability sampling method was employed by the researcher, where individual components are selected through a logical, technical, or mechanical process, similar to the lottery approach, rather than being consciously or thoughtfully chosen from a set of components (Kothari 2004). This is therefore the justification for opting for this sampling method.

1.5.4 Measuring instrument

For the proposed research, a survey questionnaire was constructed that is in line with the identified objectives of this study. Relevant questions in the data collection instrument were also constructed uniquely and originally.

1.5.5 Data analysis

According to Jamshidi *et al*. (2013), the Statistics Package for Social Scientists (SPSS) is the best application for evaluating data. For this reason, the researcher divided the qualitative data analysis process into five stages and used SPSS version 27 for the quantitative data. To create graphs, tables, and correlations for descriptive analysis, SPSS version 27 was specially employed.

1.5.5.1 Pretesting

Ten (10) participants were asked to complete a survey questionnaire to determine whether or not the study's question would yield the expected result. The pretesting participant did not participate in the main study because the results of the question served the purpose of the study.

1.6 Limitations and scope of the study

This study will not engage other manufacturing sectors. This is due to the lack of permission granted in other manufacturing sectors and the limitation of resources and time constraints, as there are numerous manufacturing sectors within the identified area.

1.7 Delimitations of the study

The study will be confined only to TSAM, which is situated in Prospecton, Durban, KwaZulu-Natal (KZN). TSAM is selected for ease of accessibility and cost effectiveness.

1.8 Ethical considerations

This research includes sensitive information and detailed answers from questionnaires. To promote the integrity of the research, the following safeguards are relevant:

- A gatekeeper letter from Toyota South Africa Motors to confirm the researcher's identity was obtained.
- The purpose of the research was explained to ensure all participants understood the relevance of their contribution to this work.
- That withdrawal from participation carries no negative implications for the respondent.
- Identity of the participants will be masked.
- Respondents' right shall be respected and they will not be engaged in any traumatising interactions.

1.9 Structure of Dissertation / Thesis Chapters

Chapter 1: This chapter explains more about the introduction to the study with an indication of LMPs and strategic sustainability at TSAM in the manufacturing sector, together with the aim, objectives, statement of the problem, and the research method that was introduced.

Chapter 2: This chapter will review the literature on the historical background of lean theory, the Toyota Production System, quality measures, and strategic sustainability before the conclusion. This chapter will also identify the gaps that were not covered in the previous research.

Chapter 3: This chapter presents the research methodology used, research design, approaches to the research method, survey method, participants of the study, target population, data collection methods, data type, data analysis, validity and reliability, anonymity and confidentiality, research ethics, limitation of the study and delimitations of the study before the conclusion. .

Chapter 4: This chapter presents the data analysis and presentation.

Chapter 5: This chapter presents the discussion of the study.

Chapter 6: This chapter presents the study's conclusions and recommendations.

1.10 Potential outputs

This study may result in improved effectiveness, efficiency, and competitiveness in the manufacturing sectors and also contribute to economic growth in South Africa. The study will also add to the knowledge base of LMPs in the manufacturing sectors, which will assist them in competing globally since lean promotes competitiveness, according to empirical research, by building quality products with a shorter lead time. This study will also contribute immensely to the students who want to pursue their studies and further their careers in the manufacturing field. The manufacturing sector will create stable products that will create job opportunities, which will be a great achievement for South Africa through the publication of this study in the International Conference on Engineering and Operations Management and a good contribution to the GDP of the country. The next chapter will contain a detailed review of the literature on lean theory, Toyota Production System, Quality measures and Strategic sustainability.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In order to identify appropriate strategies that could be employed to meet the study's objectives, this chapter will evaluate the literature on previous research projects based on lean manufacturing methods and strategic sustainability. The chapter examines four topics: lean philosophy, the Toyota Production System (TPS), quality measures, and strategic sustainability.

The study will add to the body of existing knowledge about the manufacturing industry in accordance with its goals and objectives. The study's findings will be a helpful tool for industrial businesses. Before providing a conclusion, the study discusses the general objectives and gives an outline of the variables that affect whether manufacturing organizations would be successful in implementing these four themes.

2.2 Lean Theory

Henao *et al*. (2018) and Yadav *et al*. (2017) studies (cited in Aditya *et al*. 2021) found that despite numerous studies providing empirical evidence that lean improves quality and eliminates waste in the value chain, the benefits, application, and opportunities of Lean Manufacturing Practice (LMP) are still being implemented hesitantly, which warrants further evaluation. Less than 30 percent of LMP's are successfully implemented. In addition, researchers have documented numerous cases of failed LMP implementations, even in companies in developed countries such as the U.S. and U.K. Sinxoto and Arnesh (2019) note that a significant body of literature focuses primarily on the benefits of implementing lean manufacturing principles in an organization, but researchers have acknowledged the amount of work required to critically evaluate a successful lean manufacturing program, and they note that little research addresses the challenges of sustaining lean manufacturing once it has been implemented in a production system. Bevilacqua *et al*. (2017) also believe that although many companies

report great benefits from lean applications, there is still much uncertainty about the applicability of lean outside of the stable, high-volume manufacturing environment.

According to Sahoo (2019), many researchers have proven that lean can be used to shorten lead time, improve quality and productivity, reduce inventory, and lower costs, while on the other hand, it increases profit and competition. However, not all lean initiatives are successful; some fail due to inadequate plans to implement lean strategies. Lack of management support, lack of training, and unwillingness of employees to change are all factors that contribute to the failure of lean. Lean manufacturing is well known, and many companies try to implement it, but fail because of a lack of understanding of lean performance and its measures. It is impossible to manage lean without evaluating its results. By implementing a quantitative methodology to quantify lean performance, management decision makers can quickly review the efficiency of manufacturing processes and identify potential areas for improvement. Lean principles can occasionally fail because business leaders often lack a map of their own company (Durakovic 2018). Increasing globalization and rising customer demand are forcing manufacturing companies to look more decisively for effective and flexible means to overcome the challenges they face in applying lean. Many academics have already contributed knowledge about lean manufacturing, but they have yet to distinguish the exact way in which lean tools are applied, making it difficult for scholars to grasp the practicality of lean. Sambil and Matimba (2019) studied the impact of lean in a manufacturing company by identifying problem areas, introducing the 5S technique as one of the lean methods, and proposing a more effective process flow. Companies, especially in the automotive industry, are finding it difficult to compete in the global marketplace. As a result, they are turning to alternative tools and strategies to succeed, such as lean manufacturing, which aims to meet customer demand while reducing waste. Companies must be willing to try new ideas and challenge their current workflows if they are to successfully implement lean practices. Interviews and observations were conducted to collect data. It was found that the current workflow of the replacement department was inconsistent, contained many redundant activities, and lacked a clear framework. A more efficient and effective workflow process was proposed through the application of lean techniques that resulted in the elimination of unnecessary activities in the process and the redesign of the process. It was also

suggested that future studies should focus on continuous improvement through the application of lean principles.

According to Qawekazi and Telukdarie (2019), the success of manufacturing companies is generally determined by their ability to carry out daily operations using effective work methods and techniques. Several fundamental principles for managing production in a company are part of lean manufacturing. Numerous companies have recognized the need to put lean principles into practice to increase productivity and gain a competitive advantage in the very turbulent global business environment. To gain insight into the elements that influence the sustainability of lean manufacturing, the factors that influence lean manufacturing principles in a production system were examined. The primary data collection technique for the research is observation. In order to give some order to the observations on the different topics, a checklist is used. Without neglecting the other topics of the study, the research concludes that plant meetings, training, and problem solving are the three most important topics that require attention from all the observed topics with different observable elements. If the way training is conducted is improved, many other problems could be solved, as training has been shown to be the main cause of other issues, as shown throughout the research. Yadav *et al*. (2017) concluded, "To comprehend the challenges and barriers of lean, we must examine current engineering management, managerial culture, organizational science, and employee development".

According to Tovstiga (2016), the main problem is that management often lacks an organizational chart, which sometimes causes lean concepts to fail. Recent research shows that only 55 percent of middle managers can accurately identify even one of their company's top five strategic priorities, and more than half of them fail when it comes to explaining the strategy to their employees. Not only are strategic goals poorly understood, but they also seem disconnected from the company's larger business plan. The sobering reality is that most business leaders are unable to articulate their company's strategy simply and convincingly. It is important to remember that leaders, such as managers, are the ones who drive the business, and they are expected to be knowledgeable about organizational strategies in order to run the business in alignment with the company's business strategies and goals. To get the benefits of Lean

principles, it is important to gain a better understanding of Lean and the factors that impact work teams. Cultural influences affect how critical aspects of lean manufacturing are interpreted and implemented. In one case study, a traditional manufacturing model was transformed into a lean manufacturing model by reducing waste, standardizing work, improving internal logistics and workplace design, and changing the architecture of an electronic assembly line. Applying lean principles resulted in a 40 percent reduction in labor, a 30 percent reduction in production space, and a 30 percent reduction in delivery times. The daily work practices of managers in a company that has successfully integrated lean manufacturing principles into its culture were examined, and a pattern of practices was found. Lean manufacturing is widely known and accepted in industry (Durakovic 2018).

Lean practitioners have identified seven forms of waste: transport, inventory, motion, waiting, over-processing, overproduction, and defects, which need to be clearly understood and well communicated on the shop floor (Sajan *et al*., 2017). Simboli *et al.'s* 2014 study (cited in Ghobadian *et al.* 2020) listed the seven forms of waste as follows:

2.2.1 Defects

- Unnecessary consumption of raw materials and energy in making defective products.
- Defective components or products require recycling or disposal.
- Additional floor space for rework and repair, increasing energy use for heating, cooling, and lighting.

Ahmed (2017) asserts that customers place a high value on quality, and it is this factor that keeps any business afloat. Defects can be found not only in the manufacturing process but also in any other process, such as the maintenance process. For example, if a maintenance repair is performed and the fault returns quickly, this indicates a flaw in the repair process. Standardization of work procedures is an effective way to reduce the likelihood of failure and improve quality. Processes can be mapped, and potential quality issues can be displayed on charts. If a quality issue arises, the standard

procedure should be reviewed and updated to avoid making the same mistake in the future.

2.2.2 Unnecessary inventory

- Additional use of packaging material to store work in progress (WIP)
- Waste from deterioration or damage to be stored, and the use of more material to replace damaged WIP.
- More energy is used to heat, cool, and light inventory spaces.

According to Galankashi and Helmi (2017), inventory is a type of waste that should be minimized. Lean inventory management is considered worthwhile inventory management. The following activities should be done to attain a lean inventory system:

1. Production leveling is the lean strategy employed to remove overproduction and consequently decrease the inventory level.
2. Adoption of JIT and Kanban is an important activity to achieve lean inventory.
3. Total productive maintenance (TPM), statistical process controls (SPC), and total quality management (TQM) guarantees the accessibility of machines and aid managers in implementing inventory plans.

According to Sahoo (2020), inventory reduction reduces manufacturing times and results in higher quality, increased flexibility, increased customer happiness, increased output, and enhanced quality standards. These are all benefits of implementing lean principles, and all of this is accomplished with fewer resources, such as raw materials and labor effort. According to empirical research, lean production does, in fact, boost a company's competitiveness. Increased inventory waste will result in higher interest, space, record-keeping, and obsolescence expenses. Additionally, wasteful inventory might conceal issues that might result in further inventory accumulation. WIP inventory, for instance, can mask the signs of an imbalanced production pace between work centers. Low manufacturing control, bad quality, and poor forecasting can all be hidden

by finished goods inventories. Inventory is not always an asset; it can also be a waste of space.

2.2.3 Waiting

- Potential material spoilage or component damage-causing waste
- Wasted energy from heating, cooling, and lighting during production downtime.

A backlog of materials is a waste. An operator who has no meaningful task to accomplish while waiting for supplies or instructions is wasting time.

2.2.4 Transportation

- Energy and the fuel used for unnecessary transport
- Emissions from unnecessary transport

Materials must be transported further and at greater expense due to an unsatisfactory industrial layout. To shorten the moving distance, work canters should be close to one another. Someone might argue that WIP inventories have no room in close work canters. The material should be transported to the location where it will be used. The material must be carried directly from the vendor to the assembly line area where it will be used. The term for this technique is "point-of-use storage (POUS) (Makhomu 2012).

2.2.5 Inappropriate processing

- More raw materials and parts are consumed per unit of production.
- Unnecessary processing increases waste, energy use, and emissions.

Shah and Pritesh (2018) posit that over-processing is unintentionally doing more processing work than the customer requires in terms of product quality or features, such as polishing or applying finishing in some areas of the product that will not be seen by the customer. Over-processing occurs in situations where overly complex solutions are found to be simple procedures.

2.2.6 Overproduction

- More raw materials and energy are consumed in making unnecessary products.
- Obsolescence and spoilage of extra products require disposal.
- The disposal of unwanted overruns puts pressure on landfills.
- Extra emissions and energy use
- Overproduction is the act of producing more items than are actually required. Overproduction results in more material handling, poor quality, and irrational inventories. Consuming resources for things that aren't necessary could result in a lack of resources for products that are. Never overproduce goods just to keep workers and equipment occupied. Leave it alone if the needed load is less than the capacity. Labor can be transferred to other departments, used for machine cleaning or maintenance, accepted for training and education, etc.

2.2.6 Unnecessary motions

- Additional packaging is required to protect products and components during movement.
- Spill during movement, producing environmental damage.

Ahmed (2017) points out that to avoid running and handling losses, the operator must have his tools handy and within reach, and the required parts or materials must be handed to him in the correct orientation. The operator should never leave his job to look for spare parts or tools. 5S is a good technique to eliminate the problem of searching for tools. Access to tools is greatly improved by organizing them and placing them in a visible location. Shadow boards are useful for determining whether or not a tool is missing. Tools are outlined on the shadow board. Wasted motion results from operators not performing their tasks properly. It is wasteful motion to reach far for consumables or machine buttons. It is inefficient to move around looking for tools. Any activity that detracts from value, such as poor layout or training programs, should be discontinued.

The eighth waste that was cited is unused human skills. Any company that does not value its employees or invests little effort and money in the training and coaching process is losing its human ingenuity. Toyota is the best example of a company that values its employees. When Toyota invests in its leaders, the company assumes that these individuals will use the skills and knowledge they have gained through Toyota's leadership self-development program to develop other leaders. The ability of leaders to mentor and develop others has not always been easy. Instead of thinking only of themselves and viewing others as followers, they can be very useful when they learn to coach others. The main role of leaders at Toyota is to create more leaders, not more followers. Another example of wasted human potential is the use of the operator or maintenance barge to transport tools or parts. This highly competent employee can direct or supervise a number of operations and suggest how tasks can be performed more effectively. To improve their own work, they should actively participate in the problem-solving process. Using a highly skilled worker to complete simple tasks increases the price of that employment. The decision to hire an outside contractor rather than use the worker's skills and suggestions to improve the process.

According to Purushothaman *et al*. (2020), production waste occurs during a production process, and to the seven forms of production waste already mentioned, the authors added two more, namely human health and space in a production process. The continuous identification and elimination of waste as a value of production process activities leads to the concept of lean production, which aims to maintain a smooth flow of production. According to their findings, various lean tools such as 5S, predictive maintenance, pull systems; failure analysis, value stream mapping and others can be used to achieve the goals of lean principles. This is an approach driven by flexibility and workplace organization. It is a good foundation for companies that want to rethink their current manufacturing methods (Sukdeo *et al*. 2020). Lean principles in manufacturing have produced mixed results, particularly in sustaining process improvement outcomes. Workgroups have a long history of helping to implement and manage process improvement initiatives (Powell and Pilar-Pazos 2016).

Sinxoto and Arnesh (2019) concluded, "The research team suggested that research must be conducted with the goal of evaluating and identifying the factors that prevent

lean manufacturing principles from being feasible in a manufacturing environment. According to their research, there are several main reasons why lean manufacturing principles are not consistently applied in manufacturing organizations. The gap was found to exist in several areas, including how the company conducts its qualification process, how knowledge is transferred to employees, and how managers and employees work together on the store floor. Looking at the different departments, the study also concluded that the assembly department is currently leading the way, while the logistics department is lacking in several areas. They recommended that future studies focus on incentive plans to encourage employees to participate in lean projects to close the gap in the lack of sustainability of lean concepts in manufacturing companies.

Dombrowski and Mielke (2013) conducted a survey to identify relevant lean leadership principles and practices. A total of 91 companies were surveyed. There were 54 participants from Germany and 37 from other nations, including participants from industry. Improvement culture, self-development, qualification, Genchi Genbutsu and Hoshin Kanri were highlighted as lean leadership techniques. In Germany, only 39 percent of participants used genchi genbutsu. In other countries, this figure is 61 percent. Only 29 percent of the companies used the Hoshin Kanri method. Only 10 percent of the German respondents indicated in their answers that they use Hoshin Kanri.

Academic literature on lean manufacturing (LM) is widely available. However, due to its fragmentation, the contribution of LM is controversial from a practical and academic perspective. A total of 403 articles published in 62 journals between 2010and 2019 were collected from four major management science publishers. The results show that LM is not clearly and consistently defined due to the different meanings and their evolution in the literature on lean philosophies, principles, and measurements. Antony *et al*. (2020)

2.3 Toyota Production System (TPS)

In most materials currently in circulation, the terms Totota Production System (TPS) and lean manufacturing are often used interchangeably. Krafcik (1988) was the first to use the term "lean," but Womack *et al*. (1990) popularized it by referring to TPS as "lean

production." In the 1980s and 1990s, a number of researchers focused on lean-related issues and used the term "lean production" to describe the evolution of TPS and lean. Toyota Motor Corporation is the 11th largest company in the world by sales. It is a Japanese automaker that has several plants around the world. Toyota is known in manufacturing and production by implementing TPS. However, after the disaster of 20 million vehicle recalls between 2009 and 2014, some experts have started to question some TPS practices. In October 2012, Toyota was hit with another wave of recalls that affected 7.4 million vehicles associated with faulty elements that fell under functional defect. In June 2014, Toyota was affected by another large recall that affected 844,001 vehicles in the U.S. and 650,001 vehicles in Japan recalled for faulty airbags associated with a functional A defect. It is estimated that Toyota lost $6 billion in six years, from 2004 to 2010, which damaged Toyota's reputation and customers' perception of Toyota as a leading and reliable vehicle brand. Xiangchen (2019) pointed out several concerns and mistakes Toyota made during the recall scandal. They ignored one of their most important KPIs, which is safety. He also emphasized that Toyota should take the lead and put business ethics and customer safety first, rather than cost savings and the pursuit of more profit and market share. Thomas and Michael (2017) concluded, "One possible cause of the recalls was Toyota's inability to keep up with its recent aggressive growth," a claim that leads the company to ignore the lean method (TPS) and focus on chasing demand. Impson (2020) agrees that Lean and TPS methods are not prioritized when demand is high, which contributes to defects flowing out of the process, which later leads to a high scrap rate, excess parts from inventory, failure to meet OPR, SDR, and lead time, or even recalls because the standard is not met. The daily target is always affected by downtime caused by production line stoppages, machine breakdowns, parts shortages, and lack of feed from downstream lines, resulting in a delay on the last line, which is an OPR line. OPR is the output of the entire production line based on the run time of the shift, calculated as follows:

OPR = Takt time x volume/ Available time – Planned stop x 100

According to Jacobs *et al.* (2009), the Toyota Production System (TPS) is widely considered the gold standard for lean manufacturing. It was developed to improve quality and productivity and is based on two principles that are fundamental to Japanese

culture: Elimination of waste and respect for people. Wang (2022) also believes that TPS improves quality by applying various lean methods that help reduce defects and improve quality in the production line: kaizen, 5S, 5 Whys, Poka-Yoke, and introducing ideas such as employee engagement and contribution, empowerment and self-responsibility, and the human touch and the idea of stopping and responding to any irregularity. The TPS /lean formula is well known, but there are still some decisions that need to be made on a daily basis. Tracking down the error, finding the source of the problem, and fixing the problem takes a lot of time and attention. Krishna and Nair (2018) also agree that TPS improves the quality of products and processes. Overall, TPS uses several lean methods to reduce defects and improve quality: Kaizen, 5S, 5 Whys, and Poka-Yoke. TPS is a system that allows us to manage and improve production so that we can produce quality products efficiently and JIT in response to customer orders.

2.3.1 Kaizen

According to Impson (2020), kaizen means continuous improvement. One of the lean management tools used by numerous companies worldwide is kaizen. The term "kaizen" has Japanese roots. It can be interpreted simply as improvement through change. The kaizen philosophy includes several proven techniques to increase the standard of implementation. Customer centricity, TQC, Kanban, just-in-time, quality improvement, zero defects, robotics, and automation are all part of kaizen. Selepe (2019) explains that the words "kai" and "zen" in kaizen philosophy stand for "change" and "better" respectively. Kaizen is a Japanese concept that emphasizes continuous improvement and progress in business processes. It can be carried out by a small group of people within an organization implementing and improving procedures, or by an individual employee making suggestions to improve processes. The kaizen philosophy states that "process improvement is endless" The goals of kaizen thinking are to develop a process with a kaizen understanding. This means understanding standard work, identifying and eliminating anomalies, identifying and minimizing attrition, and identifying and minimizing muda.

Steps 1 - Understand Standardise work:

- A member working on a process on the production line must follow standardized work.
    - How?
    - Standardize work sequence:
    - Start line/finish line/call point
- With the step sheet/work combination table, the work sequence is correct.
- Is the member doing cyclic work?

Step 2 - Identify and eliminate abnormalities:

- An abnormality is anything that is not standard or that occurs during the work cycle that is not defined as an element by the work combination charts.
- Any reason for abnormality occurrence should be understood and eliminated.
- Abnormality examples: dropping of parts while working and part shortages

Step 3 - Identify and eliminate fluctuation:

Fluctuation is the variation of time between cyclic works.

Step 4 - Identify and Eliminate waste.

- Waste of correction
- Waste of over-production
- Waste of processing
- Waste of conveyance
- Waste of inventory
- Waste of motion
- Waste of waiting

2.3.2 5S

According to Randhawa and Ahuja (2017), Takshi Osada invented 5S in the 1980s as a management tool or approach to create and maintain higher quality, productivity, and a safe work environment in an organization. 5S not only streamlines the work environment and reduces waste, but also helps improve workplace safety. 5S (sort, set in order, shine, standardize, and sustain) is a lean tool that focuses on effective workplace organization and standardized work practices. It consists of five practices: sort, set in order, shine, standardize, and sustain. To "arrange" means to design and clearly identify where items are stored, while to "sort" means to put things in a specific order. Everything should be in its place so that time and energy is not wasted searching for information; it should be kept in the right place. Shine means to keep its position. Everything is spotless. Standardization is the process of recording work procedures, while maintenance is the process of creating a continuous flow of information. Stick to your improvement techniques. Continuous implementation of 5S has several benefits, including higher product quality and safety.

According to Durakovic (2018), the 5S model consists of five components: sift (remove unnecessary items); sort (arrange all items in the correct order); spot clean (clean and sweep the work area); standardize (establish procedures and schedules to ensure repetition of the first three "S" practices); and sustain (maintain the developed process through self-discipline).

2.3.2.1 Basic concept of 5S

The figure below (figure 2.1) illustrates the 5S concept. The 5S concept requires everything to be in place and easily accessible to the operator. The five steps in 5S concept are sifting everything then sort in same category when everything is sorted you spick and span. After the first three steps has been accomplished then standardize and sustain.

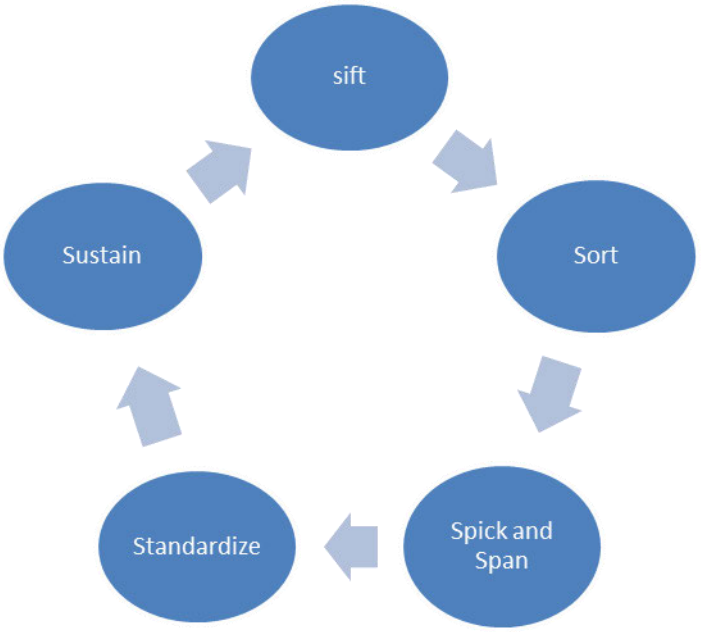

Figure 2.1: 5S

2.3.3 5 Whys

According to Selepe (2019), 5 Whys is a questioning strategy that entails pinpointing the core cause of the issues that contribute to the inefficiency of a process. A why-why analysis technique is a long-term solution to a problem; it pinpoints the cause of the issue and suggests measures to prevent it from recurring. Problems will be identified when personally involved in genchi genbutsu. The identified issue must then be traced back to its root cause, which is frequently hidden beneath more obvious issues. Toyota does this by asking "why?" five times to find the root cause. (Östlund 2020).

2.3.4 Poka-yoke

According to Krishna and Nair (2018), these are the tools that help employees quickly identify potential defects and stop the assembly line so that defects do not flow out of the process and eventually affect the final product. TPS is a tool that improves Toyota's ability to reduce waste throughout the production process; it improves through JIT, kanban, takt time, and kaizen. The findings of the study show that Toyota only focuses on processes rather than day-to-day minor kaizen.

2.3.5 Basic concept of TPS

The figure below (figure 2.2) illustrates the concept of TPS. The foundation of the TPS is standardised work. The two pillars that support the foundation are Jidoka and Just-In-Time.

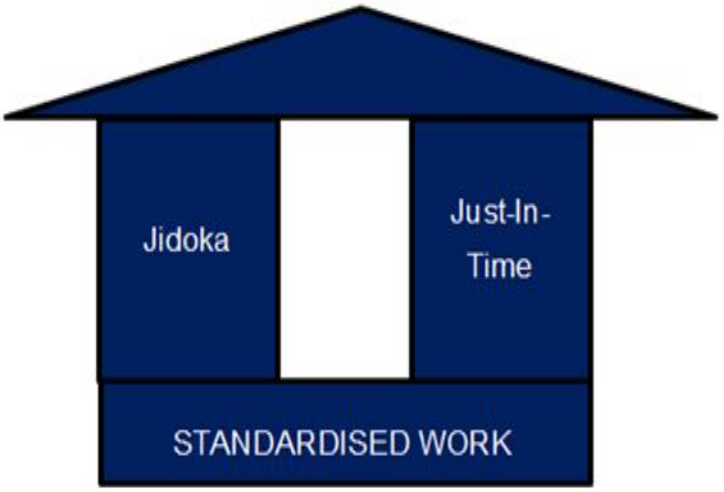

Figure 2.2: TPS House

According to Krishna and Nair (2018), standardized work is identified as the foundation of the TPS, which is supported by the twin pillars of Jidoka and JIT. Companies that pursue and implement TPS best practices have achieved a lot of success. The following are some of the advantages:

- Determine and improve the perceived value of customers.
- In the manufacturing process, reduce waste and costs.
- Enhance product quality and delivery timeliness.
- Create a world-class manufacturing industry that is competitive.

2.3.6 Standardised Work

According to Krishna and Nair (2018), standardized work organizes and defines an operator's motion to produce high-quality products safely and efficiently. Standardization of work practices is a smart technique to reduce the risk of failure while also improving

quality. Processes may be shown, and their potential can be assessed. Quality issues can be shown graphically. If a quality issue arises, the standard procedure should be re-evaluated and updated to avoid this blunder in the future.

To achieve standardised work the process should be:

Figure 2.3: Standardised work process

If the process cannot achieve this prerequisite, then problem solving is necessary.

Purpose of standardised work:

- To confirm the production method
- Allocate full workload
- Make kaizen

Standardised work identifies:

- Muri - Overproduction
- Mura - Unevenness
- Muda – Waste

Elements of standardised work:

- Takt Time
- Work Sequence
- WIP

Takt time is identified as the pace of customer demand. Takt time is the daily operating time or the customer's daily order. The Standardized Work Sequence is the standard work sequence to safely achieve built-in quality and maintain an efficient cycle. WIP is the minimum number of parts in progress, which allows maintaining standard work with minimal amounts of waiting. There are three forms of standardized work in TSAM: machine capacity charts, work combination charts, and work movement charts.

2.3.7 Jidoka

According to Zainal *et al.* (2019), "Jidoka" is a phrase that originated in Japan. The "production problem warning system that alerts everyone" is an approximate translation of Jidoka. Jidoka's theory calls for shutting down the production line entirely when a fault is found. The rationale for ceasing the whole line is to prevent the risk of adding value to substandard parts. Jidoka is used as a visual alert system to warn of issues or flaws that have occurred during assembly. Without Jidoka, a worker could only operate one machine at a time at their workstation, which required continual focus. By including Jidoka, the operator may be able to view the entire process at their workstation, allowing them to spot additional possible errors and flaws. According to Narayanamurthy *et al.* (2016), Jidoka, the first pillar of the TPS, is the idea that quality should be integrated into the process rather than being addressed separately. Scrap prices are a waste. However, when compared to other waste brought on by manufacturing errors, it is the least significant. Defects prevent the production line's materials from moving smoothly. The following workstation may attempt to use the scrap to create additional waste if it is not detected, or it may waste time waiting for suitable supplies. Other authors have started to add to the list the eighth waste: underutilization of people. That is the cost of not using the creative potential of every person in the factory. There are two elements to Jidoka: to separate manpower from machine work and to prevent defect flow.

2.3.7.1 The process of Jidoka

The figure below (Figure 2.4) illustrates the process of Jidoka.

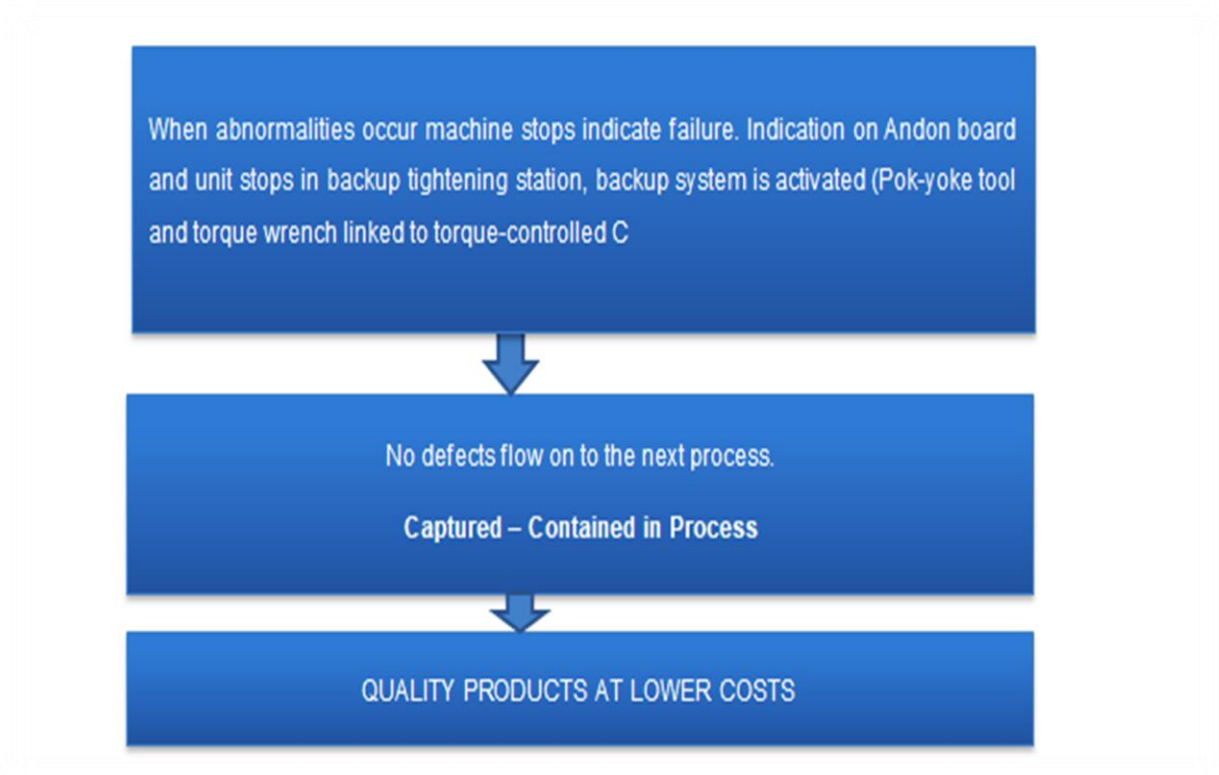

Figure 2.4: Element of Jidoka

According to Ndaba (2020), TSAM's mission is to produce quality cars for the customer in order for the company to make a profit and contribute positively to the South African economy. For the company to successfully achieve a good-quality product, it must eliminate any type of waste to improve productivity through TPS. The types of waste have been illustrated in the figure below.

2.3.8 Toyota Production System (TPS) Structure

According to Krishna and Nair (2018), TPS raises the quality of processes and products. Overall, TPS employs a number of lean techniques, including Kaizen, 5S, 5 Whys, and Poka-Yoke, to help decrease errors and enhance quality. These technologies give employees the ability to identify inefficiencies, mistakes, or potential flaws and to stop the assembly line if necessary to prevent those flaws from being present in the finished product. TPS decreases waste while boosting productivity and cutting costs. Toyota's

capacity to eliminate waste throughout the production process is directly related to its ability to deliver high-quality and cost-competitive products. Waste is identified via Just-In-Time (JIT), Kanban, Taki-Time, and Kaizen. Until waste is removed, areas with wasteful movement, overproduction, underproduction, inefficient transportation, surplus inventory, and defects are found and improved. By offering products that are devoid of flaws, TPS raises consumer satisfaction.

According to Xiangchen (2019), Toyota established an integrated socio-technical system called the Toyota Production System (TPS), which includes its management methods and philosophy. For the automaker, the TPS coordinates manufacturing and logistics, as well as interactions with suppliers and clients.

The figure below (Figure 2.5) illustrates TPS structure.

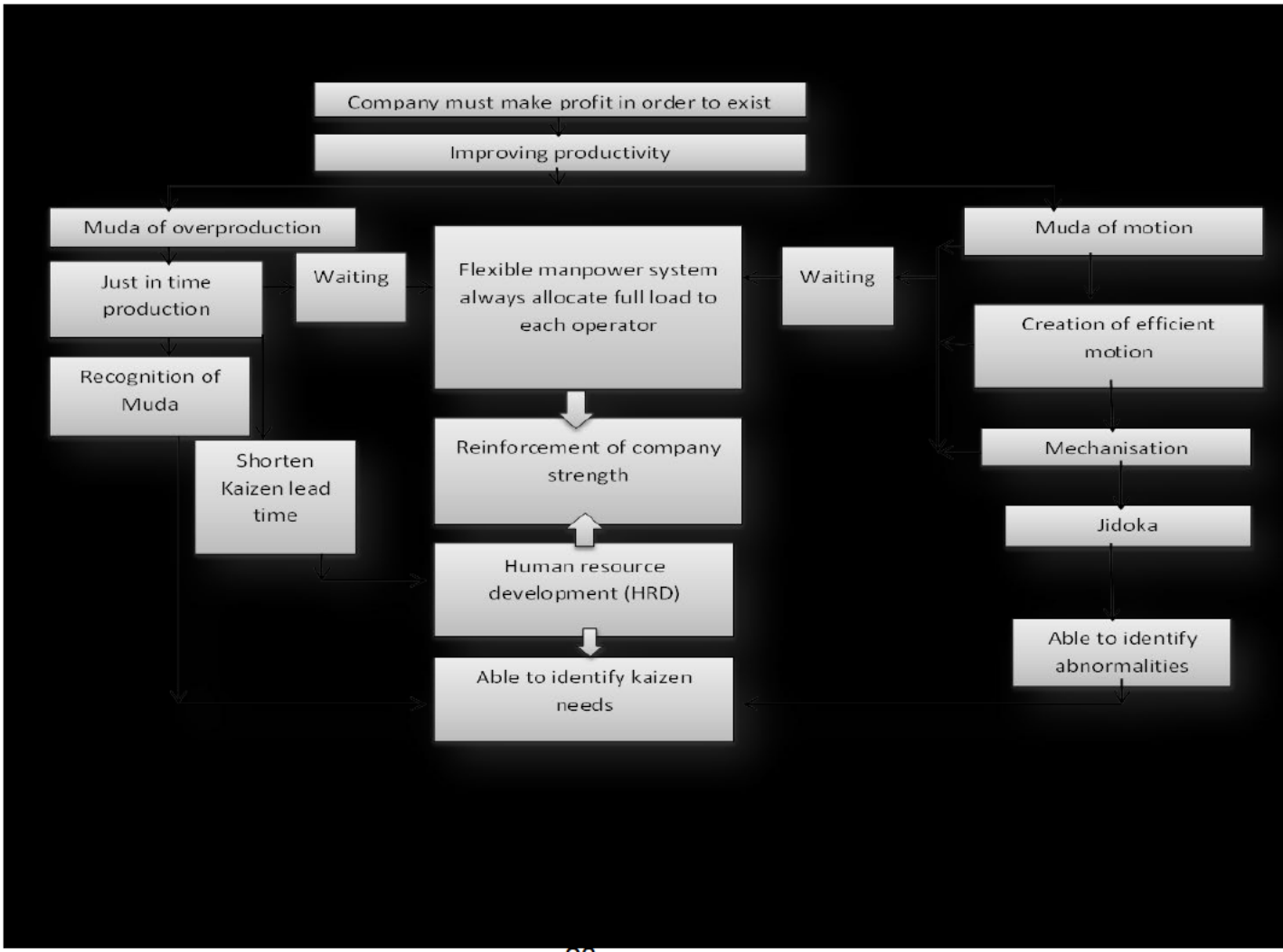

Figure 2.5: Toyota Production System (TPS) Structure

The figure above (Figure 2.5) shows the TPS system and what the objectives are. At the top of the TPS structure, it shows the goal of any company's existence, which is to make a profit in order to exist. For the company to make a profit, it must improve its productivity by building quality and eliminating any form of waste in the value chain. Overproduction and movement should be avoided. In order for the company to eliminate overproduction, they need to produce the amount of product required (JIT production) and be aware of any other form of waste (waiting). Waiting is eliminated by a flexible manpower system that allocates the full load to each operator, which is derived from company strength. JIT production can be achieved by shortening Kaizen lead times, which are managed by human resource development, which also has the responsibility of developing employees and strengthening company strength. Muda will be eliminated by doing kaizen to improve those areas.

The formation of efficient motion can get rid of the muda of motion. Waiting is also avoided as a result of mechanization, thanks to a flexible labor system that assigns full loads to each operator. Using Jidoka, you may find anomalies, create a high-quality product, and save waste. The Toyota Way is the cornerstone of TPS.

TPS is made up of two pillars, which are continuous improvement and respect for people.

1. Continuous Improvement

- Challenge (what do you want to achieve)
- Kaizen (keep on improving)
- Genchi gembutsu (go to the source of the problem and see it yourself before solving)

2. Respect for people

- Respect (treating people the way you want them to treat you)
- Teamwork (group of people working together to achieve the same goal)

2.3.9 Just-in-Time

As the name implies, JIT is a method for completing activities as and when they are required. The JIT manufacturing strategy has been embraced by many companies because it can increase output, revenue, and product quality. Performance metrics are enhanced as a result of JIT practices. Organizations that perform repetitive jobs and job shops profit from JIT. One of the key components of lean manufacturing, JIT, was developed to improve manufacturing efficiency by cutting lead times through the removal of waste. JIT prevents the risk of having enormous volumes of inventory and lowers the costs related to inventory. JIT also lowers the cost of the working process (Mtshali *et al.* 2019).

According to Ahmed (2017), a lot of manufacturers are using the JIT manufacturing strategy since it boosts output, revenue, and product quality. The findings of Shah and Pritesh (2018) agree that JIT procedures lead to better performance, prevent the risk of having enormous volumes of inventory, and lower the costs related to inventory. JIT also lowers the cost of the working process. According to Ndaba (2020), JIT refers to the production and conveyance of what is needed, when it is needed, in the quantity required. In TSAM, JIT refers to the continuous flow of material pulled through value-adding processes in the shortest lead time while maintaining pace with customer demand. He further outlined the three elements of a JIT manufacturing system as follows:

- The pull system is the mechanism for ensuring that the right parts are produced and conveyed at the appropriate time and in the appropriate quantity according to customer demand.
- Continuous flow processing ensures that there is no stagnation in and between each process.
- Takt time manufacturing: the production and conveyance of parts at the rate of customer demand leveled over the daily operating time. Takt time = daily operating time/customer's daily order.

2.3.9.1 The JIT philosophy

The figure below (Figure: 2.6) shows the JIT philosophy and its contribution to production improvement and waste elimination.

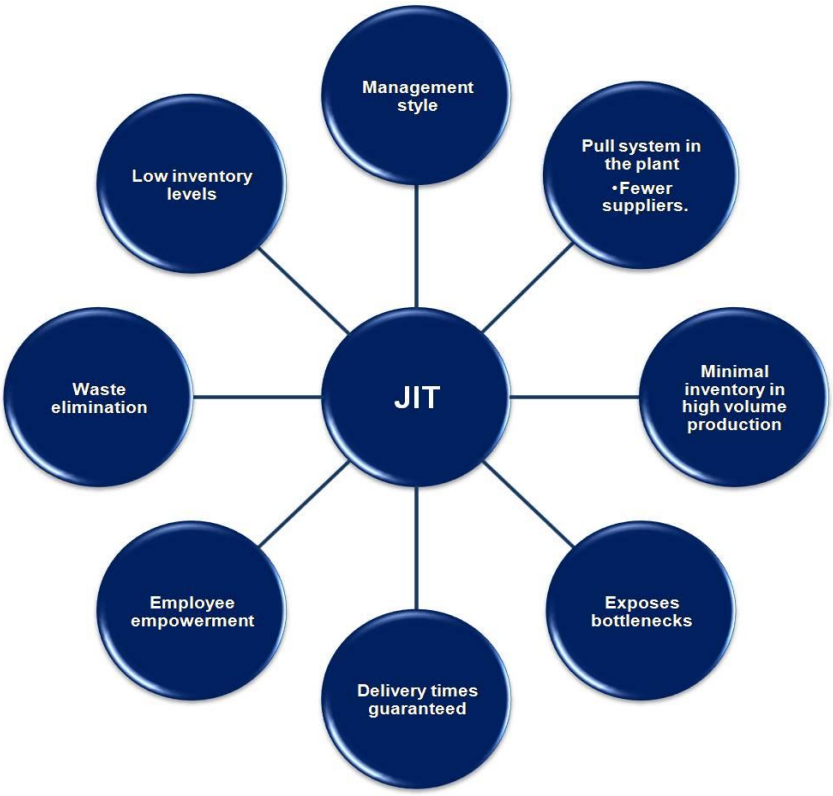

Figure 2.6: Just-In-Time Philosophy, Source: Mtshali, *et al* (2019)

According to Impson (2020), the JIT system has contributed positively to improving the OPR by reducing downtime that affects the run ratio (RR) of the production line, which further contributes to the SDR. The RR indicates the performance of the line only based on the actual time available, which is calculated as follows:

RR = available time: planned stop, a line full, and no feed

The SDR is a key performance indicator (KPI) based on first-time delivery units without defects. It indicates whether the line meets production volume and quality targets. SDR is calculated as follows:

SDR = Volume - Defective Unit/Volume x 100

The major contributing factor to SDR in the chosen organization for this study is defects per unit (DPU). DPU is the number of defects per unit built per day, which is calculated as follows:

DPU = daily defects/day volume

It is a measure of the quality of each unit that is produced; it also shows the quality of your process. There are major recurring defects that affect the SDR. The major defects are categorized into 4 categories: functional A, functional, appearance, and appearance B.

JIT, Kanban, Taki-Time, and Kaizen are used to spot waste. Areas that have wasted movement, overproduction, underproduction, inefficient transportation, unnecessary inventory, and defects are identified and improved until the waste is eliminated. The two primary principles of TPS are JIT and Jidoka. The principal foundation of the TPS is the Toyota Way, a set of 14 principles practiced that serves as the Toyota culture at every Toyota manufacturing plant around the world (Krishna and Nair 2018).

Liker's 2004 study (cited in Thomas and Michael 2016) describes the 14 principles of the Toyota Way:

1. Make management decisions based on a long-term perspective, even if it means sacrificing short-term financial objectives.

The long-term decisions are being taken at the executive level and communicated through downward communication. The management and employees are being trained to be flexible to accommodate any changes. The production system is designed to accommodate the time change to create a continuous process flow even when the short-term goals are affected by the long-term. The next point will discuss the continuous process flow.

2. Make the continuous process flow.

One of the keys to being able to respond quickly to customer needs while also being a JIT manufacturer is having equipment flexibility and the ability to align it with product flexibility. Because customer requirements are unpredictable, it's crucial to look at manufacturing costs across a range of volumes. When the optimal volume requirement is reached, manufacturing costs drop sharply, and when the volume exceeds the requirement, manufacturing costs rise sharply. This system is characterized by a significant upfront investment, which is usually extremely expensive; more stiff and complex equipment, which is sometimes not technologically modern; and larger capacity increments, which are usually quite high. In the next point, the use of a pull system will be further discussed.

3. Use ‘pulls’ systems to avoid the danger of overproduction.

The terms "push" and "pull" denote two distinct methods of moving materials through a manufacturing process. When work is done at a workstation in a traditional manufacturing setting, the output is transported to the next station or, in the case of final operations, to final inventory. In a pull system, however, each workstation pulls work from the previous workstation as needed, and the output of the end operation is pulled by client demand or the master timetable. Workload equalization will be discussed in the next section.

4. Workload leveling (heijunka)

To create consistently level daily mix schedules, the master production schedule is developed to offer level capacity loading (referred to by the Japanese as heijunka). Once created, production schedules are locked in for a brief period (usually three months), giving the system some predictability. The next point will discuss the importance of building quality at the source and the systems that are in place to ensure quality.

5. Build quality at the source.

It is not always necessary to conduct an inspection, audit, or self-evaluation to detect flaws; sometimes staff must pay attention to do so. TSAM has introduced systems like jidoka, yatara kakunin (do and check), and stop and fix to ensure defects do not flow to

the next process. One of the tools TSAM is using effectively is standardized work, which will be further discussed in the next point.

6. Use standardized work.

Standardized work organizes and defines the operator's motion to produce high quality. For the process to be certified as standardized, it must be repeatable, reliable, and capable. Standardizing the work also ensures that any problems occurring in the process will easily be identified and eliminated, which ensures no problems are hidden, which is the next point to be outlined.

7. Use visual control to ensure no problems are hidden.

TSAM has adopted a system whereby everything is documented and displayed on a board. The defects that occurred are displayed together with the countermeasures. Hour-by-hour downtime is required throughout the shift and is presented by the respective departments. The use of technology and its contribution to quality will be discussed at the next point.

8. Use reliable and tested technology that helps your people and processes.

Smart tools that are linked to the tightening sequence have been introduced; if one element is not tightened, the smart tool can pick it up and stop the assembly line until the correct tightening sequence is followed, ensuring good quality and preventing critical defects that can lead to fatalities. Employee development is one of the most effective ways to change mindsets and give employees a sense of belonging.

9. Human Resource Development (HRD)

Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others.

10. Develop teamwork.

Develop exceptional people and teams that follow your company's philosophy. Respect is key in a working environment.

11. Respect for people.

This is one of the pillars of TSAM, which is respect for people and teamwork. These two pillars stress the point of treating people the same way you want them to treat you, under the pillar of respect for people, and encouraging group work as part of problem-solving and improving the workplace environment.

12. Go and see to understand the situation (genchi genbutsu).

To understand the problem, it is important to go to Gemba (the place where the problem occurs) and see for yourself the nature of the problem so that your investigation can start at that point.

13. Make decisions based on considering all options; implement rapidly (nemawashi).

Make decisions slowly by consensus. All the employees need to understand why certain decisions are being taken in the organization. TSAM has introduced the "Understanding Our Business" course to uplift the knowledge of the employees about the full operation of the business, including managing the company's costs" course to uplift the knowledge of the employees about the full operation of the business, including managing the company's costs. Continuous improvement will be discussed at the next point.

14. Continuous improvement (kaizen)

There's never a perfect process, so there's always an opportunity for improvement. Because all other TPS and lean principles and practices revolve around improvement and kaizen, the notion of continual improvement is paramount. There is a desire to strive for perfection at all times; perfect conformance to specifications is always possible. Kaizen is the philosophy of striving for perfection. It is the process of making incremental improvements, regardless of magnitude, in the endeavor to eliminate waste (Liker 2004). All employees should try to improve processes all the time.

2.4 Quality measures

Husain *et al*. (2021) define quality as mere suitability for the intended use. In manufacturing, quality is determined by how closely the product meets the specified product requirements. Higher quality products, due to their higher acceptance, often result in more satisfied customers, an increase in product demand, a decrease in product rejection, and lower costs. This ultimately leads to improved organizational productivity, which translates to a better work environment for employees and leads to business expansion. Seven quality control (QC) tools are very helpful in improving quality within an organization to achieve higher quality. Inspection sheets, Pareto charts, cause and effect diagrams, flow charts, histograms, scatter diagrams, and control charts are the seven basic QC tools. To increase profits, quality is a critical aspect in the manufacturing industry. Quality tools are an approach to control and improve productivity in various ways, including reducing recurring defects. Sreedharan *et al*. (2017) believe that quality principles use simple and clear methods that must be followed if the company wants to achieve world-class quality. It should understand that these methods will not work without a strong corporate culture. Training, technology, management support, poor planning, and employee attitude are some of the many factors that affect the quality of the product produced by an organization (Odhiambo *et al.* 2017).

According to Foster (2016), quality issues waste resources by causing scrap and rework. Lean is a collection of techniques or systems aimed at improving quality processes. Ishikawa spent his life working to improve quality in Japan, and his ideas were synthesized into 11 points that made up his quality philosophy, namely:

- Education is both the beginning and the end of quality.
- The first step towards quality is to understand the customer's needs.
- Quality control is at its best when inspection is no longer required.
- Address the core causes rather than the symptoms.
- All employees and divisions are responsible for quality control.

- Don't get the objectives mixed up with the means.
- Prioritize quality over quantity and focus on long-term goals.
- Quality enters and exits through marketing.
- When facts are revealed to subordinates, top management should not become enraged.
- 95 percent of a company's problems can be remedied with the seven quality control instruments.
- Data that lacks dispersion information is erroneous.

According to Agrawal (2019), quality is considered one of the most difficult problems that manufacturers must solve in the era of globalization as they seek low-cost distribution channels for their goods. Companies need to maintain quality at marginal cost and apply total quality concepts as the best approach to solve this problem. "This study has provided a systematic framework of Crosby's 14 quality principles for manufacturing challenges and contributes to the body of knowledge by recognizing a hierarchy model of variables used in a ISM-MICMAC strategy for successful TQM implementation. Up to 85 percent of all inefficiencies are the result of a company's systems. The TQM methodology extends the traditional manufacturing process to the entire organization and all of its functional areas. According to the findings, the stated principles of "take action to make change happen," "introduce training," "encourage employees to learn," and "introduce leadership" are strategic requirements, while "dispel fears," "break down barriers between personnel areas," and "eliminate number quotas" are tactical requirements. Operational requirements for TQM applications include "adopting the new philosophy," "creating consistency in improving products and services," and "ending reliance on mass inspection" TQM is a collection of management principles for continuously improving product quality and operational efficiency to satisfy customers. It is now widely used in the management jargon of companies on a global scale (Sreedharan *et al.* 2017). TQM is the main manufacturing strategy that plays an important role in strengthening organizational competitiveness in the marketplace, and

the popularity of lean manufacturing is largely due to empirical evidence that it increases a company's competitiveness (Sahoo 2020).

According to Garza-Reyes *et al*. (2017), TQM is based on three factors: customer orientation, continuous improvement, and employee engagement. Customer orientation means looking at things from the customer's perspective and working for the good of the customer. Continuous improvement means constantly striving to improve situations. Employee involvement means that all members of the organization, from the top to the bottom, must share the same work objectives and information to achieve a common goal. All members of the organization must feel they belong and participate in activities to improve the organization. The TQM principle is illustrated in the figure below:

2.4.1 Total Quality Management

According to Selepe (2019), the theory of total quality management (TQM) places a strong emphasis on employee engagement, customer happiness, and continual development. The overall goal of an organization is to meet the expectations of the client or customer. For every organization or firm to be resilient and competitive, the business world has prioritized quality.

The figure below (Figure 2.7) illustrates the concept of TQM.

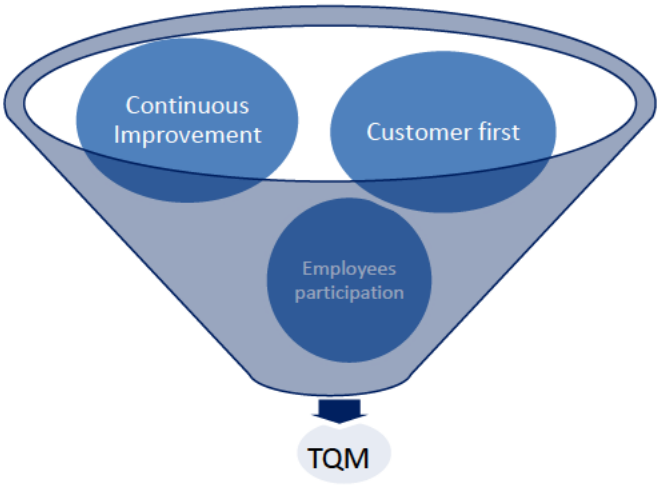

Figure 2.7: Total quality management

The figure above (Figure 2.7) is showing TQM concept. To achieve TQM the customer comes first and to meet the needs of the customers there must be employee participation in the continuous improvements.

The study goes on to state that several studies have been conducted on TQM, but no study has examined the relationships among Deming's 14 quality principles. The study concludes, "Top management should promote employee education and institute leadership to successfully implement TQM in service and manufacturing companies." TQM is a philosophy that emphasizes customer satisfaction, employee involvement, and continuous improvement (Mtshali *et al*. 2019).

Husain *et al.* (2021) agree that the seven quality control (7QC) tools can be of great help in improving quality in a company. Control sheets, Pareto charts, cause-effect diagrams, flow charts, histograms, scatter diagrams, and control charts are examples of graphs for improving product quality and competitiveness. Companies' main goals are to improve quality and reduce costs and lead times. They achieve this by putting the ideas of lean manufacturing and quality measures into practice (Kamble *et al.* (2020)).

According to Morgan (2015), the quality of goods and services is largely determined by the competence of the people who provide them. In commerce, products are tangible items that are exchanged for other goods or services. Services, on the other hand, are activities provided by others, such as teachers, doctors, hairdressers, dentists, and even Internet services (Dragoni *et al*. 2011). According to economic theory, the end consumer is rewarded with satisfaction and utility through the consumption of products and services. Businesses consume products and services as part of the process of producing other goods and services. Marketing theory, on the other hand, uses the goods-services model. According to Amber (2016), employees' work experience has a significant impact on how customers perceive the quality of goods and services. Consumer satisfaction is determined by receiving the goods and services that the customer expects. If an organization's employees promise a good or service that the operation cannot deliver, the customer's expectations are not met, the consumer is disappointed, and the quality of goods and services is not perceived. Operations and

production do not determine the quality of goods and services. Customer expectations, the actual goods or services received, and the manner in which the service is delivered

Lean and quality are often organized as distinct domains. A comparison of Lean Manufacturing publications from South Africa and Germany shows a marked difference in the acceptance and application of the method. This discrepancy exists more in publications that deal with the extension and evaluation of lean concepts. The ability to achieve higher productivity standards without compromising quality is an important goal of a manufacturing company (Randhawa and Ahuja, 2017). According to Galankashi and Helmi (2017), quality has a cost that is more than double the cost of doing things well the first time. All the resources and expenses used to produce the defective product have been lost, and new expenses are incurred to make up for that defect. In addition, there are other costs associated with implementing changes, root cause analysis, and process improvement. Defects, rework, and additional requirements or adjustments are added together to form the cost of quality. Some examples of lean manufacturing techniques include cellular manufacturing, multifunctional workforces, lot size reduction, just-in-time (JIT), labor delegation, TPM, setup time reduction, TQM, continuous flow manufacturing, agile manufacturing strategies, safety improvement programs, process capability measurements, and human resource management (HRM).

According to Toma (2017) the fierce competition that exists today on a global scale in all industries is forcing companies everywhere to constantly strive to improve their goods, services, and operations. Toyota Motor Corporation is one of several companies in the automotive sector that have distinguished themselves by placing quality at the heart of their production process. The Toyota Production System, which promoted the formation of business excellence models, has been continuously developed, applied and refined to improve their goods, services and operations. Today's business environment is becoming increasingly unstable and unfavorable. In an increasingly global business environment, they must perform remarkably to thrive and expand. In this regard, constantly improving the quality of their goods, services and operations is one of their main concerns. In order to achieve the objectives of the paper, data from a variety of secondary sources, as well as information obtained directly from the observer, were collected, processed and analyzed. The main findings show that the Toyota Production

System is the source of Toyota Motor Corporation's best practices for total quality management and business excellence, and that these practices can be found in the characteristics of business excellence.

According to Ndumia *et al* (2020), the factors that affect product quality in Kenyan printers are training, technology, management support, poor planning and employee attitude. These are just some of the many factors that affect the quality of the product produced by a company. This study was important to the management of the company, to other companies in the same field, and to future researchers. A descriptive research approach was used for the study, targeting 44 respondents from the company. The target population was divided into strata using a stratified random sampling method. Primary and secondary sources were used to compile the data. The organization should ensure that its employees are well trained through seminars to equip them with the skills they need to perform their duties. Quality agencies should ensure that rules and regulations are properly implemented and followed to ensure quality production. The organization should source its raw materials from approved suppliers.

According to Impson (2020), TSAM defines quality as a product that meets and exceeds customer expectations. To ensure good quality at TSAM, the company has implemented various quality measures, such as quality cycles, kaizen, cause-and-effect diagrams, problem-solving procedures, Group-by-Off (GBO), Poka-Yoke systems, suggestion system, the 5Tei system, system check sheet, Andon system, My Problem and Countermeasure Sheet, system check sheet, defect tracking sheet, and the use of smart tools TSAM includes Hoshin Kanri (policy management) and Nichijo Kanri (daily management) by management and supervisors. TSAM is based on two pillars: continuous improvement and respect for people. People are the heart of any organization, and they must be respected at all times. Respect can be achieved by giving people the opportunity to voice their opinions on important issues. TSAM gives people a platform to express themselves through the QC and suggestion systems. The goal is to strengthen the vitality of the people and the organization and to create a corporate constitution that can respond flexibly to the business environment.

2.4.2 Quality Cycle Structure and Activities

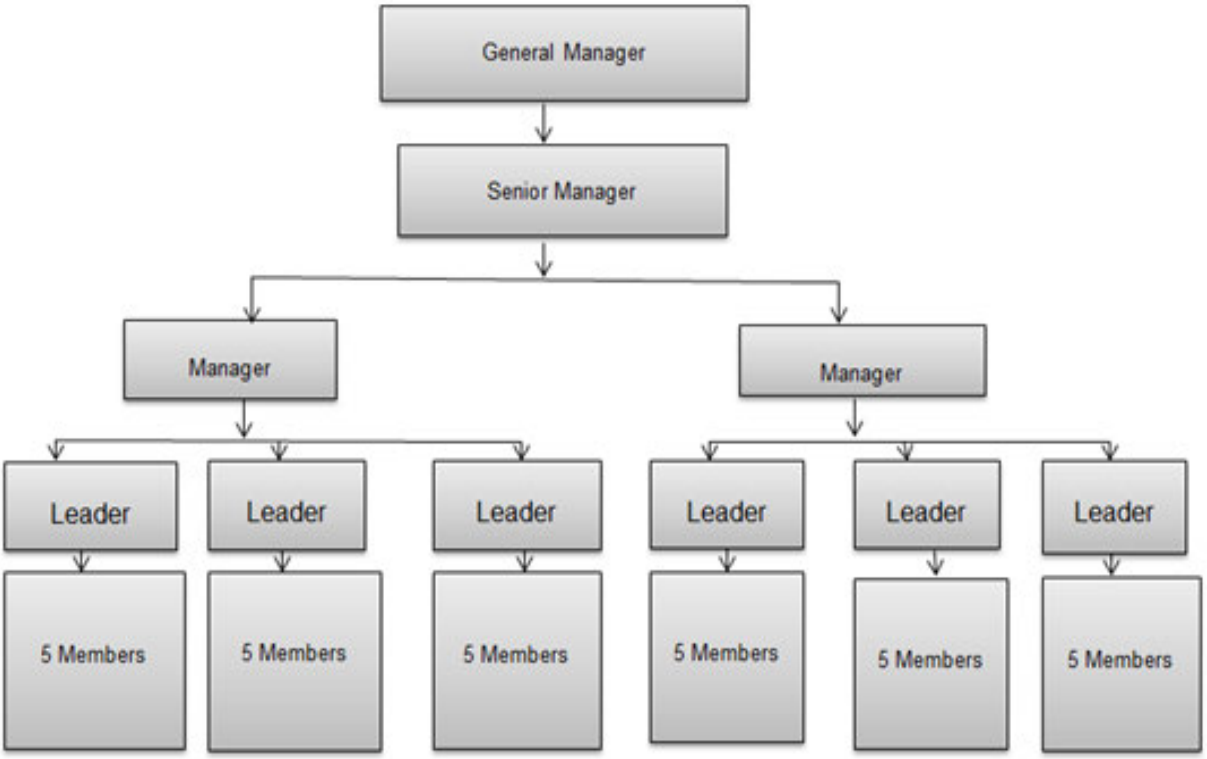

Figure 2.8: Quality Cycle Structure and Activities

The structure above (Figure 2.8) shows the small groups formed by five members working in the organization. The purpose of forming these groups is to continuously manage and improve product quality and service. All members, including the leader, meet and brainstorm ideas on how to improve product quality and the processes on assembly lines. These small groups use a problem-solving procedure that TSAM has developed and implemented successfully. The purpose of forming these groups is to improve individual capability, increase enthusiasm in workplaces, improve communication, and ultimately increase workplace strength and contribute to company development.

2.4.3 Cause-and-effect analysis

The cause-and-effect diagram below (Figure 2.9) illustrates the problem-solving technique that TSAM employs to get to the root cause of the problem. The diagram shows one of the functional A defects that was picked up at group-by-off (GBO).

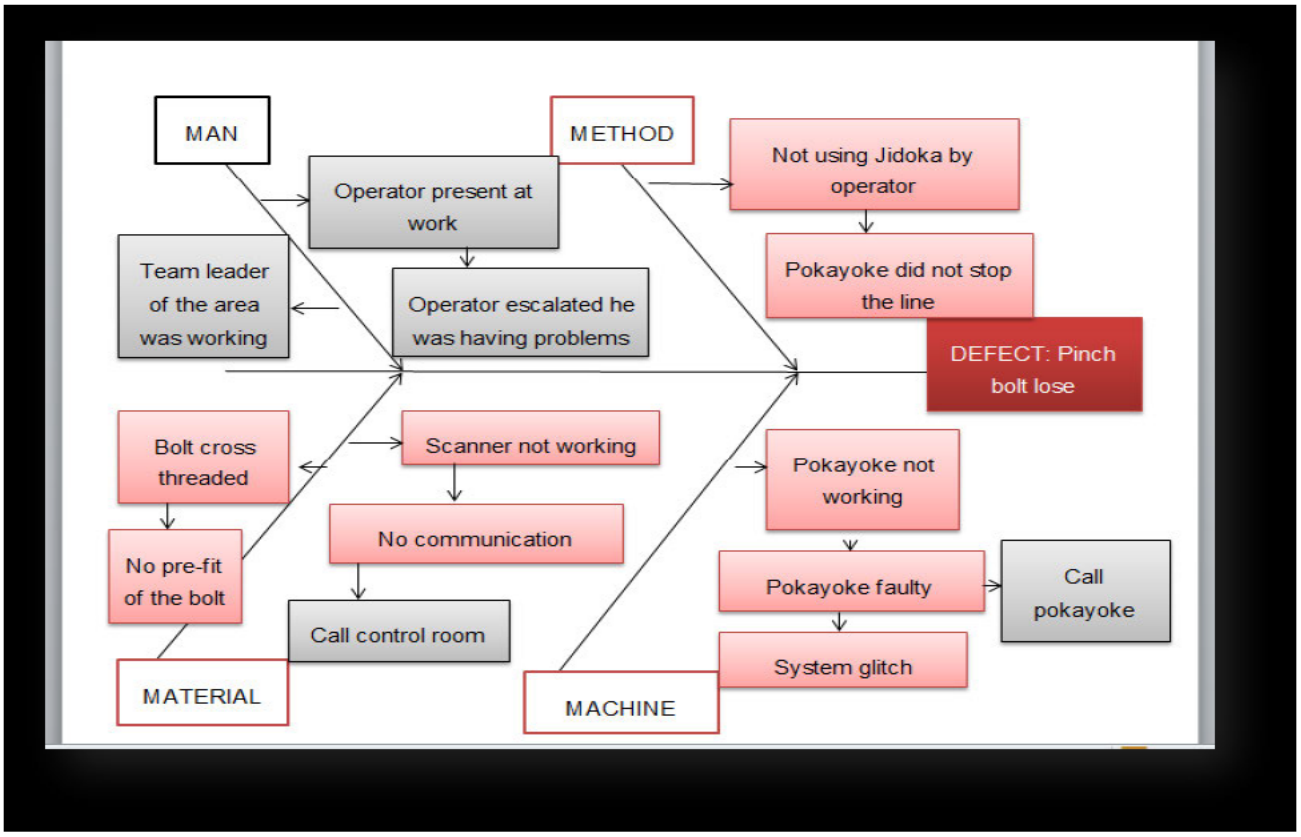

Figure 2.9: Cause-and-effect analysis

In this diagram (Figure 2.9), it is easy to pick up what was the cause of this defect (pinch bolt loss). The first noticeable thing is that under "machine", the poka-yoke tool was faulty. A poka-yoke is a tool that detects if there is a problem and stops the line, but in this instance, it did not detect the problem. It is also noticeable under "material" that the scanner was not working and the bolt was cross-threaded, which caused the bolt to not be fully tightened. The bolt was not pre-fitted, which caused the cross threads. Under "man," it shows that the operator did report that he was experiencing a problem with the

poka-yoke tool. The finding from the analysis shows that the problem occurred under "method", "machine" and "material", which led to "pinch bolt loss". After the root cause has been found, a countermeasure needs to be implemented to ensure this defect does not flow out again.

2.4.4 Group-by-Off (GBO)

The GBO diagram below (Figure 2.10) illustrates the system that TSAM employs to pick up the defects that occurred during the process.

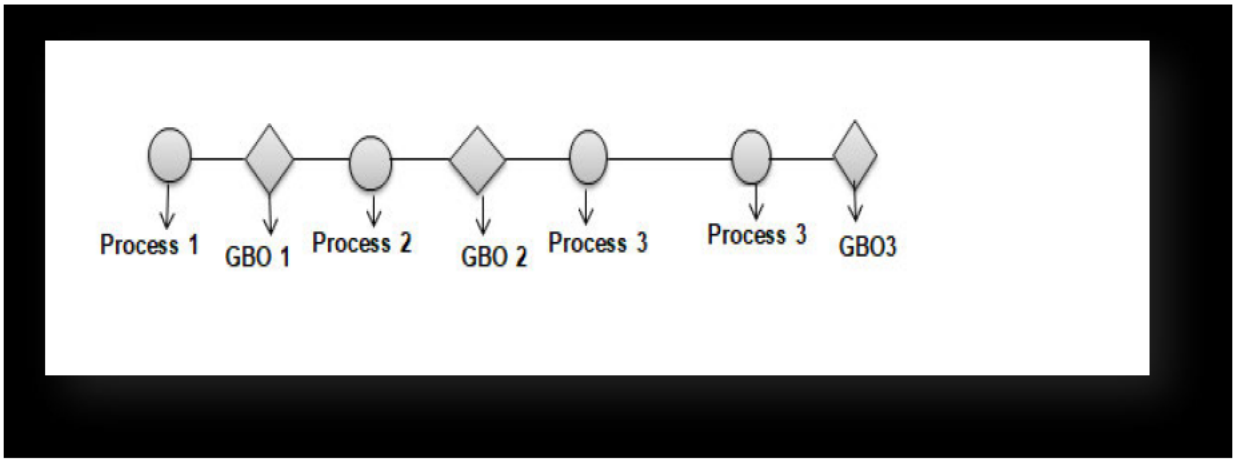

Figure 2.10: Group-by-Off

Each production line has a quality gate, also known as a group-by-off (GBO), where double quality assurance checks are performed. TSAM has established a culture in which the customer is a part of the production line; process number one sells the product to process number two, and so on until the product reaches a consumer who has paid for it, all while adhering to quality standards. The quality management system and standardized work are considered the organization's culture, which is followed by all of TSAM's affiliates.

2.4.5 Problem Solving Procedure

Giving people the freedom to work on current problems for which solutions do not yet exist can be an efficient way to develop the necessary competencies. Developing the necessary competencies is fostered by identifying solutions to problems and finding effective approaches to solving them. Today, experience and reliance on leaders

playing the role of experts, rather than structured problem solving, are the norm for finding a solution to a problem (Christiana *et al*. 2015). Because line workers, rather than engineers, have a significant amount of knowledge that is important to problem solving, they become knowledge workers through this process. However, training and learning processes are still required to improve skills. A fundamental tenet of the problem-solving approach is to involve the employees involved in the process. The complexity of the problems and the process for solving them are critical factors. There are three levels of complexity: simple problems that an operator can handle; semi-complex problems that a team leader can handle with the help of the team and support staff; and complicated problems that require management intervention (Christiana *et al*. 2015). The problem-solving process requires a collaborative approach and should start at the bottom of the hierarchy, from the operator level to the engineer level. However, for simple problems, the operator can be relied upon. According to Taiichi Ohno's research, problem solving depends more on the ability to identify the root cause of the problem than on its origin. The five-why analysis forces people to address the root causes of the problem rather than opting for stopgap solutions (Wojtaszak 2015). The problem-solving process is a sequence of basic steps, actions, and tools that TSAM uses to solve problems related to production and to assist in small continuous improvements. The table below shows the number of steps, the sequence of basic steps, the actions taken as part of each basic step, and the tools used in addressing each step.

Table 2.1: Problem Solving Procedure

The table below (Table 2.1) shows the seven steps of the problem-solving procedure. According to Impson (2020), the problem-solving procedure is one of the tools that TSAM uses to get to the root cause of the problem and eventually solve it.

No.	Basic Steps	Actions	Tools
Step 1	Select theme	• Identify problems • Select theme	Stratification, graph, pareto chart, histogram
Step 2	Grasp the current situation	• Collect facts • Determine the issues	Graph, pareto chart, matrix

	and set a target	to be tackled • Set target (value and terms)	
Step 3	Prepare activity plan	• Determine action items • Set schedule and assign roles	Gantt chart
Step 4	Analyse the causes	• Investigate current status of the phenomenon. • List causes • Analyse causes • Determine countermeasure.	Fishbone diagram, graph, Pareto chart, scatter diagram, check sheet
Step 5	Develop and implement countermeasures	• Suggest ideas • Study countermeasure. • Examine countermeasure • Implement countermeasure.	Systematic diagram.
Step 6	Check results	• Check results for countermeasure • Compare results with target value • Grasp results	Graph, Pareto chart, control chart and Histogram.
Step 7	Standardise and establish control	• Set or revise standard. • Set and establish control. • Train person in charge. • Check the maintenance of the controlled situation.	Control chart

2.5 Strategic sustainability

Sustainability is the ability to meet current needs without compromising the ability to meet the needs of future generations (Resta *et al.* 2014). According to Calvo-Amodio *et al.* (2017), sustainability in manufacturing seeks to produce products that maximize profitability while minimizing negative impacts on the environment, conserving natural resources and energy, and being safe for employees, consumers, and communities. Mahat *et al*. (2015) pointed out that it is crucial to choose an appropriate strategy for sustainable production that takes into account the characteristics of manufacturing companies to improve their long-term profitability. In the context of this study, sustainability refers to the ability to maintain the reliability of production processes in a company through the application of lean manufacturing, which provides the members of the company with the practical tools and procedures needed to maintain the processes.

According to Hartini *et al*. (2019), manufacturers and engineers need practical and operational tools to understand and apply strategic sustainable manufacturing in their operations. Industries that produce goods must make continuous improvement decisions to improve their sustainability performance. A new paradigm in manufacturing is "sustainable manufacturing," where goods are produced in a sustainable manner while maintaining global competitiveness and addressing current problems and difficulties. Sustainable manufacturing means not only producing products that are more sustainable, but also producing those products using more sustainable processes. Assessing sustainability performance in terms of production quality is critical to achieving sustainable production. Traditional strategies that focus only on reducing costs and increasing efficiency must be replaced by those that additionally consider how operations affect the environment and society (Pusavec *et al.* 2010).

Henao, Sarache, and Gomez (2018) note that the world's population will grow to as many as 9 billion by 2050, and nonrenewable resources are diminishing and very expensive to obtain, so companies, governments, and organizations must make sustainability a top priority. Despite the increasing attention that research is giving to the impact of AMP on performance, there are few studies that link AMP and sustainability. The study by Reich-Weiser *et al*. (2009) (cited in Mahat *et al*. 2015) found that the effectiveness of sustainable manufacturing techniques depends on three factors: (1)

selecting the right indicators, (2) evaluating performance, and (3) making adjustments within the system.

In the studies by Zeng *et al*. (2008) (cited in Garza-Reyes *et al*. 2017), it is claimed that the reason for criticizing China as a major contributor to environmental degradation, climate change, and resource scarcity is the fact that 16 of the 20 most polluted cities in the world are in China. Suppliers, government agencies, customers and competitors, and other stakeholders all have different expectations of a company that cannot be met by pursuing a single goal. To meet the diverse needs of all stakeholders, organizations must operate sustainably in three dimensions: economic, environmental, and social (Kamble *et al*. 2020). According to Malesios (2018), sustainability is not only about producing sustainable products, but also about the most sustainable production process while maintaining global competition. Companies must first consider environmental and social impacts before focusing on cost minimization and efficiency in their operations. Today, the many constructs of sustainability are top priorities for the business community and all key participants in the many production chains, driven by the increasingly urgent concerns raised about environmental, social and economic challenges.

Training has proven to be very helpful in improving the quality of goods delivered by companies. It encourages workers' resourcefulness and enables them to learn their jobs better and perform them with more competence. This increases not only the productivity of workers, but also the productivity of the company. Numerous studies show that worker productivity is increased through training. Training as a process is one of the most commonly used strategies to increase individual productivity and communicate company goals to employees (Ekaterini and Constantinos-Vasilios 2019). According to Rohan and Madhumita (2012), investing in employee training in the areas of decision making, teamwork, problem solving, and interpersonal interactions has a positive impact on a company's growth and employee performance. Employee behavior and work skills are influenced by training, resulting in improved performance and positive change (Satterfield and Hughes 2007).

The most successful method of motivating and maintaining quality human resources in an organization is through training. According to Lowry *et al.* (2016), training is a method

of increasing employee engagement and maximizing employee potential. Training is a tool that significantly influences the achievement of an organization's goals. The ultimate goal of any organization is to increase sales and maximize profits, and to achieve this goal requires an effective and efficient workforce. Therefore, employees can only be effective and efficient if they receive the necessary training and development, which leads to higher productivity. (Konings and Vanormelingen 2019)

According to Dieste *et al.* (2019), there is empirical evidence that AMP helps organizations improve their environmental performance. However, the environmental impact of AMP is not yet clearly identifiable. The results of the study indicate that several significant studies find relevant inconsistencies in the results of lean practices on the environment; therefore, further research is needed. According to Mahat *et al*. (2015), most of the literature on sustainable manufacturing focuses on large corporations rather than small businesses. Even studies that have looked at sustainable manufacturing from the perspective of SMEs are scarce and mostly focus on economic and/or environmental factors. He also pointed out that several studies have identified numerous problems that prevent SMEs in developing countries from succeeding, including lack of business experience, technical knowledge, inadequate management skills, lack of planning, and lack of market research.

In conclusion, Hyland-Wood *et al.* (2021) states that people are more inclined to follow advice if they understand its purpose. Therefore, explaining why certain activities are necessary, beneficial, or inconvenient and explaining the rationale for decisions is critical. People also need to be able to act on prompts; being told how to act is only one aspect of the problem. Therefore, to support behavior change and action, communication usually needs to be accompanied by appropriate actions. People must be able, empowered, and motivated to engage in recommended activities; therefore, communicators and policymakers must consider both psychological and practical barriers to desired behaviors. Transparent dissemination of accurate information prevents people from becoming susceptible to new misinformation and conspiracy ideas.

Without communication, people are alone and lost. Effective communication is an essential tool for organizational success. When the desired outcome is the result of an

intentional or unintentional exchange of information that is interpreted by many entities and acted upon in the desired manner, it is called effective communication. Moreover, this effect prevents distortion of the message during transmission. Effective communication should be able to enhance the impact of the message while achieving and sustaining the desired effect. Thus, effective communication achieves the intended purpose. Possible outcomes include bringing about change, stimulating action, promoting understanding, educating, or conveying a particular idea or point of view. If the desired outcome is not achieved, issues such as communication barriers are investigated to determine why the communication was not successful. The flow of information from one place to another is influenced by the method of communication, with some methods being faster and more effective than others (Dlamini 2017).

2.6 Conclusion

Operational disruptions occur when there is a significant shortage of personnel and the attention of remaining employees is diverted to training new employees. A shortage of labor may cause delays in the production of certain products. Manufacturing goods or providing services to customers are two examples. When work is interdependent, the departure of one person may have an impact on the quality of the work of others (Staw and Ross 1985). The impact of losing a key person in an interdependent and specialized organization can be devastating. The importance of the role of the departing employee is the critical factor in business disruption. It is generally assumed that the higher the position of the departing employee, the greater the disruption the departure will cause to the business. However, the loss of a key employee at a lower level in the organization can be extremely disruptive if he or she holds a specialized position and has an extensive understanding of the organization's operations. Staw and Ross (1985) also emphasize the importance of predictability of turnover in reducing the operational disruption it causes (ibid.). According to Hausknecht *et al*. (2009), one reason for the negative impact of turnover is that remaining employees must divide their time between training newcomers and performing their regular duties. The following chapter (Chapter 3) will present and justify the research methodology adopted to answer the research questions that have been developed.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

Chapter 2 of the literature review is now followed by a discussion of the study's methodology. To clarify, the study examined lean manufacturing practices and the extent to which TSAM uses new techniques to improve sustainability. According to previous research, the methodology refers to the overall perspective and approach used in the research process and analyzes the considerations underlying the collection and analysis of the material (Creswell 2009). The considerations underlying research approaches and methods are also considered and explained by methodology. According to various authors, methods explain and define the types of problems worth exploring, what constitutes a problem worth exploring and testable hypotheses, how to frame a problem so that it can be studied using specific designs and procedures, and how to select and develop appropriate means of data collection (Creswell 2009).

The research methodology used in this study to compile data for the specific and general questionnaires is described in this chapter. It describes the methodology used in the study and the instruments used to collect data. The aim and purpose of the study, the participants and location of the study, and the types of data (primary, secondary, and tertiary) are discussed. It also explains the creation of the questionnaires, the scaling, the construction of the instruments (questions), and the methods and instruments used to collect the data. The last part of this chapter describes the recruitment of study participants, validity, reliability, and administration of the questionnaire.

3.2 Research design

The study of Lekhanya (2006) (cited in Dlamini 2017) states that research design is an instrument of evidence to clearly define the research problem. It is a strategy for collecting and analyzing all applicable responses and writing a report. Mtshali *et al*. (2019) are of the same view that research design is a well-organized, structured, and

strategic way of conducting an investigation to obtain answers to a research problem. In addition, research design can also be considered as the strategy that best explores and focuses on the research questions of a study. There are three types of research designs: qualitative research, quantitative research, and mixed methods. According to Flick (2018), qualitative researchers study things in their natural environment to understand or investigate novel events that have not been well researched in their meaning. In addition, qualitative research is an approach that emphasizes words, while quantitative research emphasizes statistics in the collection and analysis of data. This allows the study to be inductive, productive, and interpretive.

We also note that:

- An inductive perspective allows for the creation of theory from research as a qualitative aspect of research.
- A constructionist characteristic suggests that social features are the result of interpersonal interactions rather than external occurrences unrelated to the people who develop them; an
- By examining how its participants interpret it, an interpretative feature emphasizes the importance of understanding the social world.

Things in the natural environment are studied, and phenomena are interpreted using the qualitative technique to determine the meaning of the environment. Detailed descriptions of the environment, people, interactions, observable behaviors, events, attitudes, thoughts, and beliefs, as well as direct quotes from people who have experienced or are experiencing the phenomenon, constitute qualitative data. Depending on the initial situation, qualitative research has the advantage of providing a comprehensive and detailed understanding of human experiences, feelings, attitudes, and behaviors. In addition, it allows for a thorough examination of complicated family, personal, and cultural experiences. Consequently, qualitative methods are responsive to social circumstances, regional contexts, and stakeholder demands (Robinson 2014).

3.3 Approaches to Research Methodology

According to Makhomu (2012), the methods and techniques used for research, such as questionnaires and analytical tools, are called research methods. In addition, research methodology can be defined as a method for systematically solving the research problem, and it encompasses a broader scope, including the logic behind the methods we use in our research studies and the explanation of why we use one method or technique over another so that the research can be verified by the researcher or others.

According to Creswell (2014), research methods can be divided into three categories: Mixed methods research, qualitative research, and quantitative research. While mixed methods research combines the two methods in one study, qualitative research is defined by using words rather than numbers (quantitative). In this study, quantitative and qualitative research methods were combined in the development of the research methods. In addition, the research will be descriptive.

According to Bryman and Bell (2011), quantitative data tends to:

- Typically emphasizes quantification in data gathering and processing.
- Adopt a deductive approach to the interaction between theory and research.
- Emphasizing the validation of hypotheses.
- Embody the idea that social reality is an external, objective reality.
- Incorporate the techniques and standards of the model of the natural sciences, particularly positivism.

By contrast, qualitative research approaches:

- When gathering and analyzing data, the emphasis is typically on words rather than quantitative data.
- Places a strong focus on the inductive approach to the link between theory and research, in which the testing of theories is prioritized.
- Reject positivism in general and the behaviors and standards it promotes in favor of placing more focus on how people perceive their social environments.

- Consider social reality as emergent and continually changing, depending on how each person sees it.

According to Creswell (2014), mixed methods research (qualitative and quantitative research) believes that offering two different answers leads to greater knowledge about a research problem than either strategy alone. According to Johnson (2014), it is typical to use a hybrid technique (qualitative and quantitative) to thoroughly capture the social and behavioral aspects of the study. A study can appear strong and accurate by using any of the six main methods of data collection, including tests, questionnaires, interviews, focus groups, observation, and manufactured or existing secondary data, the researcher added. According to Daweti (2015), some studies may use the same mixed methodology, while different methods may not yield the same results. Ncube (2016) believes that many researchers' summaries of findings or conclusions are primarily based on the quantitative method.

3.4 Survey method

According to Presse *et al*. (2004), a questionnaire is an instrument that is essential for all social research. However, questionnaires used to collect data have the potential to greatly enhance our understanding of a topic. However, a pretest is crucial because it allows the researcher to determine if the study is readily feasible and also helps the researcher avoid frequent changes to the wording of the questionnaire. The questionnaires used in this study were designed in such a way that the researcher could collect data from the participants in a fair manner.

3.5 Participants of the study and the location

The research took place at Toyota South Africa Motors, situated in South Africa's KZN province, in the city of Durban.

The participants of the study were the employees of the organization where the study was conducted. This included staff members, managers, senior managers, general managers, vice presidents, and senior vice presidents.

3.6 Target population

A target population is a group of individuals involved in a study that must be identified before obtaining a sample (Berg and Lune 2012). Christensen, Elder, and Gloves (2015) believe that a target population is a large group of people to whom our research findings should apply; however, the researcher still focused on the members of the study population from whom the data were obtained and generalized the findings. Thus, the target population in this study consisted of 50 top management and other selected TSAM employees. The study focused exclusively on TSAM, and the questionnaires were distributed to top management and other employees. The questionnaires were to be completed by the participants and emailed to the researcher. To reduce the potential for COVID -19, the researcher decided to send the questionnaire via email. The questionnaire was given to the participants with seven days to respond so that they could understand and complete it appropriately. It was anticipated that the questionnaire would take no more than 30 minutes to complete. Due to their ongoing work on flood damage in TSAM, participants asked for more time to complete the questionnaire. The researcher gave the participants his contact information so he could explain the questionnaire if needed.

3.7 Sampling methods

Flick (2018) notes that there are two types of sampling methods commonly used. The first is known as random sampling or probability sampling and is often considered the most reliable method to ensure validity of all inferences about a subject, project effectiveness, and generalizability. In a probability sample, every member of the target population has a chance of being part of the sample. A random sample is composed of individuals who were selected because they were available. Some members of the target population have the opportunity to be selected for a random sample, but others do not because they are not present when the sample is assembled. Thus, the information collected is for convenience. It is possible that the sample does not match the target population at all.

The researcher used a probability sampling strategy. Non-probability sampling and probability sampling are the two most commonly used sampling methods or strategies.

Kothari (2004) defines probability sampling as a methodical, technical, or mechanical strategy, similar to a lottery, used to select specific items from a set of items without doing so intentionally or purposefully. This is the justification for choosing this sampling strategy. Kothari (2004) also states that "random sampling ensures the law of statistical regularity, which states that the sample has the same composition and characteristics as the population if the sample is randomly selected on average." Therefore, random sampling as a sampling type among probability sampling was used as a sampling strategy for this research. The sample consisted of four divisions of TSAM for the mixed method. Of the 44 questionnaires distributed, 35 were returned by the respondents. The sample size was determined based on the following calculation (Kang 2021):

$$N = \frac{N}{1} + Ne^2$$

$$= 50/1 + 50(0, 05)$$

$$= 44$$

Where N represents the population (N = 50) and a margin of error (0, 05). The formula for calculating the sample size involves determining the sample size. For this calculation, the confidence level was 95 percent, the confidence interval was 5, and the sample size needed was 44.

3.8 Data collection methods

The data collection methods were suggested by the researcher who identified TSAM, one of the largest manufacturing companies in Durban, KZN. According to Baarimeh (2017), the data collection process involves the administration of questionnaires and note taking. The researcher decided to use questionnaires with open-ended questions rather than ethnographic interviews because participants did not feel comfortable interacting with the researcher due to COVID -19 and the actions taken by the company and the government; safety was the top priority in this study. As the name implies, a questionnaire is a type of document that contains a series of questions about a specific topic, issue, question, or opinion to be studied. The self-administered questionnaire is designed to be understood and completed by respondents without assistance or with minimal guidance. The researcher used both open-ended and closed-ended questions.

The closed-ended questions were divided into structured questions with response options. The open-ended questions allowed respondents to express their opinions on the topic.

The questionnaires were distributed at TSAM, the organization that the researcher identified as the gatekeeper. The researcher emailed the questionnaires to the organization's staff. The purpose of the research was explained, and the questionnaire was emailed along with the informed consent form. The questionnaire took about 20-25 minutes to complete, but respondents had seven days to answer the questionnaire.

Respondents were asked to check the correct answer, and as part of the qualitative method approach, they were given enough blank lines to comment on their answers to the survey questions or provide additional information. Respondents were provided a box in the questionnaire to check off the quantitative method. The questionnaires formulated the quantitative and qualitative research techniques; the questionnaires consisted of three (3) sections: Section one (1) required demographic information which required closed-ended questions; section two (2) business activities used quantitative methods (closed-ended questions). Section three was qualitative (open-ended questions).

3.9 Data types

The primary and secondary sources of this study were collected through primary and secondary research. According to Kery *et al.* (2017), there are three levels of information that you will use:

3.9.1 Primary data

Kery *et al*. (2017) posits that these are all originals without any interpretation. Raw data is your research collected from letters, memos, interviews, speeches, questionnaires, legal acts, court decisions, raw government data, census data, or anything that has not been filtered in any way. It must be raw data.

3.9.2 Secondary data

This is the primary data that has been interpreted before it is given to you, often in summary form or tables. This information is in textbooks, company or machine handbooks, news reports, library sources, and even financial reports. This is raw data that has been interpreted.

3.9.3 Quantitative data

When collecting primary data from individuals using structured questionnaires or observational guides, quantitative data is obtained. The information includes anything from ideas and opinions to attitudes and lifestyles to general background data about people, including gender, age, education, and money. Quantitative data collection is frequently referred to as survey research by business researchers (Bryman and Bell 2011).

3.9.4 Qualitative data

The importance of qualitative research is that it provides the researcher with the time, place, and tools to describe, analyse, interpret, and clarify experiences as they are lived and constituted in consciousness. It helps researchers understand the views, intricacies, and under-researched areas of populations (Flick 2018).

A questionnaire was used to collect the data needed for this study, which was quantitative in nature as opposed to qualitative in nature for the literature review discussed in the previous chapter.

3.10 Methods and instrument of data collection

There are numerous research methods that can be used to study business issues. According to Bryman and Bell (2011), researchers typically choose a (1) exploratory, (2) descriptive, or (3) causal design.

When little theory is available to form a hypothesis or when the research questions are unclear, an exploratory study can be helpful. It is designed to discover new

relationships, patterns, themes, and other concepts. Consequently, it is not designed to investigate specific research hypotheses (Bryman and Bell, 2011).

The goal of descriptive research is to gather information that describes the characteristics of the object of study. Consider the following example: Who is most likely to be satisfied? When should we maximize output? How much money is needed for investment? Descriptive studies are a good example of research that tracks seasonal changes (Bryman and Bell 2011).

Causality research examines whether one event is the cause of another. Does A lead to B? A causal relationship exists when one event changes and leads to a proportional change in another event. A change in A (the cause) causes a change in B (the effect), according to the concept of causality (Bryman and Bell 2011).

3.10 Developing the Questionnaire

According to Berg and Lune (2012), questionnaires are a commonly used method. In this measure, participants answer a question about a specific topic, variable, trait, attitude, etc. The response format of a questionnaire can be divided into two general types: open and closed response formats. Open-ended responses allow respondents to give their own answers, and since they are not numerical, they are a type of qualitative measurement. Closed response formats are typically quantitative measures that allow respondents to choose from a variety of options, ranging from dichotomous options (two choices such as yes/no or true/false) to multiple choice to a Likert rating scale. The measurement tool used in this study was a questionnaire and observation that included both closed demographic questions and open-ended questions. Respondents were also provided with enough blank lines to comment on their answers to the questions asked in the questionnaire or to provide additional information. The study's research objectives guided the creation of the survey questionnaire (Appendix C). The following was the format of the survey questionnaire:

3.11.1 Section 1: Demographics details

1. Gender

2. Age

3. Race group

4. Level of education

5. Employment status

3.11.2 Section 2: Business activity

7. Number of years in the company

8. In which of the following field(s) you qualified for or trained?

9. What are the types of training TSAM is providing to its employees? in the following tools in my organisation:

10. Which way of communication does your organisation use to communicate with employees?

11. In my view the most important aspect in my organisation is:

12. What is the most important aspect to successfully implement lean principles?

13. Which factors that can be identified that affect quality in TSAM?

3.11.3 Section 3: business activities (Likert Scale)- Quantitative method (Closed-ended questions)

3.11.4 Section 4: Open-ended (Qualitative)

3.12 Methods to avoid bias

Bias, as described by Pannucci and Wilkins (2010), is a tendency that occurs when a researcher attempts to favour one conclusion or answer over another, especially in a way that is considered unreasonable or unfair. This type of behaviour is typically seen when a researcher interviews subjects for data. There was no bias in this study.

3.12.1 Question bias

Through testing, the final version of the questionnaire was created. The researcher focused more on structuring the questions in a sequential pattern and checking the language of the questions for ambiguity.

3.12.2 Subjectivity

According to Ratner (2002), it is a subjective approach when a person's judgment is influenced more by his or her own thoughts and feelings than by external factors. In other words, the opinions of the target groups rather than those of the researcher must be used to interpret the results. In the study, the researcher tried to be objective. As a result, a subjective perspective was never offered, and this study never changed the objective approach.

3.13 Data analysis

The Statistical Package for Social Scientists (SPSS) version 27.0 was used to collect data. Data collection was double-checked for possible inaccuracies. Tables and charts were used in the text to illustrate the results. According to Mtshali *et al*. (2019), data analysis is the process of evaluating and deriving information from the data collected, and the methods of data analysis are determined based on the objectives of the study. Data were collected through a questionnaire and observations. "Quantitative analysis works with data in the form of numbers and examines their properties using mathematical procedures" "The types of measurements used in data collection, such as nominal, ordinal, interval, and ratio numbers, as well as the number of instances involved, are critical factors in determining the type of analysis appropriate" (Walliman 2011). According to Creswell (2009), the qualitative data analysis procedure was divided into five parts by the researcher.

- To begin, data from the survey questionnaire and observations were transcribed.
- Second, a thorough check of the transcripts was performed as part of the data cleaning and preparation for coding. This included removing all mistakes and missing words in this preliminary reading; the pertinent paragraphs were underlined as recommended.

- Third, the researcher identified and organized the data into themes.
- Fourth, the researcher devised a coding system. This was a template for where the themes and codes, ranging from broad codes to sub-codes, were to be placed.
- Finally, the data was coded using the coding technique Saldana's (2009) coding handbook (cited in Creswell 2009) study was followed during the coding procedure. Inferential statistics showing frequency and cumulative frequency will be used to interpret the comparisons between responses to each question.

This chapter also compared gender, divisions, participant experience, measurement instruments, job experience, and methodologies for evaluating LMPs and, finally, improving quality metrics. This chapter also discusses the strategic components in place to keep the company afloat and competitive in the market. The current scenario was assessed further by looking at the plant's performance and the lean systems in place.

According to Creswell (2009), the goal of qualitative research is to delve deeply into words and observations. As a result, this research was both exploratory and inductive. The qualitative methodologies employed allowed the researcher to comprehend human beings as they performed actions and interacted with one another in their environments. As a result, the researcher was able to learn about the leadership's perspectives on productivity enhancement techniques within the company.

3.14 Validity and reliability

According to Roberts and Priest (2006), reliability means consistency and validity means accuracy. Both reliability and validity are critical factors in research. Reliability refers to the extent to which data collection techniques or analysis procedures will produce consistent and accurate results (Mark and Saunders 2015). "Validity" refers to the test of whether or not the data collected are consistent with the issue being studied (McNeill and Chapman 2005). In the study by Heale and Twycross (2015) (cited in Dlamini 2017), reliability refers to the consistency of a measure. However, the researcher assumes that applicants interacting with an instrument for the first time will give the same responses when repeated.

Study reliability refers to the expectation that one would find similar results if the study were repeated. The purpose of the study was to identify general patterns for certain behaviours. If similar studies come up with different results, it indicates that a pattern we can trust has not been found. Replication, or repeating a study, is one way to test the reliability of a study's results, both literally and conceptually.

The reliability of a study refers to how consistent the results of similar studies are. Replication involves conducting the same study with new participants (literal replication) or a study examining the same pattern or relationships but using different methods (conceptual replication).

According to Graue (2015), the question of whether the results of a study are replicable is answered by reliability. The integrity of the conclusion drawn from a research paper is called validity.

3.15 Anonymity and confidentiality

The study requested consent from the targeted sample, and the names of those who participated were kept anonymous. Any sensitive information that was exchanged was kept discrete. The questionnaires excluded the personal or contact details of any of the participants. A consent letter was given to the participants, which protects both the participants and the researcher.

3.16 Research Ethics: Key Considerations

In any study, certain ethical standards must be met in order for the researcher to fulfill his or her moral and professional obligations, even if the participants are not aware of them (Ekhsan 2019). The following guidelines were followed in conducting this study:

- Ensure that participants gave their informed consent

Respondents were adequately informed of the type of information they were being asked to provide, the reasons for the request, the intended use of the information, how they may be expected to participate in the study, and how it may directly or indirectly affect them (Creswell 2014). Participants in this study were required to sign an informed

consent form, and participation was completely voluntary. This means that participants had the freedom to stop the interview at any point.

- Ensure that participants are not harmed

According to Creswell (2014), any social study that involves discomfort, tension, provocation, security attacks, or demeaning or dehumanizing methods is considered harmful. The researcher provided safety and security throughout the study. No harm resulted from the subject or the techniques used. To further ensure the protection of the participants, the researcher informed the participants of potential hazards and took all necessary precautions to avoid them. This is done to avoid any possible inconvenience.

- Ensuring confidentiality and anonymity

According to Khalid and Nawab (2018), anonymity and confidentiality are essential components of research as they affect participants' well-being, experiences, and feelings. Maintaining participant anonymity is a critical component, whether in daily interactions and conversations with others, data storage, or reporting. It also clarifies the difference between anonymity and confidentiality. Unlike anonymity, which involves obscuring names or other identifying information to hide the identity of a person or organization, confidentiality is about protecting the information provided by participants from third parties. To prevent their names from being recorded or revealed, participants in this study were masked. In addition, participants were assured that only the parties involved in the study would have access to their confidential and anonymous information.

According to Leedy and Ormod (2013), different organizations have different ethical standards and codes of ethics that are followed by the companies. Consequently, human-centered research has social implications, is inherently sensitive, and must be conducted in accordance with all ethical considerations and standards. The study followed the ethical guidelines established by Leedy and Ormrod (2013), which state that "obtaining informed consent, not causing harm, maintaining confidentiality, and ensuring that permission has been obtained must be observed as standard ethical principles." All conventional ethical standards were followed during the data collection

process Toyota SA top management was given a presentation explaining the purpose, benefits, and risks of the study. All participants volunteered to participate in the study and were required to sign an informed consent form. Since lean decisions are made at the top level of the company, the population is composed of Toyota SA top management. The study was conducted in accordance with Toyota's seven ethical principles.

3.16.1 Seven Ethical Principles at Toyota

- Honor the language and spirit of the law of every nation and undertake open and fair business activities to be a good corporate citizen of the world.
- Respect the culture and customs of every nation and contribute to economic and social development through corporate activities in the respective communities.
- Dedicate our business to providing clean and safe product and to enhancing the quality of life everywhere through all of our activities.
- Create and develop advanced technologies and provide outstanding products and services that fulfill the needs of customers worldwide.
- Foster a corporate culture that enhances both individual and creativity and the value of team work, while honoring mutual trust and respect between labor and management.
- Pursue growth through harmony with the global community via innovative management.
- Work with business partners in research and manufacture to achieve stable , long-term growth and mutual benefits, while keeping ourselves open to new partnerships

The Durban University of Technology (DUT) and the Human Sciences Research Council (HSRC) established anonymity, confidentiality, and other standards, which were followed. The researcher also adhered to all of Toyota SA's reasonable requirements. For confidentiality reasons, no personal information was requested in the questionnaire, and respondents had the ability to withdraw from the study at any moment without having to explain why.

The DUT procedure was followed in terms of data storage. The survey is kept in the Department of Operations Management at DUT in a wall-mounted safe that requires a pin code that only the researcher knows. The informed consent and audiotape recordings will be kept separate to maintain confidentiality. The list of codes as well as the data collected will be password-protected. Both the researcher and the supervisor will have access to the data so that they can analyze and transcribe it. The collected data will be stored electronically and password-protected for a period of 5 years. The data will be erased after this period of time has passed.

3.17 Limitation of the study

Several limitations were established while conducting the empirical research and were found to apply to this study. The sample size for this study was 35 respondents. This sample size was too small and limited. This study used a structured questionnaire in which participants were expected to tick off the appropriate answer. In the qualitative method approach, the participants were also given limited blank lines to elaborate on their answers to the questions asked in the questionnaire or to give supplementary information. This study focused on the assessment of lean manufacturing and strategic sustainability: a case study of the manufacturing sector in Durban. Therefore, findings were limited to the assessment of LMPs and quality improvement.

3.18 Delimitations of the study

Delimitation defines the boundaries around the study (Simon 2011). This study was limited to only one (1) big manufacturing company in the city of Durban, KZN and only top management and other stuff were target population in this study.

3.19 Conclusion

The goal of this chapter was to provide a clear understanding of the research methodology. The research design was defined, the research objective was clearly presented, the approach to research methodology was also explained, the survey method to be used was clarified, and the target population and sample procedure for the study were described. The data collection methods and measuring instruments used were determined, and the development of questionnaires was also illustrated. The data

analysis clearly explained the research tool (Statistical Package for Social Scientists—SPSS) that was used for only quantitative data. This chapter also defines the terms validity and reliability. From the data collected in the following chapter, data analysis will be performed. The next chapter covers the presentation of results from the surveys and observations, the interpretation and analysis of the data, and the connection to prior studies.

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION

4.1 Introduction

This chapter covers the results obtained from the surveys and interviews, as well as the interpretation and analysis of the data and the connection to prior studies.

4.2 Response rate

Forty-four (44) questionnaires were sent out to various respondents in the organization. Of the questionnaires that were sent out, only 35 of them were returned, representing a response rate of 80 percent. Of the returned questionnaires, none of them were spoiled. The respondents were suitable since they understood the questionnaire and expressed an interest in the research. This high net response rate ensured that the research findings were credible and reliable. The high response rate can be attributed to the researcher's piloting efforts. The response rate allowed the researcher to make population-wide generalizations. Communication and follow-up prior to the administration of the questionnaires contributed to a greater response rate.

Table 4.1: Response rate

Status	Number of Questionnaires	Percentage
Total sent	44	100
Total returned	35	80 percent
Fully completed	35	100 percent
Spoiled	0	0 percent

4.3 Demography

4.3.1 Age

Table 4.2: Number of people per age group

		Frequency	Percept	Valid Percept	Cumulative Percept
Valid	20 - 30 years	14	40.0	40.0	40.0
	30 - 39	16	50.7	50.7	85.7
	40 - 49	5	14.3	14.3	100.0
	Total	35	100.0	100.0	

According to the information displayed in (Table 4.2) above, age group 30-39 years had the highest number of respondents, constituting about 50.7 percent, followed by age group 20-30 years, which recorded 40 percent. The age group of 40–49 years recorded the least number of respondents in the study, with 14.3 percent.

4.3.2 Race

When respondents were asked about their race, the results indicated in (Table 4.3) show that about 88.6 percent indicated that they were African, and the remaining 11.4 percent were Indians. These results show the population representation in the organization represents the typical make-up of the South African population.

Table 4.3: Race Group

		Frequency	Percept	Valid Percept	Cumulative Percept
Valid	African	31	88.6	88.6	88.6
	Indian	4	11.4	11.4	100.0
	Total	35	100.0	100.0	

4.3.3 Level of education

Table 4.4: Level of Education

		Frequency	Percept	Valid Percept	Cumulative Percept
Valid	Matric	8	22.9	22.9	22.9
	Diploma	13	37.1	37.1	60.0
	Degree	6	17.1	17.1	77.1
	Honour's Degree	3	8.6	8.6	85.7
	Technical collage certificates	5	14.3	14.3	100.0
	Total	35	100.0	100.0	

The results displayed in (Table 4.4) above indicate that the highest number of respondents in the organization were in possession of a diploma 37.1 percent, followed by those with a matric certificate 22.9 percent. Those with degrees constituted about 17.1 percent, while those with an honor's degree constituted about 8.6 percent. The remaining population is in possession of technical college certificates. The level of education of employees in an organization has an impact on how they embrace and understand lean practices. Furthermore, evidence indicates that educated employees, as a group, perform more effectively at tasks, and that certainly augurs well for the fulfillment of the managers' expectations of highly educated workers (Brenner 2018).

4.3.4 Employment Status

Table 4.5: Employment Status/Position

	Frequency	Percept	Valid Percept	Cumulative Percept

Valid	GM	1	2.9	2.9	2.9
	SM	1	2.9	2.9	5.7
	Staff Member	10	28.6	28.6	34.3
	Section Manager	23	65.7	65.7	100.0
	Total	35	100.0	100.0	

According to the results indicated in (Table 4.5) above, the highest number of respondents that participated in this research was section managers (65.1 percent), followed by staff members with about 28.6 percent. Both respondents, the general manager and senior manager, constituted about 2.9 percent each.

4.5 Business activities

4.5.1 Years in the organisation

The figure below (Figure 4.1) presents the number of years of experience of the participants to understand their experience in the organization.

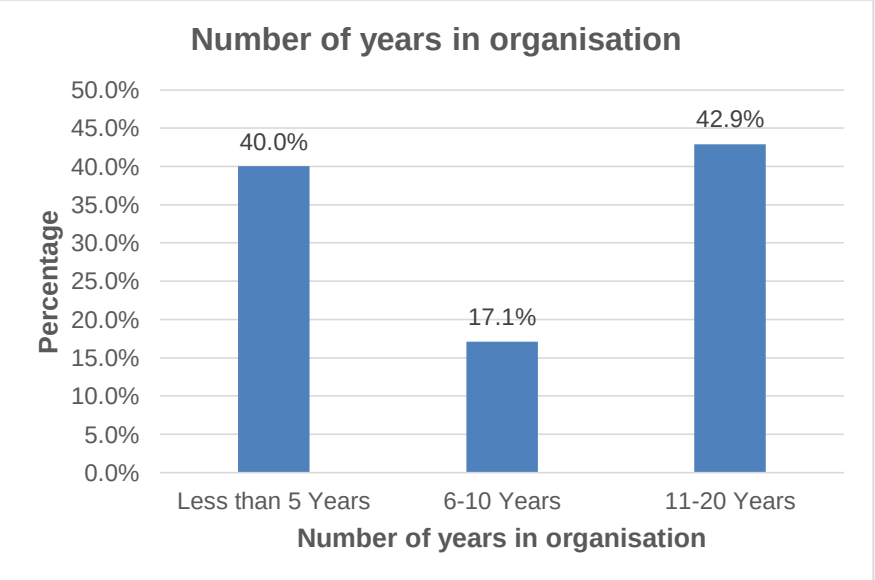

Figure 4.1: Number of years in the organisation

When asked how long they had been with the organization, 42.9 percent of participants said they had been there for 11–20 years, while 40 percent said they had been there for less than 5 years (Figure 4.1). Those who have spent 6–10 years constituted about 17.1 percent. These results explain why a study by Bevilacqua *et al.* (2017) stated that lean principles sometimes fail because leaders often lack a map of the organization. This result is further supported by Staw and Ross (1985), who stated that a shortage of workers might create delays in the production of certain products. Producing goods or providing a service to clients is two examples. If the work is interdependent, one person's departure may have an impact on the quality of others' work.

4.5.2 Field of qualification

The figure below (Figure 4.2) presents the field of qualification of the participants, who are also playing a huge role in implementing lean decisions.

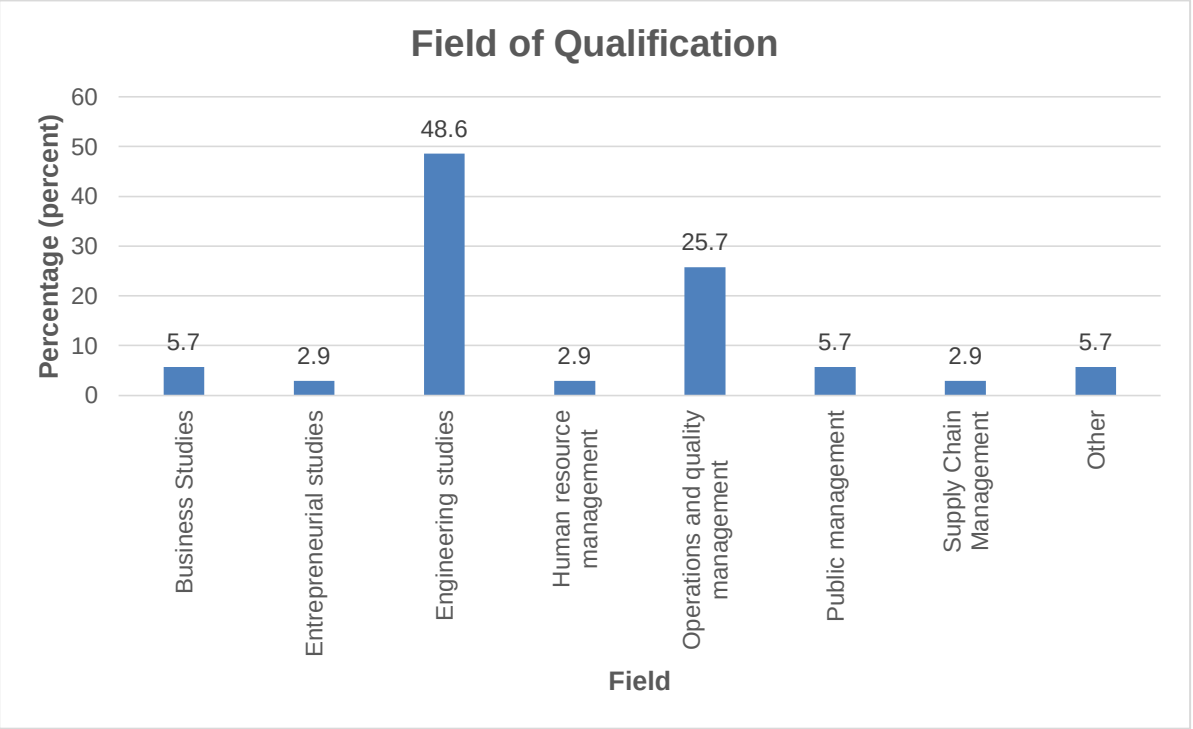

Figure 4.2: Field of qualification

The results gathered in this study indicate that the highest number of employees were from the engineering studies field 48.6 percent, followed by operations and quality

management 25.7 percent (Figure 4.2). Those who studied business studies together with public management and others had 5.7 percent each. The last two groups were those who had studied entrepreneurial studies and HRM, and they both constituted about 2.9 percent of the employees in the organization. The results gathered above are further supported by information from the literature review, which indicates that staff work experience has a significant impact on how customers perceive the quality of goods and services (Amber Hotel 2016). Consumer satisfaction is determined by receiving the goods and services that the customer expects. When employees of an organization promise a good or a service that operations cannot supply, the customer's expectations are not met, the consumer is disappointed, and the quality of the goods and services is not seen.

4.5.3 Training acquired

The figure below (Figure 4.3) shows the training acquired to understand the effectiveness of this training.

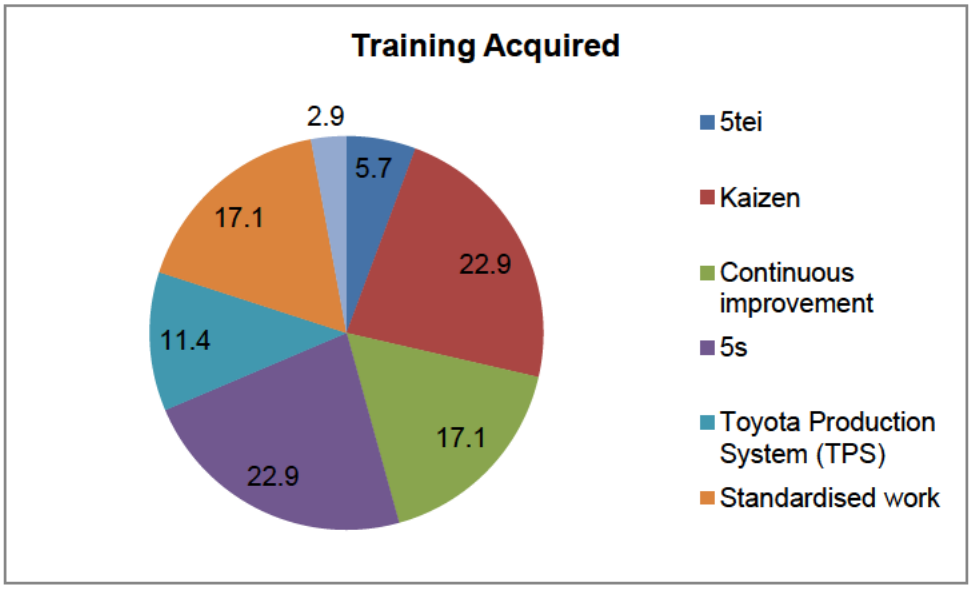

Figure 4.3: Training acquire

When the respondents were asked about the type of training that they had acquired, the results in (Figure 4.3) above indicate that both 5S and Kaizen had the highest number of people, recording 22.9 percent each. A study by Ekaterini and Constantinos-Vasilios

(2019) further emphasizes that training has proven to be quite beneficial in improving the quality of products produced by businesses. It not only improves employees' resourcefulness, but it also allows them to learn their tasks and execute them more competently. As a result, not only the productivity of personnel but also the productivity of companies will rise. Various studies show that training has a positive impact on staff productivity. Training as a process is one of the most frequently used strategies for increasing individual productivity and communicating organizational goals to employees.

Training is the most effective means of motivating and sustaining high-quality human resources within a company. Lowry *et al*. (2016) define training as a means of developing employee commitment and optimizing employee potential. Konings and Vanormelingen (2019) define training as a tool that has a substantial impact on achieving an organization's goals and objectives. However, the ultimate goal of every business is to maximize profit and create high revenue, and having a productive and efficient workforce is essential to doing this. As a result, employees are only efficient and effective if they are given the necessary training and development, which leads to higher output.

4.5.4 Ways of communication

The figure below (Figure 4.4) shows the ways of communication in TSAM to understand if the ways of communication the organization is utilizing are effective for the employees.

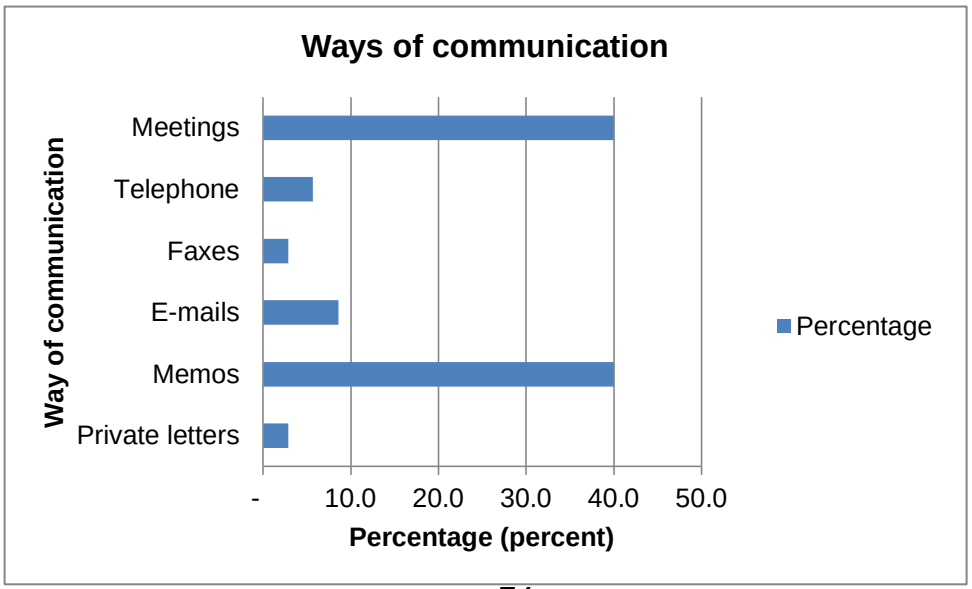

Figure 4.4: Ways of communication

During the study, respondents were asked about the type of communication the organization uses to communicate with its employees. 40 percent indicated that the organization uses meetings as well as memos (Figure 4.4). Those who said e-mails constituted about 8.6 percent, while for the use of telephones, it was 5.7 percent. Furthermore, about 2.9 percent indicated that the organization uses private letters and faxes as well. This result is further supported by those who indicated that the form of communication has an effect on how information is transferred from one point to another, with some forms of communication being faster and more efficient than others.

Effective communication should have the ability to produce and maintain the desired effect as well as the ability to increase the influence of the message. As a result, effective communication achieves the aim for which it was designed. All of these purposes are possible: inciting change, inspiring action, establishing understanding, informing, or communicating a certain viewpoint or point of view. When the desired result is not obtained, concerns such as communication barriers are looked at to see why the communication was ineffective. Information is conveyed from one place to another depending on the type of communication used, with certain types of communication being faster and more efficient than others (Dlamini 2017).

4.5.5 Organizational aspect

The chart below (Figure 4.5) shows the organizational aspects which will clearly show which aspect of the organisation is the main focus in TSAM.

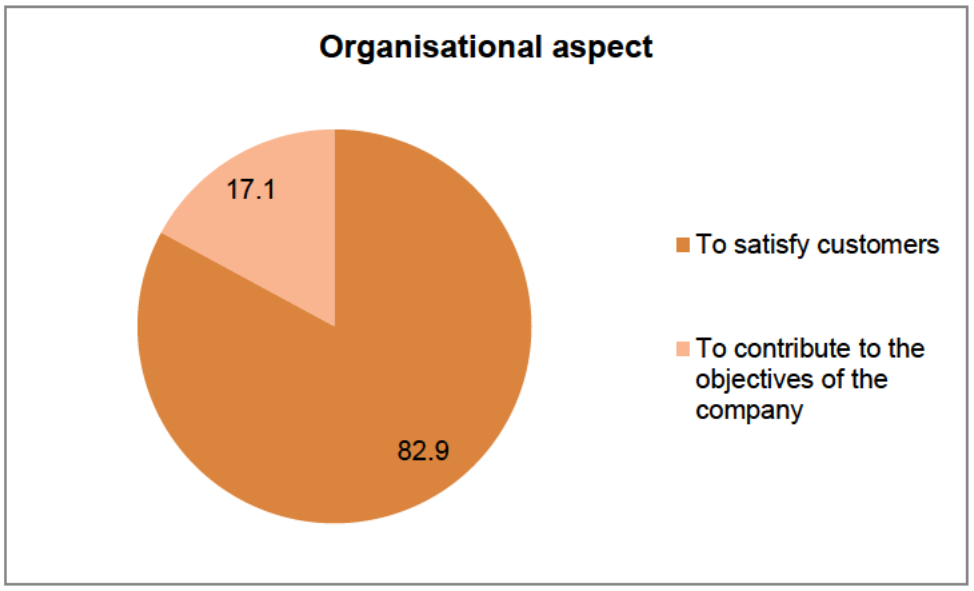

Figure 4.5: Organisational aspect

The results displayed in (Figure 4.5) above indicate that when employees were asked about the most important aspect of their organization, about 82.9 percent said that it was to satisfy customers, while the remaining 17.1 percent said that it was to contribute to the objectives of the company.

4.5.6 Lean implementation

The researcher further asked the respondents about the most important aspect of successfully implementing lean principles. The results gathered indicate that about 50.8 percent of the employees said that training was the most important aspect, while about 37.1 percent indicated that communication was the most important aspect in the implementation of lean. The remaining 17.1 percent said that management commitment was the most important characteristic in the implementation of lean. The result is further supported by a study by Sahoo (2019), who postulated that not all lean implementation initiatives are successful; some fail due to insufficient plans to execute lean strategies. Among the other things that cause lean to fail are the lack of management support, the lack of training, and the resistance to change by employees.

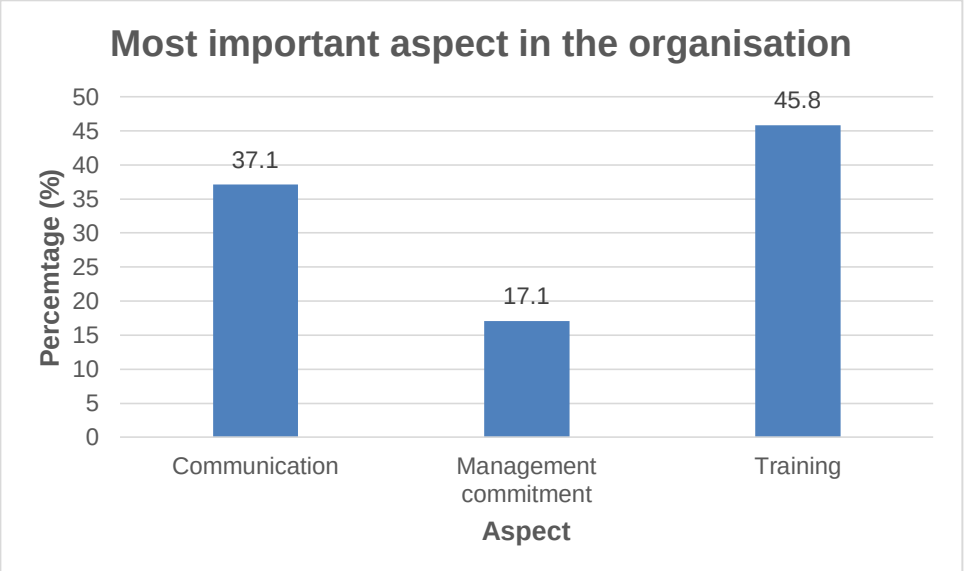

Figure 4.6: Most important aspect in the organisation

The results displayed in Figure 4.6 above reveal that 50.8 percent of employees in TSAM view training as the most important aspect of the organization, followed by 37.1 percent of employees who believe communication is the most important aspect. Only 17.1 percent viewed management commitment as the most important aspect of the organization.

4.5.7 Factors affecting quality

The figure below (Figure 4.7) shows the factors that affect quality in TSAM. This figure also indicates where the company must focus on improving in order to achieve high quality.

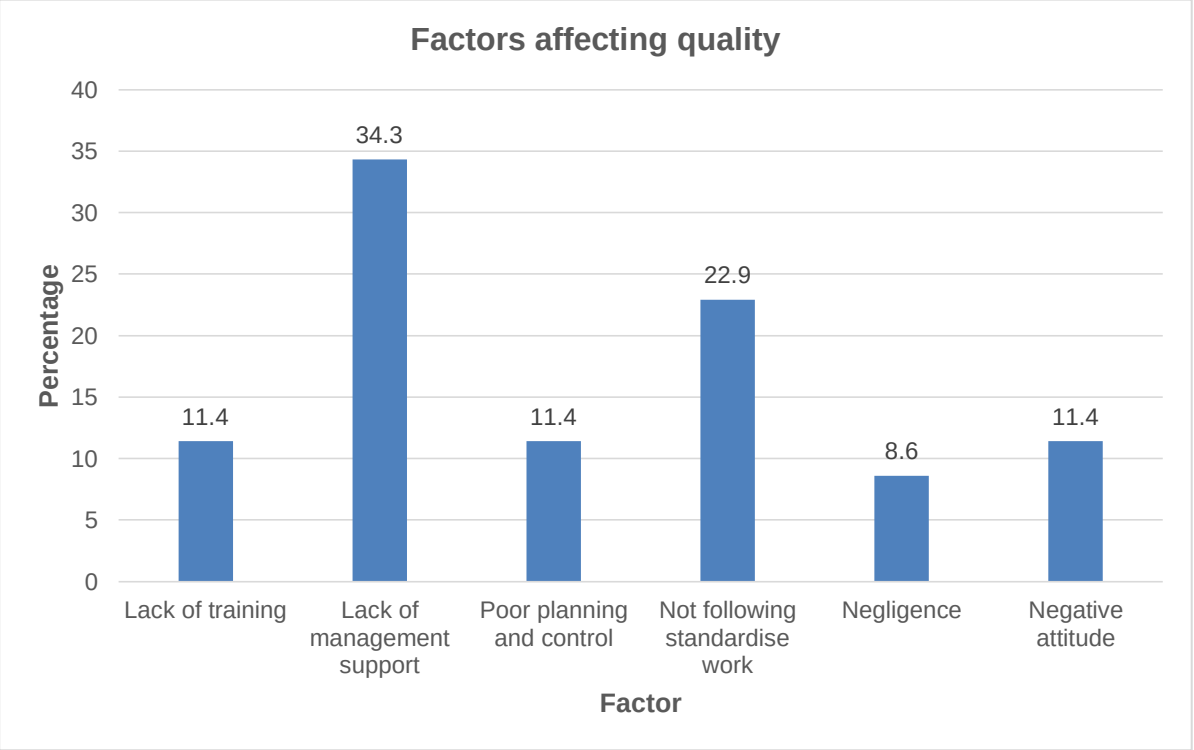

Figure 4.7: Factors affecting quality

The results displayed in (Figure 4.7) above reveal that about 34.3 percent of the employees at TSAM believed that a lack of management support was the greatest factor affecting the implementation of lean, followed by not following standardized work

22.9 percent. Poor planning, lack of training, and a negative attitude constituted 11.4 percent, while those who indicated that negligence was the greatest factor constituted about 8.6 percent. According to Hufkie (2021), motorized manufacturing is the most important industrial sector in South Africa. The main challenges in the manufacturing sector are the quality of the product, which does not meet the global standard; defective products that affect the image of the organization; and the lead time, where customers do not receive their orders on time, which contributes more to customers opting to utilize alternatives.

4.5.8 Perception of lean

The perception of lean as understood by TSAM is depicted in figure 4.8 below. The perception was based on the following aspects:

1. Lean tools are applied to assess the current layout for potential improvement.
2. Lean means developing a value stream to eliminate all waste. VSM should be used to determine the waste of transportation.
3. My organization supports my personal growth through human resource development.
4. Cost, and hence the sales price, is linked to leanness. Keeping component inventory to a minimum level can decrease the cost and provide a desirable price to customers.
5. My input is considered when solving problems and finding the root cause.

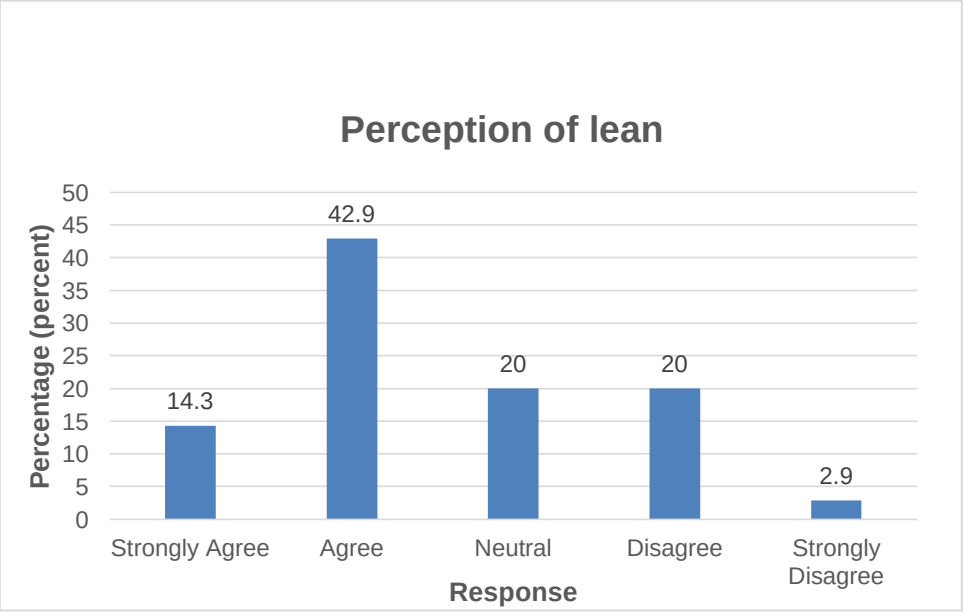

Figure 4.8: Perception of lean

As displayed in Figure 4.8, the results indicate that about 42.9 percent of the respondents agreed that they had a better understanding or perception of lean, while 14.3 percent indicated that they strongly agreed with the aspects that were being asked about lean. These results indicate that the employees at TSAM have an understanding of lean production since they could understand the issues in line with the process of lean production.

4.5.9 Quality Measures

The figure below (Figure 4.9) represents the quality measures that are in place in TSAM and also shows which quality measure is the most effective.

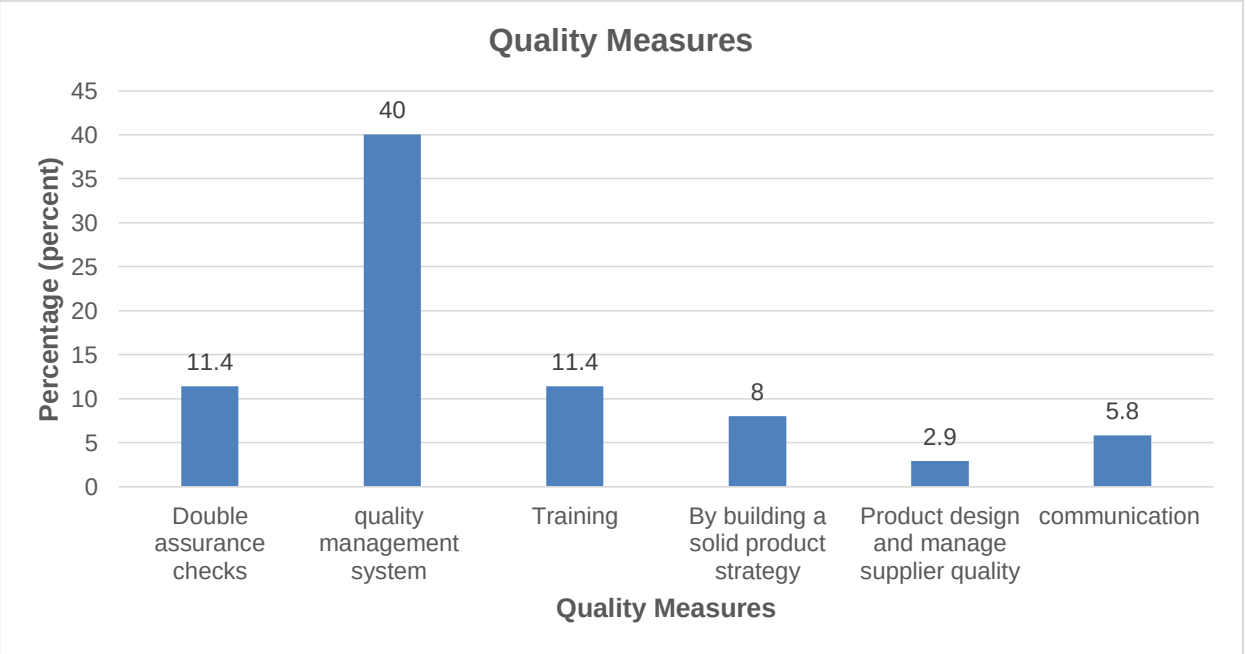

Figure 4.9: Quality measures

When respondents were asked about the quality measures put in place for the organization to remain competitive in the market, 40 percent of them indicated that the organization has implemented some quality management systems (Figure 4.9). 11.4 percent of the respondents said that the organization uses double assurance checks, while about 11.4 percent said that the organization uses training to control the quality of employees in the organization. Furthermore, about 8 percent of the participants

indicated that the organization manages by building a solid product strategy, while about 5 percent believed that communication was the best tool to manage the quality of products. According to Hufkie (2021), motorized manufacturing is the most important industrial sector in South Africa. The main challenges in the manufacturing sector are the quality of the product, which does not meet the global standard; defective products that affect the image of the organization; and the lead time, where customers do not receive their orders on time, which contributes more to customers opting to utilize alternatives.

4.5.10 Continue to Practice

The figure below (Figure 4.10) represents the elements that TSAM must continue to practice in order to lead and dominate in the market.

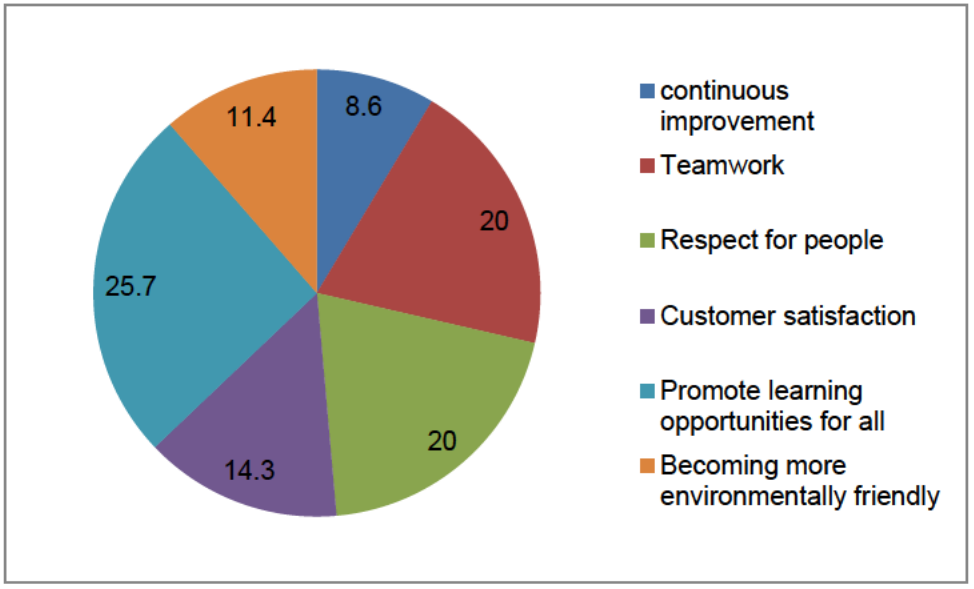

Figure 4.10: Continue to practice

During the study, respondents were asked about the practices they would want to see the organization carry on practicing. 25.7 percent recommended that the organization carry on promoting learning for everyone (Figure 4.10). 20 percent of the respondents encouraged the organization to carry on promoting teamwork amongst employees, while the other 20 percent emphasized the aspect of respecting employees no matter

their position in the organization. 14.3 percent indicated that the organization must keep focusing on customer satisfaction; on the other hand, 11.4 percent indicated that the organization must become more environmentally friendly. The remaining 8.6 percent emphasized that the organization should continue focusing on continuous improvement.

Figure 4.11: Stop practicing

The researcher asked the employees at TSAM about the practices that the organization should stop practicing, and the results in Figure 4.11 indicate that 22.9 percent of the respondents highlighted that the organization should stop treating employees as numbers but rather as assets. Furthermore, 20 percent of the employees indicated that the organization should stop compromising on the quality of products over volume, while 14.3 percent said that the organization should stop prioritizing profit over employee well-being. About 11.4 percent of the employees emphasized that the organization should stop hiring or employing unskilled people in positions of influence; the other 11.4 percent said that the organization should stop setting unrealistic goals as well as instituting poor planning and control. The remaining 8.6 percent said that the organization should stop micromanaging employees.

4.5.11 Level of communication

The figure below (Figure 4.12) represents the level of communication in TSAM to understand if the level of communication is at the level where it can assist the organization to run smoothly or if it is contributing to the problems occurring in the organization.

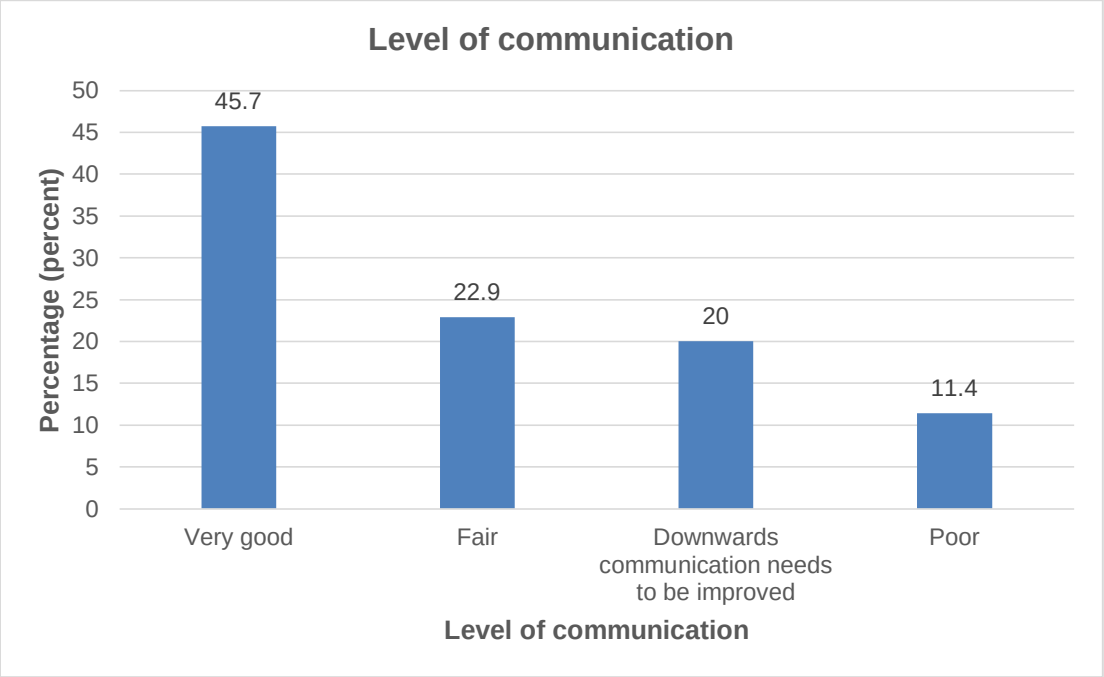

Figure 4.12: Level of communication

When employees were asked about the level of communication in the organization, about 50.7 percent indicated that the communication was very good, while 22.9 percent said that the communication was fair. 20 percent of the respondents said that the downward communication needed to improve, and 11.4 percent indicated that the communication was poor (Figure 4.12).

4.5.12 Perception of lean practices

The figure below (Figure 4.13) is showing the perception of lean practices by TSAM staff members.

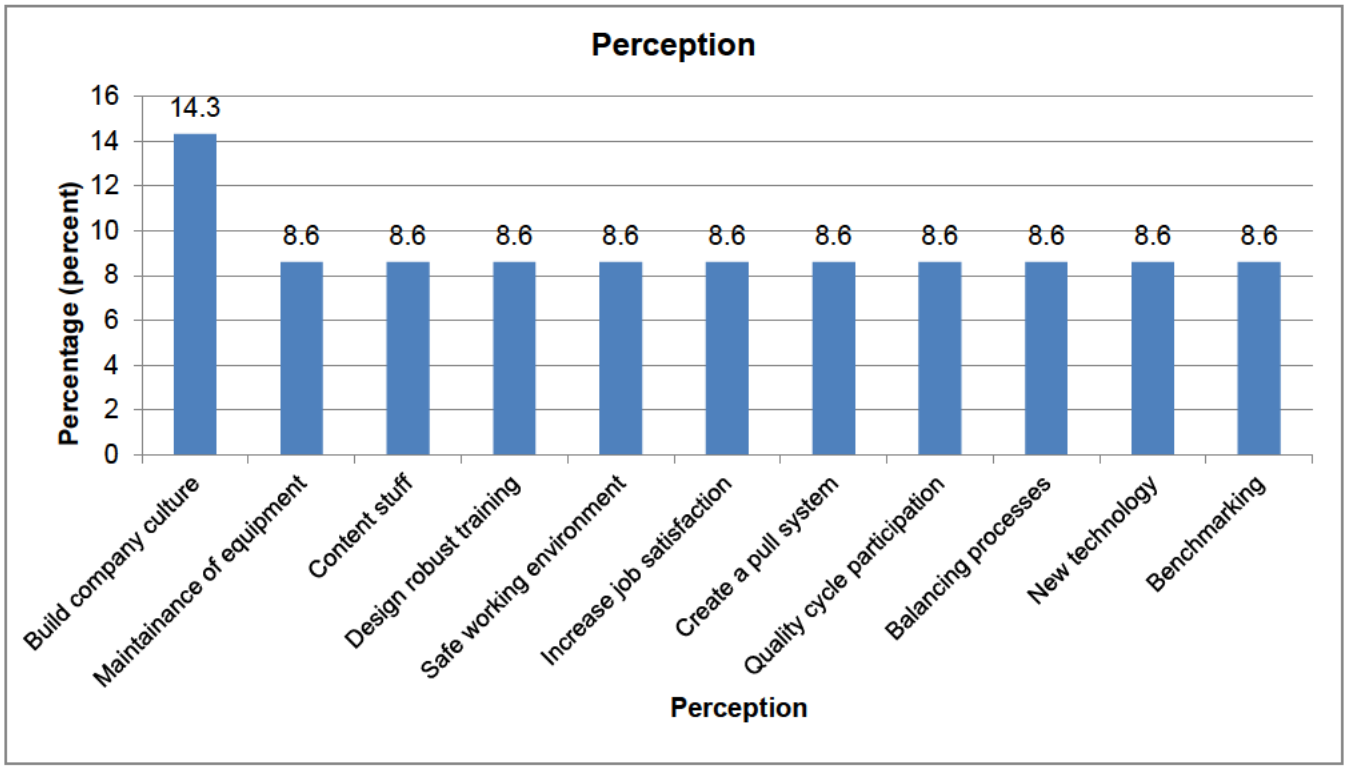

Figure 4.13: Perception

In Figure 4.13, the respondents recommended that the organization build a company culture that emphasizes quality improvement 14.3 percent, while 8.6 percent recommended that the organization ensure that equipment is maintained regularly. It was suggested that organizations must ensure that staff are content with their working environment 8.6 percent. Furthermore, respondents recommended that the organization design a robust training program for personal growth 8.6 percent. The organization was advised to provide a safe working environment. At the same time, managers should increase job satisfaction among employees. In Trading Economics (2020), the sector's competitiveness in the manufacturing sector has been further hampered by other challenges, including currency volatility, equipment, a poor rate of productivity improvement, electricity shortages, and skills constraints, which have led to deindustrialization.

Table 4.6: Descriptive statistics

The table below (Table 4.6) shows the correlations between two variables, which are employment status or position and the number of years in the organization, to show the experience of employees who are in these positions and if they are experienced enough to tackle lean issues since lean decisions are taken at the higher levels of the organization.

Correlations			
		Employment Status/Position	Number of Years in Organisation
Employment Status/Position	Pearson Correlation	1	0.821**
	Sig. (2-tailed)		.001
	N	35	35
Number of Years in Organisation	Pearson Correlation	0.821**	1
	Sig. (2-tailed)	.001	
	N	35	35
****. Correlation is significant at the 0.01 level (2-tailed).**			

According to the results displayed in Table 4.6 above, the Pearson's correlation coefficient between employment status and years in an organization is 0.821, indicating that there is a strong positive correlation between these two variables. In other words, as the number of year's increases for an employee in the organization, his or her position will also tend to change positively—the employee gets promoted.

CHAPTER FIVE

DISCUSSION

5.1 Introduction

The close-ended, likert scale and open-ended questions were designed to allow respondents to provide more detailed information about lean processes. Descriptive statistics were used to present the data results in the form of table and pie charts representations. This chapter uses the analytical results from the previous chapter to analyse whether the objectives of the study were met and how well the results align with theory and findings from other studies discussed in Chapter 2 of the research study.

This chapter provides a comprehensive statistical analysis of the questionnaire responses. An analysis of the data collected from the respondents was conducted. SPSS Statistics version 27 was used to explicitly determine the relationship between position in the company and number of years in the company. SPSS is the only tool that can reveal this relationship. The results obtained from the answers to the open-ended questions in the questionnaires will be addressed.

Before discussing the research results, the extent to which the objectives of the study were achieved is examined. It will also explain how the questionnaire was designed in accordance with the objectives of the study and how the results of the survey relate to the theory and objectives of the study.

5.2 Aims and Objectives of the study

This study aims to examine Lean Manufacturing Practices and the extent to which TSAM uses innovative strategies to enhance quality and its sustainability.

The following three research objectives were established:

- To assess what strategic factors are in place to sustain the business and stay competitive in the market?

- To determine what measures are in place to ensure high quality product is achieved?
- What can TSAM recommend as best lean/TPS practices and strategic sustainability in other small and large manufacturing sector?

A chapter summary will conclude the chapter by outlining key aspects as discussed in this chapter.

The research objectives were all met during the research, and this is discussed further in the following discussion of results. The results of a study are meant to help businesses in the manufacturing industry and to broaden the understanding of other academics interested in working there. In order to accomplish the three aforementioned research aims, a survey questionnaire was created, the findings of which are further discussed below.

5.3 Demographics of respondents

The demographic profile of the respondents shows a skewed profile in some cases, and in other cases the categories are almost the same. For example, 88.6 percent of the participants were African and 62.9 percent were men; regarding the age of the participants, 20-30 years and 30-39 years were almost equal, while 40-49 years represented 14.29 percent. In terms of position in the organization, the results show that respondents came from four different groups, namely department managers 65.7 percent, staff employees 28.6 percent, senior managers (SM) (2.9 percent), and general managers (GM) 2.9 percent. The results indicate that most of the respondents were from department management, which corroborates the findings as the objective of the study was mainly to explore the Lean Manufacturing Practices and the extent to which TSAM is using innovative strategies to improve its sustainability. Therefore, talking to the people who do the practical part of production would imply that they have experience with the lean system.

5.4 Business activity

The descriptive statistics for the number of years one has spent in the organization indicate that around 60 percent of the employees in TSAM have spent 6 years or more.

This indicates that a high number of the employees have experience working with the lean system being used by the organization during its manufacturing process.

5.5 Qualification obtained

In terms of qualification, the highest number 48.6 percent of employees at TSAM has studied engineering courses, followed by those who studied operations and quality management studies 25.7 percent. Since it is an engineering company dealing with manufacturing, these results justify why the organization would have such a high number of employees with such qualifications.

5.6 Type of training

The results indicate that most employees participated in kaizen training 22.9 percent. According to Impson (2020), kaizen means continuous improvement. One of the lean management tools used by numerous companies worldwide is kaizen. The term "kaizen" has Japanese roots. It can be interpreted simply as improvement through change. The literature also includes a study by Selepe (2019), which states that the words "kai" and "zen" in the kaizen philosophy stand for "change" and "better," respectively. Kaizen is a Japanese concept that emphasizes continuous improvement and progress in business processes. It can be carried out by a small group of people within an organization implementing and improving procedures, or by an individual employee making suggestions to improve processes. The kaizen philosophy states that "process improvement is endless" The goals of kaizen thinking are to develop a process with a kaizen understanding. This means understanding standard work, identifying and eliminating anomalies, identifying and minimizing attrition, and identifying and minimizing muda. In support of the study's findings, Krijnen (2007) describes the 14 principles of the Toyota Way: Principle 14: Continuous Improvement (Kaizen) states, "There is never a perfect process, so there is always an opportunity for improvement. Since all the other principles and practices of TPS and Lean revolve around improvement and kaizen, the idea of continuous improvement is paramount. There is a desire to strive for perfection at all times; perfect adherence to specifications is always possible. Kaizen is the philosophy of striving for perfection. It is the process of

incremental improvement, regardless of size, in an effort to eliminate waste." All employees should try to constantly improve processes.

The results of the study show that 22.9 percent of employees were trained in 5S. Ahmed (2017) emphasizes that to avoid wasted running and handling, operators must have their tools handy and within reach, and they must be handed the parts or materials they need in exactly the right orientation. The operator should never leave his job to look for spare parts or tools. 5S is a good technique to eliminate the problem of searching for tools. Access to tools is greatly improved by organizing them and placing them in a visible location. Shadow boards are useful for determining whether or not a tool is missing. Tools are outlined on the shadow board. Wasted motion results from operators not performing their tasks properly. It is wasteful motion to reach far for consumables or machine buttons. It is inefficient to move around looking for tools. Any activity that diminishes value, such as poor layout or training programs, should be discontinued. Randhawa and Ahuja (2017) study further supports the findings by stating that Takshi Osada, who invented 5S as a management tool or approach in the 1980s, invented it to create and maintain a superior quality, productivity, and safe work environment in an organization. 5S not only streamlines the work environment and reduces waste, but also helps improve workplace safety. 5S (sort, set in order, shine, standardize, and sustain) is a Lean tool that focuses on effective workplace organization and standardized work practices. It consists of five practices: sort, set in order, shine, standardize, and sustain. To "arrange" means to design and clearly label where items are stored, while to "sort" means to put things in a specific order. Everything should be in its place so that time and energy is not wasted searching for information; it should be kept in the right place. Shine means to keep its position. Everything is spotless. Standardization is the process of recording work procedures, while maintenance is the process of creating a continuous flow of information. Stick to your improvement techniques. Continuous implementation of 5S has several benefits, including higher product quality and safety. In addition, the study shows that 17.1 percent of employees have received training on continuous improvement as well as standardized work. According to Krishna and Nair (2018), standardized work organizes and defines an employee's movements to produce high-quality products safely and efficiently. Standardizing work practices is a smart technique to reduce the risk of errors while improving quality. Processes can be

highlighted and their potential evaluated. Quality problems can be represented graphically. When a quality problem occurs, the standard procedure should be re-evaluated and updated to avoid this error in the future. This study supports the findings of the participants.

5.7 Methods of communication

The researcher went on to ask respondents about the methods of communication mainly used in the organization. The results indicated that most employees are used to the use of memos as well as meetings about 40 percent of the employees. These results are justified since the organization is a manufacturing company with most employees working on the floor and not in offices. For easy and effective communication, memos and meetings are the most suitable. For all other forms of communication, employees would need access to computers. Therefore, the few that use other forms of communication will be those working in offices, like the management staff.

5.8 Most important aspect in the organization

The employees 82.9 percent highlighted that it was to satisfy customers. According to Foster (2016), Ishikawa spent his life working to improve quality in Japan, and his ideas were synthesized into 11 points that made up his quality philosophy. One of the philosophies states, "The first step towards quality is to understand the customer's needs". A significant percentage 50.7 percent of respondents indicated that training is the most important aspect. The literature revealed that the most successful method of motivating and maintaining high-quality human resources inside a business is through training. Training, according to Lowry *et al.* (2016), is a method of increasing employee dedication and maximizing employee potential. Training is a tool that significantly affects the accomplishment of the aims and objectives of an organization. The ultimate goal of every organization is to increase revenue and maximize profit, and reaching this goal requires an effective and efficient workforce.

5.9 Factors that affect the quality

Kim *et al.* (2016) believe that management support refers to managers' willingness to accommodate employees' schedules and tasks and provide support that can help employees cope and do their jobs better. It can be a critical organizational cultural factor that can influence employees' organization-related attitudes and behaviours. This is supported by the results of the study, which show that about 34.3 percent of TSAM employees believe that lack of management support is the biggest factor affecting the quality of work. However, not all lean initiatives are successful; some fail due to inadequate plans to implement lean strategies. Lack of management support, lack of training, and unwillingness of employees to change are all factors that contribute to the failure of lean, which also leads to poor product quality. Ahmed (2017) asserts that customers place a high value on quality and that this factor keeps any company afloat. Defects can occur not only in the manufacturing process but also in any other process such as maintenance process. For example, if a repair is made and the defect quickly reappears, this indicates a defect in the repair process. Standardizing workflows is an effective way to reduce the likelihood of errors and improve quality. Processes can be mapped and potential quality problems can be represented in diagrams. When a quality problem occurs, the standard procedure should be reviewed and updated to avoid the same error in the future.

Thomas and Michael (2017) concluded, "One possible cause of the recalls was Toyota's inability to keep up with its recent aggressive growth," a requirement that leads the company to ignore the lean or TPS methodology and focus on chasing demand. The study was supported by Impson (2020), who shares the same view that Lean and TPS methods are not prioritized when demand is high, which contributes to defects flowing out of the process, which later leads to a high scrap rate, excess parts from inventory, failure to meet OPR, SDR, lead time, or even recalls because the standard is not met.

The study also found that 22.9 percent of respondents indicated that noncompliance with standardized work was one of the factors affecting quality. According to Krishna and Nair (2018), standardized work organizes and defines an operator's movement to produce high-quality products safely and efficiently. Standardizing work practices is a smart technique to reduce the risk of errors while improving quality. Processes can be

highlighted and their potential evaluated. Quality problems can be represented graphically. When a quality problem occurs, the standard procedure should be re-evaluated and updated to avoid this error in the future.

5.10 Quality measures

According to Hufkie (2021), motorized manufacturing is the most important industrial sector in South Africa. The main challenges in the manufacturing sector are the quality of the product, which does not meet the global standard; defective products that affect the image of the organization; and the lead time, where customers do not receive their orders on time, which contributes more to customers opting to utilize alternatives. This claim is also confirmed by the findings of this study, which indicate that 40 percent of the respondents believe that the organization has implemented some quality management systems. This is further supported by Husain *et al*. (2021), who define quality as merely being appropriate for the intended use. The study further reveals that quality in the manufacturing sector is determined by how closely the product adheres to established product requirements. Due to their higher acceptance rates, higher-quality products frequently result in happier customers, an increase in product demand, a decrease in product rejection, and lower costs. This ultimately produces improved organizational productivity, which influences a better work environment for employees and leads to the expansion of the business. This ultimately produces improved organizational productivity, which influences a better work environment for employees and leads to the expansion of the business. Seven quality control (QC) tools are very helpful in enhancing quality inside an organization in order to attain higher quality. Check sheets, Pareto diagrams, cause-and-effect diagrams, flowcharts, histograms, scatter diagrams, and control charts are the seven fundamental QC tools. To increase profit, quality is a critical aspect in the manufacturing industry. According to Foster (2016), quality issues waste resources by causing scrap and rework. Lean is a collection of techniques or systems aimed at improving quality processes. Ishikawa spent his life working to improve quality in Japan, and his ideas were synthesized into 11 points that made up his quality philosophy, namely:

- Education is the beginning and the end of quality.

- The first step towards quality is to understand the customer's needs.
- Quality control is at its best when inspection is no longer required.
- Address the core causes rather than the symptoms.
- All employees and divisions are responsible for quality control.
- Don't get the objectives mixed up with the means.
- Prioritise quality over quantity and focus on long-term goals.
- Quality enters and exits through marketing.
- When facts are revealed to subordinates, top management should not become enraged.
- 95 percent of a company's problems can be remedied with the seven quality control instruments.
- Data that lacks dispersion information is erroneous data.

Arenou *et al*. (2018) believes that the cost of quality is more than twice the cost of doing it right the first time. All the resources and costs spent to produce the defective product are lost and spent again to compensate for that defect. In addition, there are other costs incurred in making changes, determining root causes, and improving the process. So the cost of quality is the sum of the defects plus rework plus other requirements or changes. Cellular manufacturing, multifunctional labor, batch size reduction, just-in-time (JIT), labor delegation, TPM, setup time reduction, TQM, continuous flow manufacturing, agile manufacturing strategies, safety improvement programs, process capability measurements, and human resource management (HRM) are some examples of lean manufacturing practices. According to Tomas' (2017) key findings on the data collected, processed, and analyzed from a variety of secondary sources, as well as information collected directly from the observer, the key findings show that the Toyota Production System is the source of Toyota Motor Corporation's best practices for total quality management and business excellence, and these practices can be found in

the characteristics of business excellence. The Toyota Production System, which promoted the formation of business excellence models, has been continuously developed, applied, and refined to improve their goods, services, and operations. According to Garza-Reyes *et al*. (2017), TQM is based on three factors: customer orientation, continuous improvement, and employee involvement. Customer orientation means looking at things from the customer's perspective and working for the good of the customer. Continuous improvement means constantly striving to improve situations. Employee involvement means that all members of the organization, from the top to the bottom, must share the same work objectives and information to achieve a common goal. All members of the organization must have a sense of belonging and participate in activities that improve the organization.

Oestlund (2020) believes that TPS improves quality by applying various lean methods that help reduce defects and improve quality in the production line: kaizen, 5S, 5 Whys, Poka-Yoke, and introducing ideas such as employee engagement and contribution, empowerment and personal responsibility, and the human touch and the idea of stopping and responding to any irregularity. The TPS /lean formula is well known, but there are still some decisions that need to be made on a daily basis. Tracking down the error and finding the source of the problem, fixing the problem takes a lot of time and attention. Krishna and Nair (2018) also agree that TPS improves the quality of products and processes. Overall, TPS uses several lean methods to reduce defects and improve quality, namely: kaizen, 5S, 5 Whys, and Poka-Yoke. TPS is a system that allows us to control and improve production so that we can produce quality products efficiently and JIT in response to customer orders. According to Impson (2020), kaizen means continuous improvement. One of the lean management tools used by numerous companies worldwide is Kaizen. The term "kaizen" has Japanese roots. It can be interpreted simply as improvement through change. The kaizen philosophy includes several proven techniques to increase the standard of implementation. Customer focus, TQC, Kanban, just-in-time, quality improvement, zero defects, robotics and automation are all part of Kaizen.

According to Randhawa and Ahuja (2017), Takshi Osada invented 5S as a management tool or approach in the 1980s to create and maintain superior quality,

productivity, and a safe working environment in an organization. 5S not only streamlines the work environment and reduces waste, but it also helps to improve workplace safety. 5S (sort, set in order, shine, standardize, and sustain) is a lean tool that focuses on effective workplace organization and standardized work procedures. It is made up of five practices: sort, set in order, shine, standardize, and maintain. Set is designing and clearly marking where items are stored, whereas sorting is organizing things in order. Everything is supposed to be in place to avoid wasting time and energy looking for information; it should be kept in the correct place. Shine is maintaining its position. Everything is spotless. Standardizing is the process of recording work procedures, while maintaining is the process of creating a continual flow of information. Stick to your improvement techniques. Continuously implementing 5S has several advantages, including increased product quality and safety. According to Krishna and Nair (2018), these are the tools that help employees quickly identify potential defects and stop the assembly line so that defects do not flow out of the process and eventually affect the final product. TPS is a tool that improves Toyota's ability to reduce waste throughout the production process; it improves through JIT, kanban, takt time, and kaizen. According to Krishna and Nair (2018), standardized work organizes and defines an operator's motion to produce high-quality products safely and efficiently. Standardization of work practices is a smart technique to reduce the risk of failure while also improving quality. Processes may be shown, and their potential can be assessed. Quality issues can be shown graphically. If a quality issue arises, the standard procedure should be re-evaluated and updated to avoid this blunder in the future.

5.11 Perception of lean

The results show that about 42.9 percent of the respondents agreed that they had a better understanding or perception of lean. The respondents in this study were employees, department managers, senior managers, and directors who indicated they had a better understanding or perception of Lean. However, according to Tovstiga (2016), the main problem is that management often lacks an organizational chart, which causes lean concepts to occasionally fail. Recent research shows that only 55 percent of middle managers can accurately identify even one of their company's top five strategic priorities, and more than half of them fail when it comes to explaining the

strategy to their employees. Not only are strategic goals poorly understood, but they also seem disconnected from the company's larger business plan. The sobering reality is that most business leaders are unable to articulate their company's strategy simply and convincingly. It is important to remember that leaders, such as managers, are the ones who drive the business, and they are expected to be knowledgeable about organizational strategies in order to run the business in alignment with the company's business strategies and goals. To get the benefits of Lean principles, it is important to gain a better understanding of Lean and the factors that impact work teams. Cultural influences affect how critical aspects of lean manufacturing are interpreted and implemented. About 14.3 percent said they strongly agreed with aspects that the company supports employees' personal growth through workforce development, which is supported by Liker's 2004 study (cited in Thomas and Michael 2016) describing the 14 principles of the Toyota Way: Principle 9 (People Development) states, "Train leaders who thoroughly understand the work, live the philosophy, and pass it on to others. According to Narayanamurthy *et al*. (2016), Jidoka, the first pillar of TPS, is the idea that quality should be integrated into the process rather than treated separately. Scrap prices are a waste. However, they are the most insignificant compared to other wastes generated by production defects. Errors hinder the smooth flow of materials in the production line.

It was also found that 11.4 percent of respondents reported that the company performs duplicate safety checks. This is supported by Impson (2020), which defines quality as a product that meets and exceeds customer expectations. To ensure good quality at TSAM, the company has implemented various quality measures, such as quality cycles, kaizen, cause-and-effect diagrams, problem-solving procedures, group-by-off (GBO), poka-yoke systems, suggestion systems, the 5Tei system, system check sheets, the Andon system, my problem and countermeasures sheet, system check sheets, double assurance, defect tracking sheets, and the use of smart tools. TSAM includes hoshin kanri (policy management) and nichijo kanri (daily management) by management and supervisors. TSAM is based on two pillars: continuous improvement and respect for people.

The results also show that 11.4 percent of respondents indicated that the organization uses training to control quality in the company. This finding is corroborated by Ndumia *et al*.'s (2020) study on factors affecting product quality in Kenyan printers, which found that training, technology, management support, poor planning, and employee attitude are some of the many factors that affect the quality of products produced by a company. This study was important for company management, other companies in the same field, and future researchers. A descriptive research approach was adopted for the study, targeting 44 respondents from the company. The target population was divided into strata using a stratified random sampling method. Primary and secondary sources were used to compile the data. The organization should ensure that its employees are well trained through seminars to equip them with the skills they need to perform their duties. The quality units should ensure that rules and regulations are properly implemented and followed to ensure quality production. The organization should source its raw materials from approved suppliers.

5.12 Good lean practices (continue practicing)

During the study, respondents were asked about the good practices they would like to see the organization continue practicing. About 25.7 percent recommended that the organization carry on promoting learning for everyone. About 20 percent of the respondents encouraged the organization to carry on promoting teamwork amongst employees, while the other 20 percent emphasized the aspect of respect for employees no matter their position in the organization. About 14.3 percent indicated that the organization should keep focusing on customer satisfaction; on the other hand, 11.4 percent indicated that the organization should become more environmentally friendly. The remaining 8.6 percent emphasized that the organization should continue focusing on continuous improvement.

5.13 Not good practices (stop practicing)

The researcher asked the employees at TSAM about the practices that the organization should stop practicing, and the results indicated that 22.9 percent of the respondents highlighted that the organization should stop treating employees as numbers but rather as assets. Furthermore, 20 percent of the employees indicated that the organization

should stop compromising on the quality of products over volume, while 14.3 percent said that the organization should stop prioritizing profit over employee well-being. About 11.4 percent of the employees emphasized that the organization must stop hiring or employing unskilled people in positions of influence. The other 11.4 percent said that the organization should stop setting unrealistic goals and practicing poor planning and control. The remaining 8.6 percent said that the organization should stop micromanaging employees.

5.14 Level of communication

When employees were asked about the level of communication in the organization, about 50.7 percent indicated that the communication was very good, while about 22.9 percent said that the communication was fair. 20 percent of the respondents said that communication needs to improve "downward" from the highest echelons of management to other employees. 11.4 percent indicated that the communication is poor.

During the study, the respondents recommended that the organization must build a company culture that emphasizes quality improvement 14.3 percent, while 8.6 percent recommended that the organization should ensure that equipment is maintained regularly. It was recommended that the organization ensure that the staff is content with their working environment 8.6 percent. Furthermore, respondents recommended that the organization design a robust training program for personal growth (8.6 percent). In addition, the organization was recommended to provide a safe working environment while managers increase job satisfaction among the employees.

5.15 Conclusion

The data gathered from the various respondents is provided in this chapter. The data was presented using a variety of data presentation approaches, including simple pie charts, and tables. The interpretation and analysis of the data gathered were also covered in this chapter. The purpose of the interpretation was to make the presentation technique easier to use. The data was analyzed to critically evaluate the information received.

The study's objectives were reassessed, and the statistical results of the data were consistent with the study's goals. Respondents were found to have a strong awareness of the lean tools and quality measures in place in the organization, as well as the lean tools they had received training for. Overall, respondents had a good understanding of the factors that affected the quality of their goods and services, and they had some notable recommendations on good lean practices.

The majority of employees believe that training and management support can improve quality. It was interesting to see that the majority of the respondents indicated that the level of communication was very good at TSAM; however, there was still room for improvement in the downward communication.

There were some good practices that the respondents would like to see the organization continue practicing, such as promoting learning opportunities for all, continuous improvement, respect for people, teamwork, customer satisfaction, and becoming more environmentally friendly. The goal of the next chapter is to make recommendations based on the key findings of the study before concluding.

CHAPTER SIX

RECOMMENDATIONS AND CONCLUSION

6.1 Introduction

This chapter will conclude the study by summarizing the key findings in relation to the research objectives of the study structured in the form of questions, a summary of key findings in relation to the literature review, a summary of key findings in relation to the types of waste and methods of Lean/TPS that help eliminate them, a conclusion based on the study, and recommendations based on the study thereof. It will also propose recommendations for further study, along with a brief conclusion of the study.

6.2 Summary of key findings based on research objectives

The main aim of this study was to examine lean manufacturing practices and the extent to which Toyota South Africa Motors uses innovative strategies to enhance quality and sustainability. The conclusions that have been reached for each of the research objectives will be presented, as outlined in the following sections. According to the findings of this study, the following conclusions have been drawn:

6.2.1 Objective 1:

What limitations, challenges and good practices of lean that can be identified in TSAM?

From the data in this study, it appears that the organization should stop treating employees as numbers, but rather as assets, and that the organization should stop compromising on the quality of products versus quantity. In addition, organizations should stop hiring or employing unskilled employees in positions of influence. This is consistent with literature highlighting that Lean and TPS methods are not prioritized when demand is high, which contributes to defects flowing out of the process, which later leads to a high scrap rate, excess parts from inventory, failure to meet OPR, SDR and lead time, or even recalls because the standard is not met. The daily target is

always affected by downtime caused by stoppages on the production line, machine breakdowns, parts shortages, and lack of replenishment from downstream lines, resulting in a delay on the last line, an OPR line (Impson 2020). The literature also highlights that most of the evidence put forward by many researchers proves that lean can be used to reduce lead time, improve quality and productivity, and reduce inventory, and lower costs, while on the other hand it increases profit and competition. However, not all lean initiatives are successful; some fail due to inadequate plans to implement lean strategies. Lack of management support, lack of training, and unwillingness of employees to change are all contributing factors to lean failure (Sahoo 2019).

In terms of best practices, the study found that the organization should continue to promote learning for all. This is supported by the literature, which states that any company that does not value its employees or invests little effort or money in the training and coaching process will lose its human ingenuity. Toyota is the best example of a company that values its employees. When Toyota invests in its leaders, the company assumes that these individuals will use the skills and knowledge they have gained through Toyota's leadership self-development program to develop other leaders. The ability of leaders to mentor and develop others has not always been easy. Instead of thinking only of themselves and viewing others as followers, they can be very useful when they learn to coach others. The main role of leaders at Toyota is to create more leaders, not more followers. Another example of wasted human potential is the use of the operator or maintenance barge to transport tools or parts. This highly competent employee can direct or supervise a number of operations and suggest how tasks can be performed more effectively. To improve their own work, they should actively participate in the problem-solving process. Using a highly skilled worker to complete simple tasks increases the price of that employment. The decision to hire an outside contractor instead of using the worker's skills and suggestions to improve the process (Ahmed 2017).

6.2.2 Objective 2:

What are the quality measures that TSAM has implemented to improve product quality and competitiveness?

From the data in the study, it was brought out that 40 percent indicated that quality management systems should be utilized as a practice to ensure good quality is achieved. The literature indicates that motorized manufacturing is the most important industrial sector in South Africa. The main challenges in the manufacturing sector are the quality of the product, which does not meet the global standard; defective products that affect the image of the organization; and the lead time, where customers do not receive their orders on time, which contributes more to customers opting to utilize alternatives. This claim is also confirmed by the findings of this study, indicating that 40 percent of the respondents believe that the organization has implemented some quality management systems to improve quality and competitiveness. (Hufkie 2021)

6.2.3 Objective 3:

What can TSAM recommend as best lean/TPS practices and strategic sustainability in other small and large manufacturing sector?

Different data collected indicate that the organization should stop setting unrealistic goals as well as poor planning and control, promote learning for everyone, invest in training and development, and improve communication. This is supported by the literature that suggests that training, technology, management support, poor planning, and the attitudes of employees are some of the many factors that impact the quality of the product produced by an organization (Odhiambo *et al*. 2017). Furthermore, the majority of the literature on sustainable manufacturing focuses on huge corporations rather than small businesses. Even studies that have looked at sustainable manufacturing from the standpoint of SMEs are few and mostly concerned with economic and/or environmental factors. He also pointed out that several studies have highlighted numerous problems that are preventing SMEs in developing countries from succeeding, including a lack of business experience, technical knowledge, inadequate management skills, a lack of planning, and a lack of market research (Mahat *et al.* 2015).

6.3 Summary of key findings based on literature review

The tables below (Table 1.8) present the findings based on the literature and the sources of the literature. These findings also assisted the study in assessing even further the factors that affect lean practicability in the manufacturing sector and are the roadmap for future studies.

Table 1.8: Findings based on literature

Findings based on literature	Sources
The sobering reality is that most business leaders cannot articulate their organization's strategy in a simple, compelling way.	Tovstiga, (2016)
Problems that are preventing SMEs in developing countries from succeeding include lack of business experience, technical knowledge, inadequate management skills, lack of planning, and lack of market research.	Mahat *et al.* (2015)
Work groups have a long history of assisting in the implementation and management of process improvement initiatives.	Powell and Pazos (2016)
Defects can be found not only in the manufacturing process but also in any other process, such as the maintenance process.	Ahmed (2017)
Standardization of work procedures is an effective way to reduce the likelihood of failure and improve quality. Processes can be mapped, and potential quality issues can be displayed on charts. If a quality issue arises, the standard procedure should be reviewed and updated to avoid making the same	Ahmed (2017)

mistake in the future.	
The cost of quality is more than twice as high as the cost of getting it right the first time.	Ahmed (2017)
Previous research acknowledges that manufacturing firms can achieve significant improvement from the introduction of lean practices.	Sitharam (2017)
Even at businesses in developed economies like the USA and the UK, where the success rate of LMPs is less than 30percent, LMP implementation failures have been documented in the literature.	Adity *et al.* (2021)
However, researchers have acknowledged the amount of work needed towards the implementation of a successful lean manufacturing program and reveal that limited research has been devoted to difficulties experienced to sustain lean manufacturing once implemented in a production system. A significant amount of literature primarily focuses research on the benefits of implementing lean manufacturing principles in an organization.	Sinxoto and Arnesh (2019)
The research revealed the major contributors in the failure of manufacturing organizations in sustaining the application of lean manufacturing principles. The identified gap ranges from the manner with which the organisation conducts the qualification process; and knowledge transfer to the workers to the manner with which shop-floor engagement between leaders and workers takes place.	Sinxoto and Arnesh (2019)

Not all lean implementation initiatives are successful, some fail due to insufficient plans to execute lean strategies. Lack of management support, lack of training, and employee reluctance to change are all factors that contribute to lean-to-failure	Sahoo (2019)
To understand the challenges and barriers of lean we must look at the existing engineering management, managerial culture, organizational science; and employee development must be at the core.	Yadav *et al.* (2017)
Because of the introduction of a quantitative methodology to quantify lean performance, decision-makers in management can quickly examine the efficiency of manufacturing processes and detect possible areas for improvement.	Durakovic (2018)
Cultural factors play a key role in the interpretation and implementation of critical success elements in lean manufacturing.	Durakovic (2018)
To create a new generation smart factory, throughout the value chain, the Fourth Industrial Revolution demands the smart linking of machines, goods, components, assets, humans, and ICT systems. Top management must take action and begin implementing lean manufacturing in their organizations.	Durakovic (2018)
Quality principles use simple and clear methods to be followed if the business wants to achieve world-class quality, it should understand that these methods would never work without a strong company culture.	Sreedharan, Raju and Srinivas (2017)

Several studies have been conducted on TQM but no study has been undertaken to comprehend the relations among Deming's 14 quality principles.	Agrawal (2018)
Lean success depends on recognizing what is considered as of value by the customers.	Sahoo (2020)
Due to the projected increase in global the population to 9 billion people by 2050 and the increasing difficulty and cost of obtaining non-renewable resources, businesses, governments, and other organizations must make sustainability a key concern.	Henao, Sarache and Gomez (2018)
The effectiveness of sustainable manufacturing techniques is dependent on three factors: (1) choosing the right set of indicators, (2) evaluating performance, and (3) making adjustments within the system.	Mahat *et al* (2015)
Training has proven to be quite beneficial in improving the quality of products produced by businesses. It not only improves employees' resourcefulness, but also allows them to learn their tasks and execute them more competently.	Ekaterini and Constantinos-Vasilios, (2019)
Training employees in decision-making, teamwork, problem-solving, and interpersonal interactions has a favorable effect on both employee performance and the rate of growth of the company.	Rohan and Madhumita (2012)
Training has an impact on an employee's behavior and work abilities, which results in enhanced performance and positive	Satterfield and Hughes,

changes.	(2007).
Training is a method of increasing employee dedication and maximizing employee potential.	Lowry *et al*. (2016)
Training is a tool that has a significant impact on the achievement of an organization's goals and objectives.	Konings and Vanormelingen (2019)
Training, technology, management support, poor planning and attitudes of employees are some of the many factors that impact the quality of the product produced by an organization.	Odhiambo *et al*. (2017)
Traditional strategies that simply consider cost reduction and efficiency enhancement must be replaced by ones that additionally consider how operations will affect the environment and society.	Pusavec *et al*. (2010)
Sustainability is not always about producing sustainable products but also looking at the most sustainable process for production, whilst maintaining global competition.	Malesios (2018)
Seven quality control (7QC) instruments can greatly aid in the enhancement of quality within a business. Check sheets, Pareto diagrams, cause and effect diagrams, flowcharts, histograms, scatter diagrams, and control charts are all examples of graphs to improve product quality and competitiveness.	Husain *et al.* (2021)
To ensure good quality is maintained in TSAM several quality measures that the company has put in place such as Quality cycles, Kaizen, Cause and Effect diagram, Problem Solving	Impson (2020)

Procedure, group-by-off (GBO), Poka-yoke system, suggestion schemes, The 5Tei system, System check sheet, Andon system, My problem and countermeasure sheet, System check sheet, System check sheet, Defect tracking sheet and the use of smart tools. TSAM includes hoshin kanri (policy management) and nichijo kanri (daily management) by management and supervisors	

6.4 Findings based on: The types of waste and methods of Lean/TPS which help eliminate them.

Table 1.9: Types of waste

Waste	**Methods of Lean/TPS Manufacturing**
Overproduction	Kanban, Heijunka, VSM, JIT
Excessive Inventory	Kanban, Heijunka, VSM, JIT
Mistakes and defects in the quality of products	Poka-Yoke, Jidoka, Kamishiba, Standardized work
Excess Motion	5S, Standardized work, TPS tools
Unnecessary transport	Kanban
Waiting	TPM, SMED

Excessive processing	Standardized work, Kanban
Overtime	JIT,Standardized work, 5S

6.7 Conclusion based on the study

The main objective of this study was to assess lean manufacturing practices and the extent to which Toyota South Africa Motors uses state-of-the-art tactics to improve quality and sustainability. Based on the results of the study, the following conclusions were drawn:

- The fact that department managers made up a large portion of the respondents to this study (65.1 percent) provides a perfect opportunity to gain insight from those involved in the day-to-day planning of operations. The results of the study also benefit greatly from the responses of general managers (2.9 percent), as lean decisions are made at the highest levels of the organization and implemented by senior executives, department managers and division managers.
- In terms of number of years and degree attained, (42.9 percent) of the participants indicated that they had been working there for 11to 20 years, indicating that the respondents were individuals with experience in the organization. The majority of participants (48.6 percent) also reported having degrees in engineering, operations, and quality management. According to the survey results, the majority of respondents have worked in manufacturing organizations, and their qualifications are consistent with manufacturing methodologies such as lean manufacturing, quality control, and sustainability.
- The training survey found that 5S and Kaizen had the highest number of participants at (22.9 percent) each, indicating that the majority of employees know and can successfully implement some of the lean methods.
- The study concludes that meetings and memoranda are efficient forms of communication, which is supported by responses from (40 percent) of respondents. A strong communication strategy should be able to increase the

impact of the message as well as achieve and sustain the desired effect, the study further concludes. For this reason, successful communication achieves its goal. Communication can be used to achieve any of the following goals: To bring about change, to inspire action, to develop understanding, to convey knowledge, or to express a particular point of view. To understand why communication was ineffective when the expected goal was not achieved issues such as communication barriers are explored.

- In terms of lean implementation, the study concludes that the most important aspect of the organization is training. This is supported by the results of the study, with (50.8 percent) of respondents indicating that training is the most important aspect of the organization.
- The study concludes that the factors that impact quality are lack of management support and failure to follow standardized work procedures. The study also suggests that a negative attitude is the cause of many problems in the company and in the outside world. The responses show that (34.3 percent) believe that lack of management support is the main factor affecting quality, while (22.9 percent) believe that standardized work is the main factor.
- Regarding the perception of lean in terms of understanding, the study concludes that there is an understanding of lean production, as respondents can understand the issues related to the process of lean production. About (42.9 percent) of the respondents support the study's findings.
- In terms of perceptions of lean as it relates to lean practices, the study concludes that companies need to build a culture that emphasizes quality improvement and ensures that employees are satisfied with their work environment. The study also concludes that managers should increase job satisfaction and encourage personal development. Respondents (14 percent) support the study's findings.
- According to the research findings, the study can conclude that the vast majority (82.9 percent) of respondents want to satisfy customers, which indicates that respondents are willing to go the extra mile to satisfy customers.
- Based on the research findings on quality measures, the study concludes that quality management systems should be used in practice to achieve good quality.

(40 percent) of respondents believe this is the best quality measure that can be implemented.

6.8 Recommendations based on the study

The recommendations for this study are based on the empirical findings of the study and aim to help the manufacturing sector become more competitive and sustainable. The following recommendations were made for this study:

- It is recommended that the organization continue to promote learning for all. The study revealed that management engagement is a major issue. Management roles need to be reviewed based on their involvement in problem solving and grassroots employee support. To avoid waste, good management encourages effective skill and knowledge development among its employees and minimizes tasks that do not add value.
- The study recommends that plant employees be trained in areas such as TPS, TQM, standardized work, kaizen, and other problem-solving techniques such as quality cycles and suggestion schemes. Involving shop floor employees in problem solving will help the organization find the root cause of the problem, and with the proper training, they can solve the problem themselves.
- The study recommended that the organization must ensure that employees are satisfied with their work environment to understand the culture of the organization. The long-term and short-term goals of the organization must be communicated at the grassroots level. Any changes the organization makes must be well communicated to employees. Employee reluctance to change is due to not understanding the larger plan of change. It is important to share the plan with employees.
- Developing goal setting, goal alignment, performance management, and communication routines for empowerment, ownership, and accountability is a process that enables people in the workplace to achieve a common goal of performance improvement. These are the best practices that the organization should implement. Based on the data collected from the literature, the study recommends controlling and monitoring performance through regulated work

processes and using processes to monitor performance at short intervals. Performance measurement and monitoring ensure that work processes are under control and performance goals are met.

- The study recommends that companies encourage personal development of employees who are aligned with the organization's goals, support their studies, and provide more training on how the organization works so that employees understand how the organization operates and know what factors affect how the organization operates, both internally and externally. The study also recommends that employees who have gained essential skills in key facilities should be used effectively as they can be seen as globally competitive - unused skills are another form of waste.
- It is recommended that the company invest in new technologies. To create a new generation of smart factories, the fourth industrial revolution requires the intelligent connection of machines, products, components, real estate, people and ICT systems along the entire value chain. In the age of globalization, quality is considered one of the biggest challenges for manufacturers trying to sell their products at minimum cost.

6.9 Limitations of the study

Only top executives and employees who work for Toyota South Africa Motors were included in the sample population for this study. Other manufacturing industries were hesitant to give the researcher permission to carry out the study.
A standardized survey questionnaire was employed for this study because the researcher was unable to conduct one-on-one interviews with the respondents throughout the COVID-19 period, which limited their ability to offer detailed feedback.

6.10 Recommendations for future research

In light of the subject matter of this study and the objectives it pursued, the empirical results and conclusions as presented in the previous chapters have led to the following suggestions for further research:

- Since this study was unable to gain further insight into small and medium sized manufacturing firms, it is recommended that research be conducted into the particular techniques that these firms use to produce high quality goods and maintain their competitiveness in the marketplace.
- Future research should focus on the advantages and disadvantages of different cultural perspectives within an organization.
- Future studies could focus on incentive programs and encourage employee engagement in lean efforts to address the gap in the lack of sustainability of lean concepts in manufacturing organizations.

6.11 Overall conclusion

The assessment of lean manufacturing and strategic sustainability at Toyota South Africa Motors was the main focus of the study. The results of the study were important because they aimed to identify the successes and difficulties in lean methods and the variables that affect quality. The results of this study support the idea that lean can increase productivity and quality if lean tools are properly applied, lean supporting forces are maintained, and lean resisting forces are improved or eliminated. The management are at the core existence of the business and play major role in the production, by the results revealed by the study it shows the need for managers to be trained in their role as managers to understand the bigger role they play in terms of contributing to job creation and economic emancipation. If quality is poor deindustrialization is inevitably.

6.11.1 Forces supporting and resisting lean in TSAM

The figure below (Figure 6.1) has a list of the forces that support lean and those that resist lean in TSAM. These forces have been revealed by the study and can also assist TSAM in terms of where the company needs to focus when improving lean activities.

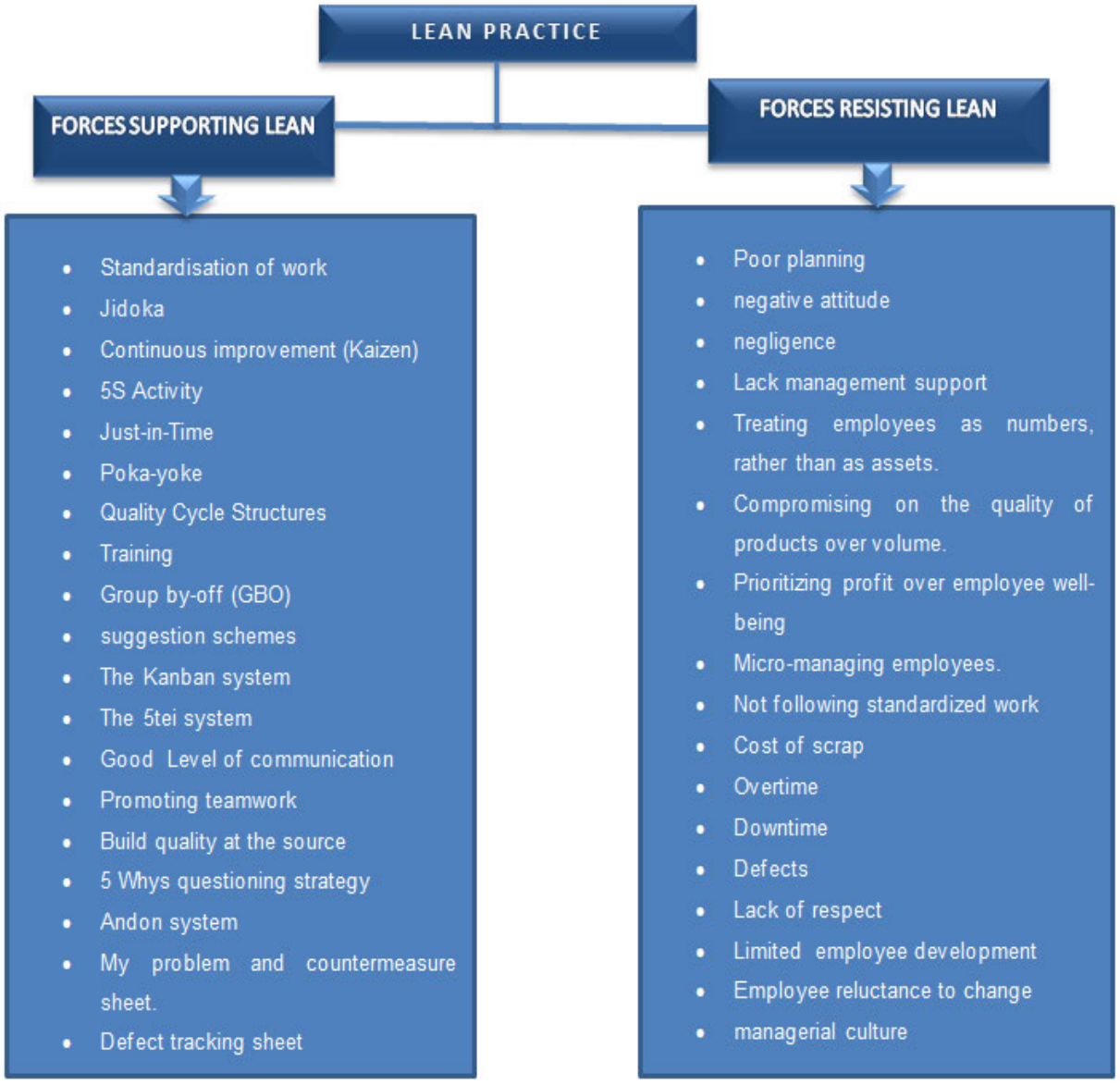

Figure 6.1: Forces supporting and resisting lean in TSAM

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Appendix A: Letter of information

LETTER OF INFORMATION

Title of the Research Study:

Assessment of lean manufacturing practices and strategic sustainability in Toyota South Africa Motors.

Principal Investigator/s/researcher:

Sanele Kheswa, B-tech Operations Management

Co-Investigator/s/supervisor/s:

Prof. KR Ramdass, D.Phil. Engineering Management

Brief Introduction and Purpose of the Study:

This study is about the assessment of lean manufacturing practices in manufacturing sector and their strategy to ensure the sustainability of the company. The purpose of this study is to assess lean practices, quality measures and the extent to which Toyota SA uses innovative strategies to minimise all types of waste and enhance its sustainability and competitiveness. The study will also add on the existing knowledge in

the manufacturing sector and to all other scholars who wish to pursue a career in manufacturing sector.

Good Day.

I am Sanele Kheswa a 4th year student at DUT doing research for my Master's degree in the Philosophy of Quality Management.

I would like to invite you to participate in the research that I will be conducting. This research is about the assessment of lean manufacturing practices and the strategic sustainability.

Research is a systematic search or investigation into and study of materials and sources to establish facts and reach new conclusions.

The research is driven by the popularity of lean manufacturing stems mostly from empirical proof that it enhances a company's competitiveness and quality. Because of the challenges the manufacturing industries that use lean and the evidence that other scholars have provided about lean practices the researcher decided to assess lean manufacturing and the strategic sustainability in the manufacturing sector as the aim of the study.

The study also addresses the following objectives:

- To assess what strategic factors are in place to sustain the business and stay competitive in the market?
- To determine what measures are in place to ensure high quality production is achieved?
- What can TSAM recommend as best lean/TPS practices and strategic sustainability in other small and large manufacturing sector?

The researcher will give 44 survey questionnaires to Toyota employees, who will be expected to fill them out and return them to the me. The researcher will email the participant a questionnaire. The researcher also emailed the questionnaires and attached a letter of the researcher's identity to you and explained the purpose of the

research. The participant will have seven days to fill the survey questionnaire and email back to the researcher.

You should be aware of the prospective participation in the study, the rationale behind it, and, most crucially, what is expected of you to avoid unintended harm to yourself and maintain the study's scientific integrity.

You will participate voluntarily, and there will be no negative consequences if you choose to withdraw. If you decide to withdraw please inform the researcher that you are withdrawing from participating in the study and it is in your own right not to disclose any reasons for withdrawing. You will have seven days in position of the questionnaire in order for you to comprehend the questionnaire and respond accordingly. Filling the survey questionnaire will take a maximum of 30 minutes and email back to the me. I have provided my contact details at the end of this letter where you can contact me for any queries.

The study will make an important contribution to Toyota SA as a company and employees to address the areas of improvement. Benefit to the researcher involves fulfilment of a Master’s degree and publications of a journal article. Because of the study's limited budget, no monetary or other sort of remuneration will be provided. There will be no costs that will be covered by you.

The study will request consent from the targeted sample and the names of those who willingly participate shall be kept anonymous and any sensitive information that may be exchanged will be made discrete. The questionnaires will therefore exclude personal or contact details of any of the participants. A consent letter will be handed to the participant that protects both the participants and the researcher.

The results of the research will be disseminated in the University library and also it will be published as a journal article that can be accessed online. There will be no compensation for research related injury; safety will be our main priority. The data will be stored in the University library for the duration of 5 years. Only authorized librarians will have access to the data using the privacy policies of the university. No one will be allowed to use the data that has been used by the researcher (Sanele Kheswa).

Persons to contact in the Event of Any Problems or Queries:

Please contact the researcher Mr Sanele Kheswa 0782539324, my supervisor Prof. KR Ramdaas 0824173550 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 B: Consent form

CONSENT

Full Title of the Study: Assessment of lean manufacturing practices and strategic sustainability in Toyota South Africa Motors.

Names of Researcher/s: Sanele Lungani Kheswa

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Sanele Kheswa

, 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, Sanele Kheswa herewith confirm that the above participant has been fully Informed about the nature, conduct and risks of the above study.

Sanele Kheswa **11/05/2022**

_____ _____ _____

Full Name of Researcher **Date**

Signature

_____ _____ _____

Full Name of Witness (If applicable) **Date**

Signature

_____ _____ _____

Full Name of Legal Guardian (If applicable) Date

Signature

Appendix C: Questionnaire

QUESTIONNAIERE

Instructions: Please complete the following questionnaire relating to your experience by making a tick (√) against the appropriate answer below.

Title: Assessment of lean Manufacturing Practices and Strategic Sustainability in Toyota South Africa M.

DEMOGRAPHIC DETAILS

3. **GENDER**

Tick relevant option √

Male	1
Female	2

4. **AGE**

Tick relevant option √

<19	1
20 – 29	2
30 – 39	3
40 – 49	4

50 – 59	5
>60	6

3. RACE GROUP

Tick relevant option √

African Black	1
White	2
Indian	3
Coloured	4

6. LEVEL OF EDUCATION

Tick relevant option √

Matric	1
Diploma	2
Degree	3
Honour' s Degree	4
Master's Degree	5
PhD-Degree	6
Other	7

7. EMPLOYMENT STATUS

Tick relevant option √

Vice President (VP)	1
General Management (GM)	2
Senior Management (SM)	3
Section Manager	4
Junior Management (supervisory)	5
Team Leader	6
Non-management	7

SECTION 2:

BUSINESS ACTIVITIES

6. NUMBER OF EMPLOYEES

Tick relevant option √

0 - 4	1
5 - 19	2
20 – 49	3
50 - 100	4
>100	5

7. NUMBER OF YEARS IN THE COMPANY

Tick relevant option √

Number of years in the company

< 5	1
6- 10	2
11- 20	3
21- 30	4
31- 40	5
>40	6

8. In which of the following field(s) you qualified for or trained?

(Please note that from this question, you are free to tick more than one answer)

Tick relevant option √

Business studies unit	1
Entrepreneurial studies and	2
Leadership studies	3
Engineering studies	4
Human resource management	5
Marketing and retail	6
Operations and quality management	7
Public management	8
Supply Chain Management	9

Other 10

9. I have received training in the following tools in my organisation:

(Cross as many as applicable)

5tei	**1**
Kanban	**2**
Kaizen	**3**
Continuous improvement	**4**
5S	**5**
Toyota Production System (TPS)	**6**
Standardized work	**7**
JIT	**8**

10. Which way of communication does your organisation use to communicate with employees?

(Please note that from this question, you are free to tick more than one answer)

WAYS OF COMMUNICATION(S)	Tick relevant option √
Private letters	1
Memos	2
E-mails	3

Faxes	4
Telephone	5
Meetings	6

11. In my view the most important aspect in my organisation is:

(Tick only one)

To satisfy customers	**1**
To satisfy the management	**2**
To satisfy my needs	**3**
To contribute to the objectives of the company	**4**
To develop myself or my career	5
Other	6

12. In my view the most important aspect to successfully implement lean principles is:

(Tick only one)

Communication	1
Management commitment	2
Union-management relationship	3

Training	4

13. Which of the following factors affect quality?

(Please note that from this question, you are free to tick more than one answer)

FACTORS

Tick relevant option √

Lack of training	1
Lack of management support	2
Poor planning and control	3
Not following standardise work	4
Tools not up to standard	5
Negligence	6
Negative attitude	7

14. Section 2: business activities (Likert Scale) - Quantitative method (Closed-ended questions)

Please indicate your response to the following statements regarding the lean manufacturing practice.

Perception on lean	Strongly	Agree	Neutral	Disagree	Strongly

manufacturing practices	agree 1	2	3	4	disagree 5
Lean tools are applied to assess the current layout for the potential improvement.					
Lean means developing a value stream to eliminate all waste, VSM should be used to determine the wastes of transportation.					
My organisation is supporting my personal growth through Human Resource Development.					
Cost, and hence the sales price, is clearly linked to leanness. Keeping components inventory to a minimum level can decrease the cost and provide a desirable pricing to customers.					
My input is considered in problems solving and finding the root cause.					
I understand all seven types of waste.					

SECTION 3:

SHORT-QUESTIONS

15. What strategic sustainability factors are in place to sustain the business for a long time and stay competitive in market?

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16. What are quality measures that the business has put in place to ensure high quality product is achieved to be more competitive and potentially dominate the market?

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17. How is lean/TPS adopted as a practice at the business and what unique practices can be identified?

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18. What would the business recommend as its future practices in manufacturing sector, large and small-medium enterprises?

To continue practicing:

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To stop practicing:

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19. How would you describe the level of communication in your organisation?

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20. What advice would you give to the organisation and other manufacturing sectors to improve quality management?

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21. What advice would you give to the organisation to avoid from financial crisis?

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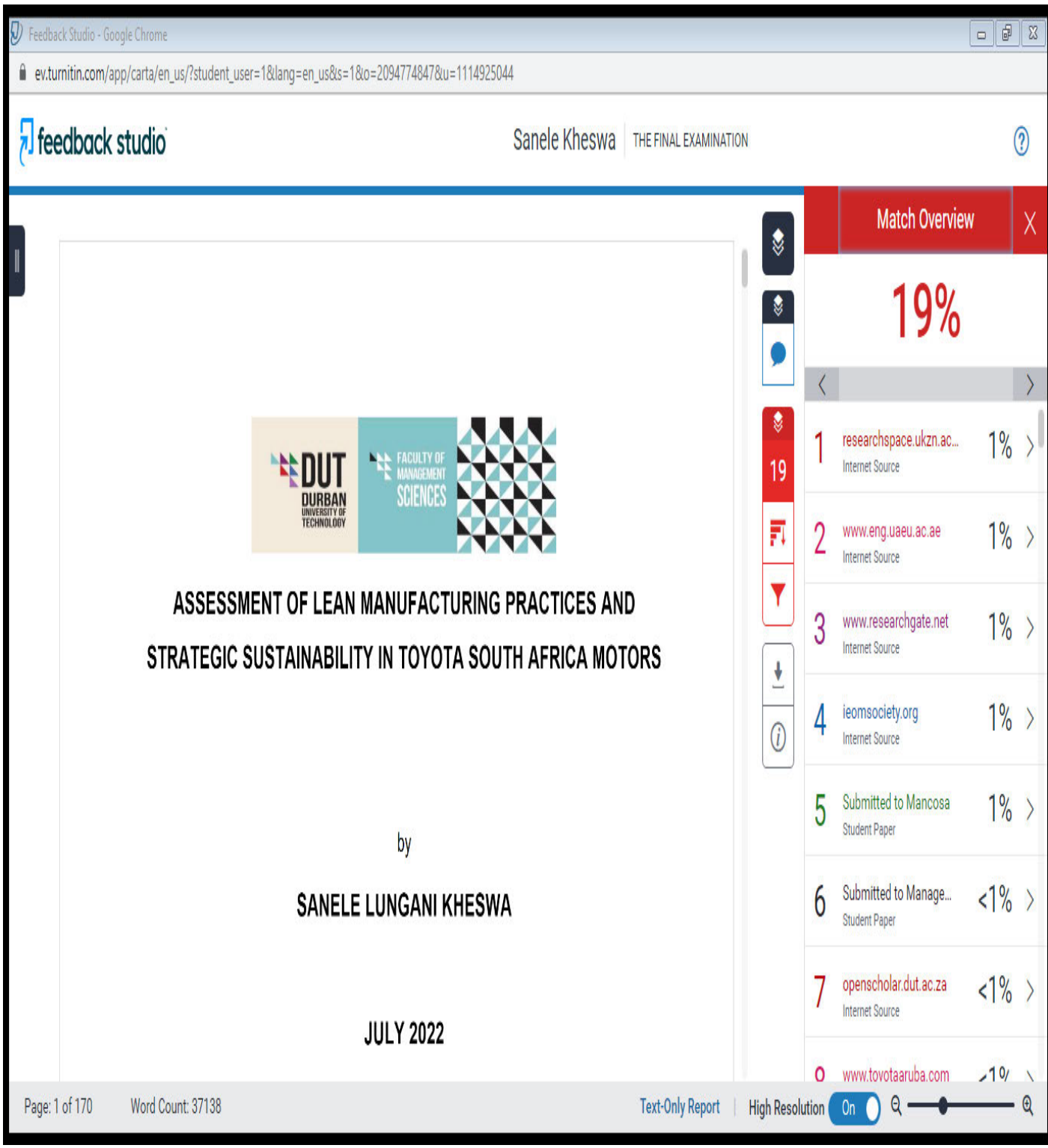
Thank you for your participation.__

Appendix D: Turnitin report



Appendix E: Location of the study (TSAM)

Appendix F: Editor's Letter

Tracy Khuzwayo
Editor

47 Thomas Halstead Drive
Sea View
Durban, 4093
(+27)78 208 5052
tracykhuzwayo126@gmail.com

To whom it may concern,

This letter serves as a formal confirmation of my services as editor for the master's student Sanele Kheswa (student 20705789) from the Faculty of Management Sciences at the Durban University of Technology (DUT)

I was responsible for proofreading and editing Mr. SL Kheswa thesis. I am a registered editor on the DUT editor's list and have been so since 2017. I submitted the thesis to the student on the 25th of April 2023.

If there is any further information that is required, please feel free to contact me via email or phone using the details listed below.

Yours sincerely,

Tracy Khuzwayo
Editor
(+27)78 208 5052
tracykhuzwayo126@gmail.com

Faculty of Management Sciences
Tromso Annex
1st Floor, Gate 1
Steve Biko Campus

Appendix G: Ethical clearance

Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd Floor, Berwin Court
Gate 1, Steve Biko Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2375
Email: lavishad@dut.ac.za
http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

13 June 2022

Mr S L Kheswa
9398 Illovo T/ship
Winklestruit
4126

Dear Mr Kheswa

Assessment of lean Manufacturing Practices and Strategic Sustainability: a case study of a manufacturing organisation in KZN
Ethics Clearance Number: IREC 027/22

The Institutional Research Ethics Committee acknowledges receipt of your notification regarding the piloting of your data collection tool.

Kindly ensure that participants used for the pilot study are not part of the main study.

Please note that FULL APPROVAL is granted to your research proposal. You may proceed with data collection.

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the IREC according to the IREC SOP's.

Please note that any deviations from the approved proposal require the approval of the IREC as outlined in the IREC SOP's.

Yours Sincerely

Prof J K Adam
Chairperson: IREC

Appendix H: Gatekeeper letter

To:	Chief Executive, Toyota South Africa Motors (TSAM)
From:	Sanele Khoswa, Team Leader, Toyota South Africa Motors, Corolla Assembly Plant
Date:	20 March 2022
SUBJECT:	**REQUEST FOR PERMISSION TO CONDUCT RESEARCH WITHIN TOTOTA SOUTH AFRICA MOTORS (TSAM) AND WITH EMPLOYEES AS PARTIAL FULFILLMENT OF MASTERS DEGREE IN THE PHILOSOPHY OF QUALITY MANAGEMENT.**

PURPOSE:

1. The aim of this submission is to request permission for myself, Sanele Khoswa to conduct research within Toyota South Africa Motors employees; as partial fulfillment of my Master's Degree qualification

BACKGROUND:

2. I am currently registered for my 4th year of my Master's degree in the Philosophy of Quality Management through Durban University of Technology (DUT).
3. I have thus far, completed three years towards my qualification which was funded by the University as a full-time student.
4. I am in my final year of my Master's degree and I am required to conduct research as per the topic of my dissertation.
5. The title of my study is: **"Assessment of Lean Manufacturing Practices and Strategic Sustainability: a case study of manufacturing organisation in Durban, KZN.**

DISCUSSION:

The study also addresses the following objectives:

- To assess the extent of lean manufacturing practices at TSAM in order to identify challenges and good practices.
- To determine the quality measures that has been implemented to improve product quality and competitiveness.
- To recommend strategies that can be employed to improve productivity and sustainability

1

FINANCIAL IMPLICATIONS:

6. There will be no financial implications as the study is funded by the University.

BUDGET IMPLICATIONS:

7. None

RECOMMENDATION:

8. It is recommended that the request to conduct research as part of Master's degree be approved by the Section Manager, SM, GM, VP, and HR Department.

Compiled by:

Sanele Kheswa

Team Leader, Assembly Corolla

Date: 20 March2022

Recommended by/Not Recommended:

Section Manager

Date: 24/03/2022

Recommended /~~Not Recommended~~ by:

SM: Production

Date: 28/3/2022

Supported/Not Supported by:

GM: Production

Date: 24/03/2022

~~Approved/Not Approved~~ by

Human Resources

Date: 22/4/2022

VP/SVP

Date: 22.04.2022