Lean manufacturing strategies in small and medium enterprises: A case of a Durban shoe manufacturer

By

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DECLARATION

I, Nikita Reddy, declare that:

(i) The research information reported in this dissertation, except where otherwise indicated, is my original work.

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Nikita Reddy **Signature** **Date: 3 December 2021**

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ABSTRACT

The study explores lean manufacturing strategies concerning supply chain processes in the shoe industry. These processes have been mainly difficult as the practices involved cannot always be automated which leads to large amounts of wastage. There has also been an increase in consumer demand for quality products to be delivered in a short space of time at the lowest price. This type of manufacturing process results in a high volume of waste that contributes to increased costs. This study addressed all the research questions incisively from which rich and detailed data emanated which identified and assessed lean manufacturing challenges faced by small and medium enterprises in eliminating manufacturing waste that emanated from overproduction, transportation and motion mismanagement, and inappropriate processing skills, among others. The study employed a qualitative methodology and utilised data collection techniques such as interviews and observations involving all employees categorised as product coordinators, pre-production staff, and factory supervisors who are critical in planning, designing, material handling, and administrative responsibilities at production sites. The value stream mapping and eight common reasons for waste in manufacturing processes were considered in the case study by engaging a Durban shoe manufacturing company. There was a distinct identification of waste being a non-value-adding component which involved internal delays, over-processing, and non-delivery or late arrival of raw materials. These findings revealed that non-value-adding activities, increase costs and compromises quality in the production of ladies' sandals and closed-fitting shoes. The recommendation is that shoe manufacturers adopt lean methods to minimise wastage generated during unsound manufacturing processes. These lean methods consist of standardisation of work, 5S, and Kaizen which all minimise waste in manufacturing processes if applied strictly and consistently.

Key terms: kaizen, lean manufacturing strategies, non-value-adding, standardisation of work, value stream mapping

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS/ABBREVIATIONS

4IR:	Fourth Industrial Revolution
BOM:	Bill Of Material
CI:	Continuous Improvement
Cos:	Change-Over Times
CSM:	Current State Map
CTs:	Cycle Times
FSM:	Future State Map
GDP:	Gross Domestic Product
JIT:	Just In Time
LMM	Lean Manufacturing Model
NVA:	Non-Value-Adding
PCE:	Process Cycle Efficiency
PDCA:	Plan-Do-Check-Act
RFP:	Respect For People
RIG:	Research Information Gateway
SA:	South Africa
SACTLF:	South African Clothing, Textile, Leather And Footwear
SAFLIA:	Southern African Footwear And Leather Industries Association
SMEs:	Small To Medium Enterprises
TA:	Thematic Analysis
TPS:	Toyota Production System
TQM:	Total Quality Management
VSM:	Value Stream Map
WIP:	Work In Process
WHO:	World Health Organisation

CHAPTER ONE
ORIENTATION TO THE STUDY

1.1 Introduction

The concept of a shoe has mainly been interpreted in a wide, flexible, and versatile manner as it has varied connotations in our daily lives. There are different types of shoes but they all underwent similar manufacturing processes. These processes involve a range of departments that create room for large volumes of wastage in terms of raw materials, time, and labour. The Lean Manufacturing Model (LMM) was applied in this research as a total quality management tool in the shoe industry. Lean practices are considered to be ideal in adding value to manufacturing processes because of its many benefits. The adoption of these LMM principles is most likely to improve the swiftness of the system in response to order deviation in meeting consumer demands, in addition to eliminating wastage from the process. The shoe manufacturing industry experiences an enormous wastage commencing from pre-production to the finished product stage. The industry is comprised of the following departments: designing and sourcing, cutting and sorting, assembly, and the packing of the finished products department. According to (Bashar and Hasin, 2016), "lean tools can assist in the identification and steady elimination of waste, improvement of quality, and production time". Lean tools and techniques will be applied as a framework that will underpin this case study to determine how the South African shoe manufacturer can minimise waste in the production line.

1.2 Background of the study

The design and manufacture of footwear has evolved through the centuries following the development and modernisation of societies. Footwear was initially created for the safety of feet but has since transformed into many different categories of fashion and flair. These categories include safety wear for various industries, fashion statements, sports requirements for sports enthusiasts, and for withstanding environmental changes. There is simply no complete outfit or uniform without footwear. This has created an opportunity for many businesses to manufacture and sell footwear. The challenges arise when there's a rapid change in demand, or keeping up with current trends, globally and locally. The manufacturing of a shoe is a complex process for most of the different types of shoes in the market, and this has created a universal strain on the supply chain process. According to Ciasullo, Cardinali, and Cosimato (2018), supply chain is a complicated process in the shoe industry since most tasks cannot be automated due to rapid changes in the production of shoes. Globalisation is the driving force behind these changes. The current production system in the shoe industry engages a complex workstation with one assembly line (Ciasullo *et al*, 2018). This complexity causes low productivity, increased lead times in production, high reject rates, poor balancing in lines, and low flexibility of style change-over, among others. This may result in a high number of non-value-added activities (Kumar, 2018).

According to Kumar (2018), longer lead times were acceptable by customers before 1980 thus enabling producers to minimise production costs. However, in recent times as the economy progressed, customers are now demanding shorter lead times. Order quantity variances have also contributed to this problem. Earlier, companies received bulk orders at once, and this activated production lines for an entire month. The small order quantities and complex designs are major contributing factors that force shoe factories to produce multiple styles within a day (Kumar, 2018).

Lastly, some industries adhere to a high work-in-process (WIP) rate in traditional batch production. This causes an increase in the revised work level and through-put time which results in high defects and style change-over. This negatively impacts the control of the production flow. This research study focused on the production of shoes in small to medium enterprises (SMEs) to determine whether the implementation of the lean manufacturing model contributes to the reduction of costs, improves quality, and minimises waste.

1.3 The Research Problem

The survival of the shoe manufacturing industry in the current global competitive market is dependent on an effective and efficient production process (Ciasullo *et al*, 2018). Further, the deviation of order regarding quantity, increasing demands for quality at the lowest prices, and high customer demands, may compromise an effective and efficient production process. Kumar (2018) maintains that lean manufacturing initiatives such as the use of advanced technology and craftsmanship plays a vital role in the shoe industry to accommodate such demands. However, not all aspects of producing footwear can be automated using modern technology. Some scholars are of the view that despite having such lean initiatives in place, failure of the production process may originate from "lack of supply chain integration, lack of commitment from leadership, and poor understanding of lean tools and techniques" (Almanei, Salonitis, and Tsinopoulos, 2018:1160). This has unsettled SMEs in South Africa as they now have to meet the demand for quality goods at the best price in order to survive in the shoe market. As a result, for SMEs to remain competitive, they are tasked to deliver high quality goods at reduced prices with minimal waste. Therefore, this study identifies the eight common factors that contribute to waste in the shoe manufacturing industry.

1.4 The Purpose of the Study

The purpose of this study was aimed to identify the eight common factors that contribute to waste in the shoe manufacturing industry to which a local SME adopts lean tools and techniques to improve quality, reduce costs, and minimise waste to meet the demands of the competitive South African shoe manufacturing industry. Value Stream Mapping (VSM) was administered on two batches of the shoe production line to ascertain the presence of the eight types of non-value-adding activities that hinder maximal functioning. It was envisaged that the results and recommendations of this study are considered by shoe manufacturing industries such that they apply the LMM to be at the cutting edge of the competition.

1.5 Research Questions

1.5.1 Main Research Question

To what extent does the local SME adopt lean tools and techniques to minimise non-value activities in the production of shoes for the South African market?

1.5.2 Subsidiary Questions

- How does overproduction, and inappropriate manufacturing and handling processes, contribute to waste?
- How does the relationship between defects and inventory contribute to waste in shoe production?
- What is the relationship between transport and motion, and how does this contribute to waste production?
- Why does a delay in production, and the non-utilisation of talent, contribute towards waste?

1.6 Research Aim and Objectives

1.6.1 Aim of the research

The study aimed to explore lean manufacturing strategies concerning supply chain processes in the shoe industry.

1.6.2 Research Objectives

- To determine what lean tools and techniques are adopted by the local SME in the manufacturing of shoes for the South African market;
- To assess the extent to which the relationship between defects and inventory contributes towards waste in shoe production;
- To explain the relationship between transport and motion regarding its contribution towards the production of waste in the shoe production;
- To investigate the causes for delays in production, and the non-utilisation of talent that contribute towards waste in shoe production.

1.7 Literature Review

1.7.1 Value stream mapping

According to Nasir, Minhas, and Sweden, (2018:48), "the value stream mapping is one of the lean practices, that helps to visualize the whole process and identifies any bottlenecks affecting the flow". The effective management of the value stream can significantly contribute towards waste elimination by categorizing process activities to be either value adding or non-value-adding (Nasir *et al*,2018). Lean development focuses on the value through the elimination of waste. The value stream mapping will help to identify the material and information flows within the organisation. The value stream map will also help focus on areas that require improvement or has a large amount of wastage. A Durban shoe manufacturer an SME in South Africa, gathers information from the customer and then formulates a ticket which is sent to the relevant department to start processing and action movement of material from one department to the next.

1.7.2 Lean manufacturing

Lean manufacturing is a logical and systematic way of finding and eliminating waste that attributes to all non-value adding activities to the final product. Lean principles and tools are used to improve the efficiency and effectiveness of production. This concept was invented by Taiichi Ohno (1912 –1990) and introduced to Toyota as a Toyota Production System (TPS) intended to eliminate waste (Soliman, 2017). According to Kumar (2018), "waste takes on various forms and can be located at any time and in any place". Womack, James, Jones, and Daniel (1997) and (Elmosalmi and Ibrahim, 2020), proposes that this may be present in processes, product designs, hidden policies and in operations. Waste is also known to consume resources with products that have no value adding features. According to Chanarungruengkij, Saenthon, and Kaitwanidvilai, (2017), by using the lean method, the company can optimize its profit and achieve the lower resource primary to the minimum cycle time, lead time, and inventory. Hence, the profit, morale, customer satisfaction, and accident records in the company will therefore improve.

1.8 Conceptual Framework

There are seven categories of non-value-added waste in a production frame in which lean manufacturing can assist, and they are: alleviating over-production of work in progress inventory, warehouse inventory, transportation of components, waiting for preceding processes, the motion of unnecessary operations, inappropriate processing, and correction of defects (Elmosalmi and Ibrahim, 2020)(Elmosalmi and Ibrahim, 2020)(Elmosalmi and Ibrahim, 2020). According to a study by (Rathilall, 2011), untapped employee creativity is another type of waste that was identified and added to the set of non-value-added activities as the eighth category. According to Mia, Nur-E-Alam, and Uddin (2017:403), "the footwear industry's response to the increasing problem of internal and external consumer shoe waste has been negligible". It is noted that the footwear industry over the last 20 years emphasised the importance of improving material efficiency during the production phase. These eight waste categories serve as a framework to implement waste-minimising strategies to decrease shoe production costs to be locally and globally competitive.

1.8.1 Waste of Overproduction

"Over-production by definition induces excess inventory in the form of Work in Progress (WIP) and is regarded as the most important source of waste since it prevents immediate correction and improvement. There is no value added to these parts or products if they are kept in stock. It leads to higher costs for storage, excessive lead times, and difficulty in detecting defects (Bozarth and Handfield, 2019)."

1.8.2 Waste of Inventory

Inventory by definition is made up of various types of stock such as raw material, work in progress and finished products. It is also regarded as the opponent of quality and productivity according to Santosa and Sugarindra (2018). "It is closely associated with over-production as it tends to increase lead-time, space and prevents the rapid identification of problems that discourages communication. The implication is that unnecessary inventory creates significant storage costs which lower the competitiveness of the organisation or value stream wherein they exist" (Bozarth and Handfield, 2019:431) . The concept of waste of inventory is significant as it identifies high inventory conditions that reveal hidden inefficiencies that hinder production performance and have a negative cost impact on the manufacturing process and ultimately the final cost.

1.8.3 Waste of Transport

The waste of transport is generally identified as moving products from one location to another (Santosa and Sugarindra,2018). "Transportation waste involves many movements of materials in an organisation. Transporting parts or products from one location to another does not add any value, but rather creates added manufacturing lead times" (Bozarth and Handfield, 2019:431).

1.8.4 Waste of Waiting

The waste of waiting can be attributed to many different factors during production. In a manufacturing environment, this type of waste occurs whenever goods are not moving or being processed (Santosa and Sugarindra, 2018). "It is a type of waste that results from ineffective use of time and occurs whenever employees or parts wait for a cycle to be completed. The waste of waiting is directly relevant to continuity because lean manufacturing is concerned with the continuous flow of the product" (Bozarth and Handfield, 2019:431).

1.8.5 Waste of Motion

Unnecessary motion is a type of waste that refers to the ergonomics for quality and productivity which consumes time and energy (Santosa and Sugarindra, 2018). “This type of waste is most often revealed in the actions of operators as they search for tools, their selection and placement of tools and parts that are kept out of immediate reach of the workstation, and the time spent walking among machines between workstations” (Bozarth and Handfield, 2019:431)

1.8.6 Waste of Inappropriate Processing

The waste of inappropriate processing is characterised by unnecessary tasks that employees perform in the product flow (Santosa and Sugarindra, 2018). Inappropriate processing occurs in situations where overly complex solutions are found for simple procedures such as using a large fixed machine instead of small flexible ones. (Bozarth and Handfield, 2019).

1.8.7 Waste of Defects

The waste of defects occurs as a result of poor-quality work (Santosa and Sugarindra, 2018). “Defects, rework, scrap and inspection generate wasteful handling, time, and loss of additional effort which delays productivity and stops the smooth flow of the production process. In particular, defects are regarded as bottom-line waste as these bear direct costs to the organisation” (Bozarth and Handfield, 2019:431).

1.8.8 Waste of non-utilised talent

Ismail and Yusof (2016), claim that this type of waste refers to the under-utilisation of employees’ creativity, talent, skills, and knowledge. There is also the concern in which the human potential should not be set free. This means that the communication channels between employees and management should be clearly defined. Employees should clearly understand what is expected from management and management should also understand what is expected from employees.

1.9 Significance of The Study

This study contributes to the body of knowledge in the sense of applying a model which simplifies complex processes to meet consumer-expectation and demands in the manufacturing industry. Many companies can benefit from this lean model as it is simple and cost-effective to apply. This is also an academic contribution that may precipitate further research concerning the supply chain of products such that it can assist in unpacking other supply chain issues with similar processes in the shoe industry.

1.10 Justification for This Study

The lean manufacturing model (LMM) is key in boosting the productivity of a manufacturing line by minimising wastage and shortening lead times whilst improving quality to attain maximum growth in a highly competitive industry. This study is important in investigating the extent to which a major supply chain tool can elicit change in production whilst instilling quality into the company's product from the design stage to the finished product stage. This will serve as a platform to investigate the reasons for wastage in shoe production, and then suggest strategies on how improvements can be implemented. It further aimed to assist the SMEs to expand their knowledge (and profits) in the shoe manufacturing industry while creating more employment which will positively contribute to the economy of the country.

1.11 Limitations of The Study

According to Bryman and Bell (2019:105), "the study will employ a judgment sampling design, although an advantage of this kind of sampling technique is that the study could provide a springboard for future research, there is a limitation in that the study cannot be generalised". The impact on the pandemic of Covid-19 has restricted the contact between persons as well as the initiation of shutdowns on operations in the manufacturing of non-essentials. Which has a direct impact on the method of research conducted and as a result to conduct interviews without direct contact.

1.12 Delimitations of The Study

To remedy the foreseeable limitations, letters of authority to conduct the study were obtained ensuring that all Covid-19 protocols were implemented and followed. The research instrument was sent to participants in advance in order to afford them sufficient time to respond. The results and limitations of this study would be a good starting point for exploring future research needs concerning the identification of the eight-common waste in shoe manufacturing.

1.13 Ethical considerations

To overcome these constraints, firstly the letter of consent to conduct the study was obtained from the gatekeeper as well as anonymity of respondents were maintained. Secondly, the participants received the research instrument in advance to afford them enough time to respond. This was done through email and arrangements were made with participants to ensure receipt of the interview questionnaires. The instructions were clear and no further engagements were required.

1.14 Dissertation Outline

Chapter 1: Introduction

This chapter provided the introduction, background, value, significance, chapter layout, aim, objectives, and research questions of the study. It also included a brief conceptual framework, definition of terms, and the limitation of the study.

Chapter 2: Literature Review

Chapter two discussed in detail the conceptual framework for the study by examining the literature on the internal lean processes of a Durban shoe manufacturing company. The conceptual framework of the 8 common wastes in manufacturing of shoes was elaborated on.

Chapter 3: Research Methodology

This chapter explained the research design together with the research procedures and methodological frameworks. It discussed the process of the research that was conducted, the research design that included the data collection strategies, and analysis of the data. It explained the background and demographics of the population, selection criteria, sample size, and sampling method. The ethical considerations of the study were also articulated in this chapter.

Chapter 4: Data Analysis and Interpretation of Results

This chapter presented the data and the use of NVIVO to assist in sorting the raw data before it is analysed. Thereafter data was classified, sorted, and examined through the various relationships where themes will be drawn for interpretation. Tables and figures are displayed visually in graphs and diagrams for easy interpretation and sense-making by the reader.

Chapter 5: Discussion of Results and Presentation

This chapter explained the results outlined in chapter four. The results were examined against the conceptual framework, guided by the aim, objectives, and research questions of the study as outlined in chapter one.

Chapter 6: Recommendation and Conclusions

This chapter outlined the conclusions and recommendations based on the findings. It concludes the study by confirming that the research objectives have been achieved. Future research will be recommended for any gaps evident in the topic that was under study."

1.15 Conclusion

This chapter introduced and provided the background of the study. It also outlined the conceptual framework, research aim, objectives, research questions, limitation, and chapter layout. It contextualised the topic and explained the current need for the study. Additionally, this chapter presented the problem statement, ethical considerations, justification and significance of the research study, as well as the researcher's expectations of the study. The next chapter provides a literature review and the conceptual framework underpinning the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The previous chapter outlined and introduced the study. This chapter will then provide a detailed discussion of the conceptual framework for the study which examines current literature on internal lean processes of shoe manufacturing sector. In addition, a critical review of the shoe manufacturing industry from the South African and international perspectives was conducted using the lean manufacturing model (LMM) as a framework to underpin this study. The chapter begins with the evolution of the shoe manufacturing industry followed by its perception of the lean manufacturing model.

2.2 Global Evolution and Shoe Manufacturing

The shoe is regarded as a useful object throughout the context of civilisation. It is known to have been developed to serve as a form of protection for the feet. It has further evolved, especially in style, in keeping with changes in consumers’ needs and wants. The perception of the concept *footwear* has become increasingly complex. The emphasis between aesthetics, functionality, innovation in technology, and materials are the contributing factors for this complexity. The footwear industry is therefore characterised by a supply chain specialising in manufacturing each part of the shoe, and for the different kinds of activity that it is used for. Components of the shoe include the sole, heel, upper sole, and the inners; finishing works and decorations consist of cutting, assembling, embossing, micro-injection, laser-cutting, and engraving. The consistency of the supply chain is defined in the type of shoe (e.g. fashion, sport, work, and uniform) and the kind of material used [leather, textile, cork or plastic] (Di Roma, 2017).

Today, the footwear industry is focused on the implementation of advanced manufacturing systems such as additive manufacturing, 3D printing, robotics, machinery, 3D scanning, and remote use. In the context of the fourth industrial revolution (4IR), Adidas (which is promoted by the German Government), the sports shoe brand, after years of delocalised productivity strategies, brought back their production section to Germany. The introduction of speed-factory-supply-chain was thus redesigned in Germany. In addition to technological advancement and upgrades of specific performance related to the different types of shoes for the different target markets, speed-factory-supply-chain is now a distinct reality supported by coding, postural attributes, and bi-dimensional and three-dimensional scanning systems. Technology supports these requirements from reverse engineering to rapid manufacturing design programmes assisted by laser engraving machines (Di Roma, 2017).

Numerous industries have embraced the popular Continuous Improvement (CI) approach which is enhanced by the lean manufacturing model. However, several studies have confirmed that the low success rate of lean implementation can be attributed to the limited focus on lean tools and techniques at the expense of the human factor, as expressed in the *Respect for People* (RFP) principles mentioned in lean literature (Almanei, Salonitis, and Tsinopoulos, 2018).

2.3 Shoe Manufacturing: The International Perspective

The global map of industrial production is in a state of extraordinary 'unrest' as a result of China's spectacular rise and success in becoming a central player in the world economic ring. Shoe manufacturing on a large scale takes place in more labour intensive markets like China. According to Hanson (2021), "China's accession to the World Trade Organization in 2001 resulted in Government removing barriers to exporting, lowering of tariffs on imports, expansion of the sectors where foreign investment was permitted, consolidated smaller and uneconomical state-owned enterprises, and allowed labour to move from rural farms to urban factories" (Hanson, 2021:3). This helped transform China into the world's factory. The country's most significant growth in output has occurred in exporting consumer goods such as clothing and footwear. Exports from China have flooded global and local markets such as South Africa that has also earned the label of the 'world's factory'. In 2008, China's GDP became the world's third-largest. The footwear industry represents a clear example of China's rise in the manufacturing sector (Hou, Gelb and Calabrese, 2017).

The footwear industry is labour-intensive and has a relatively low barrier to entry, which results in its continuous restructuring. Mechanisation and standardisation of the production process have reduced obstacles for developing countries to enter the industry and engage in the mass production of shoes. Improvements in transportation, communication, and the global integration of markets have also made production outside the country of origin quite profitable. Moreover, the developed countries have outsourced and dispersed low-end-production to developing countries, while attempting to maintain their competitiveness in the high-end markets by improving quality and moving up the global value chain (Hou *et al.,* 2017).

The shoe industry also plays a significant role in the Indonesian economy. According to statistics, Indonesia's leather and footwear industries contributed approximately 0.27% of the Indonesian GDP in 2018. The Indonesian Minister of Industry, Airlangga Hartarto, stated that the number of footwear producers in Indonesia had nearly reached "33,000 in 2017, of which 49.62% were located in West Java with approximately 115 000 employees. He further noted that the Indonesian footwear industry was among the top 10 in the world and that the Government of Indonesia was committed to continuously creating programmes to support SMEs in the footwear industry" (Antonio and Kusumastuti, 2019,92). A study by Gordon Hanson (2021,3) reveals that "In 2018, the top 14 such countries accounted for 19.2% of global exports in labour-intensive manufacturing industries (where the next 30 countries accounted for less than 3% of these exports). Hanson (2021:3) adds that this group includes economies in South Asia (Bangladesh, India, Pakistan, and Sri Lanka), Southeast Asia (Cambodia, Indonesia, Myanmar, and Vietnam), Eastern Europe and the Mediterranean region (Bulgaria, Morocco, Poland, Romania, Tunisia, and Turkey).

2.4 Shoe Manufacturing in South Africa

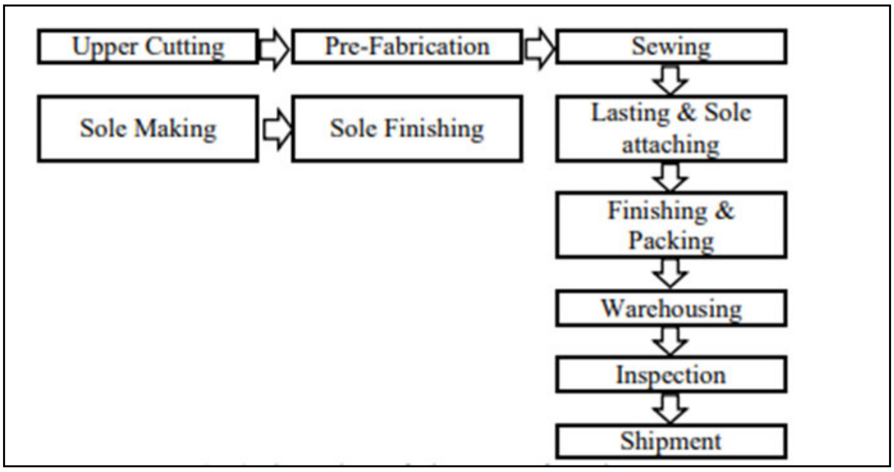
The South African footwear industry, a sector that includes the manufacturing, wholesale processes, importing and retailing of fashion-designed shoes, slippers, boots and safety shoes, is proving resilient in the face of tough economic conditions. The South African clothing, textile, leather and footwear (SACTLF) industry in South Africa (SA) contributes to the country's manufacturing sector. However, according to Mbatha, (2021), the SACTLF industry has lost its competitive advantage due to various challenges such as poor technological systems, lack of advanced skills, and a simplistic domestic value chain. Furthermore, South Africa has an inadequate supply of raw materials that are essential for domestic demand. Mbatha, (2021) adds that a lack of fabrics in South Africa promotes importing of lower-priced raw materials.

Shand (2018) confirms that the South African Footwear and Leather Industry Association (SAFLIA) caters for the local market demand for footwear which totals 248 million pairs. Although local manufacture increased from 60.8 million pairs of shoes in 2015 to 66.8 million pairs in 2016, an estimated 73% of all footwear items are imported. However, footwear imports decreased in volume by 7.6% to 181.1 million pairs, from 196 million pairs in 2015 (businesswire, 2018). According to Hanson (2021;3), "China is responsible for nearly 90% of all the footwear imported into South Africa. China's share of world manufacturing exports rose from 2.8% in 1990 to 6.8% in 2000, and to 18.5% at its peak in 2015." This has shaken SMEs in South Africa, as they must now match the demand for high-quality items at the lowest possible price in order to stay afloat in the shoe market.

2.5 Shoe Manufacturing Process

Shoe manufacturing is a labour-intensive process which cannot be fully automated. It requires craftsmanship in each phase of the production. More than a hundred operations are required for making a pair of shoes. With the introduction of footwear machines, the production time has been reduced, and processes are performed separately. Depending on the type of shoes and its material, the manufacturing process can vary. These processes include the combined efforts of various departments with the shoe factory: the technical designing department, the styling, closing (sewing of upper components of the shoe), clicking department (cutting of bottom and upper components), lasting and making department, and the finishing department (gluing and packaging). Figure 2.1 (below) shows the process of shoe manufacturing and the two components that form a shoe - the upper and the sole (bottom stock). Therefore, the manufacturing of shoes involves a variety of processing steps from pattern development to the finished product (Abu Jor, Alam and Alam, 2018).

Figure 2. 1: Processes in shoe-manufacturing



Source (Abu Jor *et al*, 2018)

The next section covers an in-depth review of lean manufacturing and value stream mapping and their application to industry, as well as a critique of lean manufacturing methods. This then forms a basis for the conceptual framework on the eight-common waste in operations.

2.6 Lean Manufacturing

Lean manufacturing is a common practice in production that considers the judicious use of resources (Dieste, Panizzolo, Garza-Reyes and Anosike, 2019). An organisation's cultural transformation leads to the implementation of new and astute methods for an organisation to operate successfully. The move towards lean-thinking requires multi-skilled staff to introduce new approaches to conduct business throughout the organisation. Toussaint and Berry (2013), claim that the implementation of the lean model involves a continuous process to attain the ultimate goal of waste elimination from inventory processes and the general operating environment (Toussaint and Berry, 2013).

Lean transformation focuses on continuous improvement which employs tools and techniques such as Kaizen, six sigmas, value stream mapping and the 5s (sort, straighten, shine, standardise and sustain) in order to eliminate waste and administer improvements to production and other areas of need (Odeyinka and Nwoye, 2019).

Lean management strategies that have been implemented by organisations have improved manufacturing performance through reduced costs, enhanced quality, and a quicker turn-around time. Adhering to lean principles minimises wastages in the value stream and thus improves the operations of organisations. In addition, lean processes contribute to the achievement of a high level of quality that favours SMEs to function successfully with small batch sizes and tight schedules. Lean Manufacturing has become the most influential paradigm in industry (Bozarth and Handfield, 2019).

The authors mentioned above have supported the fact that it is an effective method to improve competitiveness and agility. Although Lean Manufacturing was created for the automobile sector, many other industries have discovered that applying similar concepts can result in significant efficiency gains. Within the heating, ventilation and air conditioning industry, Das, Venkatadri and Pandey (2014) realised a 76% improvement in the productivity of air conditioning coils. The key Lean tools such as VSM, continuous improvement and TPM improved manufacturing capacity from 121 units to 214 units per shift. Similarly, Rohani and Zahraee (2015) found that by performing VSM studies within the paint industry, the implementation of Lean Manufacturing techniques (5s, Kaizen, Kanban) decreased production lead time from 8 days to 6.5 days and the non-value added time was reduced from 68 minutes to 37 minutes.

The essence of lean manufacturing is based on continuous improvement, which must reach all levels of employees and encompass all value streams or processes both internally and along the supply chain. (Ritamaki, 2017) affirms that the basic notion of continuous improvement should be founded on a culture of continual improvement that aims to eliminate waste in an organization. Continuous improvement in products and processes characterizes evolutionary changes, whereas revolutionary changes employ approaches such as process re-engineering and large product re-design (Bozarth and Handfield, 2019).

Kaizen is a Japanese concept for continuous improvement, and it's a vital approach for implementing lean manufacturing's "support-the-worker" principle (Krdžalić and Hodžić, 2019). It entails the continuous elimination of waste through incremental changes in procedures and quality, while also enhancing employee safety and lowering costs, according to Khan, Kaviani, Galli and Ishtiaq (2019). that successful Kaizen implementation requires the combined efforts of employees at all levels of the organization (Abdallah, 2021).

Kaizen events are designed to significantly improve the performance of the specified work area while also generating a favourable human resource outcome. According to Khan *et al*, (2019), Kaizen not only identifies better ways of working, but it also rewrites and redefines previously established standardised work. It is a practice that increases employee involvement (both management and shop floor) in the improvement process and facilitates the change process through proactive training. Similar views by Ritamaki, (2017) where management support is key to improving human resource outcomes in successful Kaizen events. Kaizen activities usually develop employees' skills to work effectively in small groups, to solve problems, to document and to improve processes and to self-manage within a peer group. Consequently, Krdžalić and Hodžić, (2019) confers that decision making is left upon the employees and requires open discussions and a group consensus before implementing any decisions. A basis of continuous improvement is the Plan-Do-Check-Act (PDCA) cycle. The cycle pertains to building a one-piece flow, revealing problems, countermeasures, and evaluating results in the context of waste elimination (Realyvásquez-Vargas, Arredondo-Soto, Carrillo-Gutiérrez and Ravelo,2018). According to Chakraborty, (2016), the PDCA cycle can be used to solve challenges in SMEs. In the 1950s, Deming adopted the PDCA method. The Japanese strongly supported the PDCA cycle and other quality concepts, and they refer to the PDCA cycle as the Deming cycle to honour Deming's contribution (Chakraborty, 2016). Therefore as supported by Chakraborty, (2016) and Realyvásquez-Vargas *et al*., (2018), the PDCA approach is employed across multiple levels in an organisation because it is part of the measurement cycle. Any problem situation should, however, follow the investigative process for the PDCA cycle to be effective. The planning phase identifies the problem or concern and establishes the goals and work plan. The following step is to put the improvement into action, after which the check phase evaluates if the goals were accomplished. Adopting the new standards and identifying additional improvements are part of the act phase (Realyvásquez-Vargas *et al*., 2018). The PDCA loop to close actions is a crucial enabler for any improvement endeavour. The last phase argues that an enabling process and a supporting management structure are required to allow for ongoing improvement. Another way to improve the flow of processes according to Rathilall (2011), is the Just in Time (JIT) methodology. Taichi Ohno, a Toyota executive, came up with the JIT concept in the 1950s as a way to improve smooth flow (Womack and Jones, 1997). JIT is a critical component of lean manufacturing because it encourages the use of visible factory controls, continuous improvement programs, and the transfer of more responsibilities to front-line workers (Taherimashhadi, 2018) .Furthermore, the goal of JIT is to improve profits and return on investment by systematically allocating and reducing wasteful activities at all levels of an organization. JIT's goal is to offer one part at a time when needed, which can be accomplished by reducing lot sizes, buffer sizes, and order lead times (Kortabarria, Apaolaza, Lizarralde and Amorrortu,2018). According to Xu and Chen, (2018), the parts moving between different processes in lots, product variants, and sequential JIT are the three levels of JIT. The sequential JIT level denotes that parts will be delivered on the line in order of arrival, and this can vary based on the nature of the items. JIT is commonly used among first-tier suppliers in the automobile industry (Xu and Chen, 2018.

2.6.1 Kanban System

According to Xu and Chen, (2018), a prerequisite for JIT production to perform smoothly is the Kanban system. The signal cards are referred to as "kanban" in Japanese. It's a system that automates production and service procedures so that personnel have the right part, at the right time, and in the right amount when they need it. Simple visual indications, such as the presence or absence of a part on a shelf, colour coded bins, cards, and flags, are used to accomplish this. Taking into consideration the aforementioned considerations, that the Kanban idea is the traditional signalling mechanism for production "pull systems." Kanban cards for specific WIP containers or batches provide information such as product name, part code, card number, batch number, lot size, and due date. When products are removed from a stocking location or a sub-assembly is used, the Kanban card indicates when to restock them (Bozarth and Handfield, 2019). The Kanban signal is returned upstream to the providing process once a particular quantity has been utilized, signaling replenishment(Asgari, 2019).

The advantages of Kanban, include visibility and control, operator empowerment regarding production-related decisions, improved communication across work centers, reduced manufacturing lead time, faster response to changing demand, and analysis of production history regarding capacity constraints, over-production, and delivery failures. Overall, a "pull system" necessitates enough inventory to meet customer service lead times and buffer against variation (Asgari, 2019).

2.6.2 Standardisation of work

According to Chan and Tay (2018), the principles of lean do not work well when everyone is allowed to choose their own work method or the work sequence in which he/she performs a job. This is because the outcomes would be unpredictable and it would be difficult to achieve flow and pull in the processes. Junior, Inácio, da Silva, Hassui and Barbosa (2022), highlighted that standardization is another key tool of kaizen, since an improvement typically involves a problem that is solved and standardization is to consolidate the new level of awareness(Junior *et al.*, 2022). Thus, in a working environment, where both products and processes are highly standardized, the critical role of continuous improvement is to ensure that processes stay within prescribed tolerances and closely follow the standard operating procedures. One of the key elements of standardized work is takt time (Bozarth and Handfield, 2019). It is therefore regarded as a heartbeat of a system. Takt time indicates the rate of customer demand for a product or a service in terms of time within which it needs to be finished (Chan and Tay, 2018).

2.6.3 Reasons for Lean Manufacturing Models

According to Almanei, Salonitis, and Tsinopoulos (2018:751), "the implementation of lean methods allows a manufacturer to streamline processes better throughout the entire organization, from the planning office, all the way to distribution". In practice, the full work potential of the operators is observed, and efficiency in production is noted. This results in an increased speed-to-market process, and reduced manufacturing costs.

The organisation firstly needs to recognise that there is a need for change, and the importance for lean operations to elicit positive change. Engaging in lean processes needs cooperation from all members of the team, as well as the supply chain participants. The utilization of lean techniques has allowed for a companywide assessment of manufacturing processes in many instances, which eventually builds teamwork and cooperation.

Defects in manufacturing a product contributes to additional costs such as repairing. The last type of wastage occurs in over-processing which occurs when a worker does more than what is required, which wastes time, energy and money (Almanei *et al.,* 2018). In other words, the implementation of lean manufacturing reduces waste, and consequently increases the productivity of the organisation. However, according to Sanders, Elangeswaran and Wulfsberg (2016), since the commencement of the first industrial revolution, the industry has been expanding in all directions, acquiring new technology along the way. The Japanese industries established a customer-value focused way of manufacturing called Lean Manufacturing in response to the western world's use of automation and computer-integrated technology to better their manufacturing. The shoe industry displays reluctance in the implementation of lean manufacturing strategies; these barriers need to be identified and investigated. This study identifies the waste in producing footwear. Over processing as a result can contribute to defects which therefore leads to the waste of time, resources and money.

2.6.4 Five Principles of Lean

Womack and Jones (1997), Ahlstrom (2004), and Martins, Fonseca, Ávila, and Bastos (2021) identify five core lean principles which determine the extent to which productivity is increased, wastage is reduced, and the time to manufacture the product is shortened. These principles are value, value streams, flow, pull and perfection. These five principles which are aligned to the research questions are discussed below.

2.6.4.1 Value

The first important principle is value, which requires an understanding of what the customer wants. The quest for value complements the pull theory where customers determine what services should be provided to them. According to Hussein, Sharif and Mohammed (2020), value is defined by the customer as something precious. Therefore, value can be viewed to assess the trade-off between benefits and sacrifices. In the lean manufacturing context, value is the understanding of what significance the customer assigns to a product or service. Therefore, massifcation of products, and made-to-order goods are elements that impact on the concept of value. The customer requires good quality, good prices, and swift delivery speed. Quality should always exceed the customer’s expectations with no exception, as it is the driving force behind an organisation’s success. A reliable, safe, and defect-free product, as well as excellent service, will help retain customers and maintain their loyalty. Non-value-added processes are those that customers are not willing to pay for as they add to cost and delay in delivery (Bashar and Hasin, 2016).

2.6.4.2 Value Stream Mapping

A value stream in the lean context is the totality of the product’s entire life-cycle from the raw material stage to the customer using it, and eventual disposal of it. An accurate and complete understanding of the value stream is central to the implementation of the lean model in order to eliminate waste. The focus is on the identification of the value, and once the value is established, it is essential for the process to capture the value stream map which should be available and transparent to all employees to observe all areas of work. In other words, a value stream map shows every step of the process, starting with the supplier and ending with the customer. As such, every step must bring the product closer to completion, and add value to it (Rohani and Zahraee, 2015).

2.6.4.3 Flow

A flow creates a value chain with no interruption in the production process; it is a synchronistic state where each activity is fully in-step with every other step (Parv, Deaky, Nasulea and Oancea, 2019). Obstacles along the process must be removed or dealt with timeously. The procedures to launch the product should be smooth without stoppages. The direction of the flow is important to allow integrated sequences to flow directly to the customer. Lean initiatives promote the smooth flow of each component of the product with no wastage in time, performance, and quality in order to deliver the right product speedily to the right customer (Rohani and Zahraee, 2015).

2.6.4.4 Pull

Pull is essentially a mechanism for limiting WIP. In the lean context, companies need to pull in everything that the market offers. Elmosalmi and Ibrahim, (2020) has supported literature based of Womack and Jones (1997) ,to see ‘pull’ as a manufacturing principle that ought to provide the product or service just when the customer needs it. To ‘pull’ simply means a fast response to a customer’s demand for quality service. Therefore, the pull system is regarded as the flowing of production and delivery processes from downstream to upstream (Mourtzis, Papathanasiou and Fotia, 2016).

2.6.4.5 Perfection

Perfection means to exceed expectation by ensuring continuous improvement and addressing root causes of challenges in maintaining quality (Botsane, Ozor and Mbohwa, 2019). In order to strive for perfection there must be a collaborative vision. Processes tend to slide downwards and lose their sustainability if the cycle of continuous improvement, or plan-do-check-act cycle, has not been repeated continuously.

2.6.5 Lean's Strengths and Weaknesses

According to Gyarmathy, Peszynski and Young (2020), the Lean manufacturing model contains inherent limits that do not account for the large range of situations that organizations face, therefore cannot be viewed as a universally applicable strategy. When customer demand is volatile and unpredictable, lean principles are ineffective or impossible to apply. In highly dynamic situations, the central concentration on excellence for specific market demands would not work. Some lean manufacturing approaches, such as flexible information systems or just-in-time production, are difficult and expensive to implement for smaller businesses. lean manufacturing limits flexibility, increases supply chain congestion, and is not appropriate for all industries(Gyarmathy *et al*., 2020).

Despite the fact that the majority of the literature in the preceding sections concentrates on the benefits of lean manufacturing. Munro (2019), implies that employees cannot be trusted to manufacture high-quality goods. The risk of human error must be eliminated from the system. As mentioned earlier, it is clear that lean manufacturing is not appropriate for all sectors. At the same time, according to Munro (2019), lean manufacturing raises concerns about employee trust. On the contrary, the research findings in the preceding sections show that lean manufacturing views personnel as the company's most significant asset.

2.6.6 Lean Success Factors

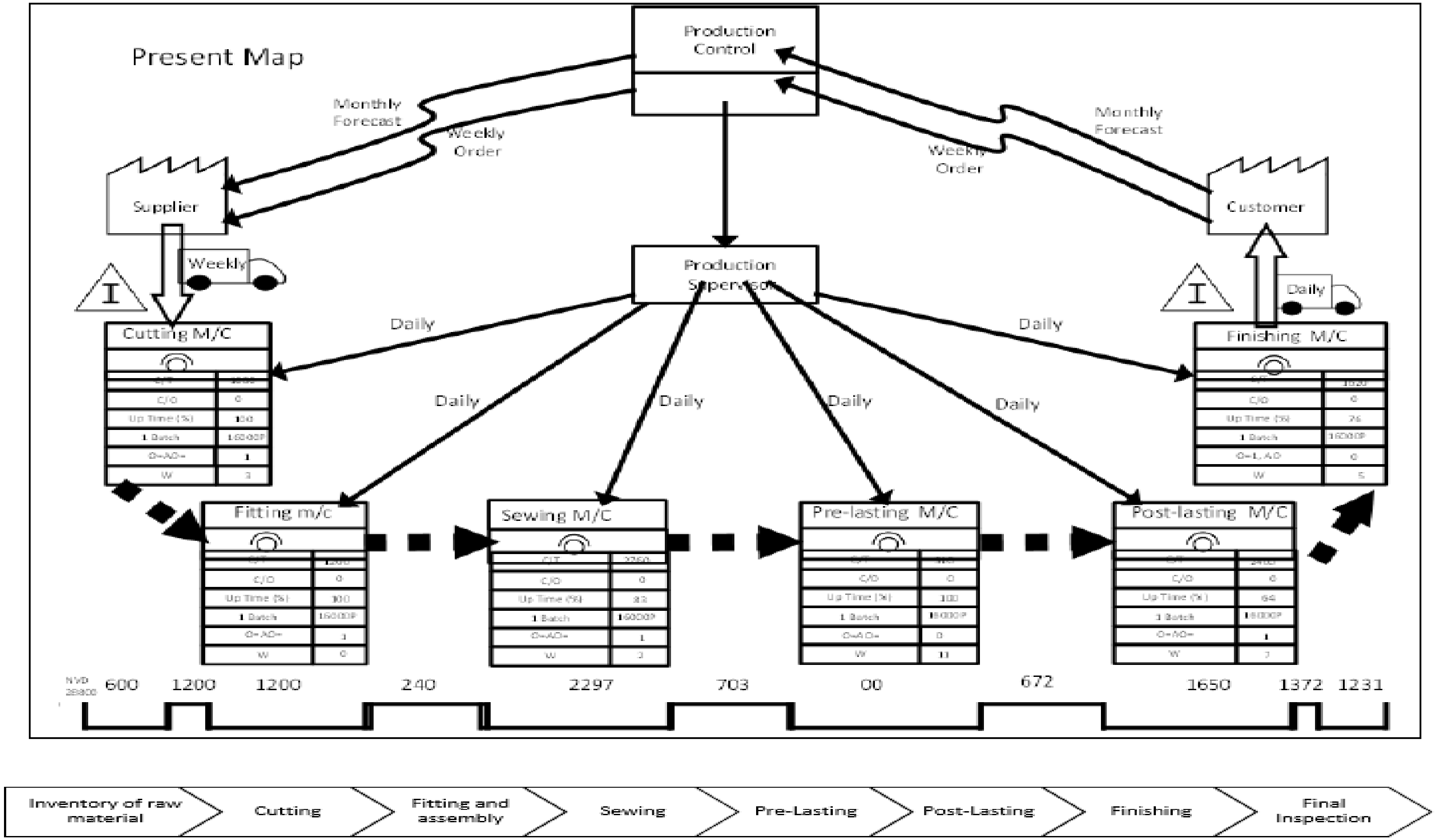
The two critical success criteria, cultural transformation and value stream mapping, are explored in the subsections that follow. According to Leksic, Stefanic and Veza (2020), the first step is to recognize that the benefits of lean manufacturing are only visible over time and do not fix short-term competitive issues. Successful lean manufacturing implementations require organizational cultural changes, new product approaches, customer satisfaction, and a high level of employee training and education from upper management to the shop floor (Atkinson, 2010). The customer is at the strategic level, whereas procedures and tools are used at the operational level. Understanding the overall lean manufacturing concept of generating customer value necessitates strategic lean thinking and operational lean production Resta, Powell, Gaiardelli and Dotti (2015)**.** Yadav, Luthra, Huisingh, Mangla, Narkhede and Liu (2020), argue that shop floor employee participation is essential for the effective implementation of lean manufacturing, which requires management support and communication. Many lean manufacturing implementations, according to focus primarily on training personnel in tools and processes rather than understanding the human component and establishing the appropriate culture.

2.7 Value Stream Mapping

According to Huang, Kim, Sadri, Dowey and Dargusch (2019), lean implementation attempts to reduce excessive inventory levels while reducing transportation and labor motion time to eliminate production lead time. The main characteristics of Lean manufacturing have been a more acceptable personnel organization in the production process, continuous improvement, and an emphasis on value-adding activities through eliminating waste.(Huang *et al.*, 2019). Ramadan (2016), supports that Value Stream Mapping (VSM) was first introduced as a versatile technique in "Learning to See" by Mike Rother and John Shook. Their initial value stream map, were produced by hand and focusing on overall manufacturing productivity rather than single cells, was able to represent the static production flow (Ramadan, 2016). According to Huang *et al*. (2019), developers of VSM admit it is impossible to draw every part’s value stream if they are many, especially for Make-To-Order job shops with many types of materials, such as welded fabrications, stamping dies, etc. This results in a deficiency of VSM results due to the difficulty of its application to SMEs. Therefore, resulting in limited information on their material flow, let alone the efficiency of their labor arrangements and equipment use (Huang et al., 2019). Additionally, when strategies for reducing lead times and lowering inventory levels are implemented, the existing facility layout is frequently changed. Dynamic monitoring is required for material handling, inventory control, purchasing, and scheduling systems. The relevance of the four Ms (material, manpower, machine, and methods) is thus established. The production system manipulates these factors to create value (Bozarth and Handfield, 2019).

Figure 2.2 (below) serves as an example of a value stream map of a court shoe production line. This value stream map (VSM) included the following data: value-adding-activities, non-value-adding-activities, downtime, cycle time, uptime, change-over time, lot size, quantity to deliver, and delivery time. The VSM was aligned to the assembly line processes such as production time, inventory storages, inspections, re-work loops, number of workers, and operational hours per day (Mia *et al***,** 2017).

Figure 2.2: Value Stream Mapping of the court shoe production line



Source: (Mia *et al*,2017)

According to Nasir, Minhas and Sweden, (2018:48), the effective management of the value stream mapping (VSM) can considerably contribute towards waste elimination. This is done by effectively categorising activities to be either value-adding or non-value-adding. Therefore, the objective of VSM is to identify all types of waste in the manufacturing processes, and to intervene to eliminate these. Although researchers have developed a number of tools to optimise specific operations within a supply chain, most of these tools fail in linking and visualising the nature of the material and information flow throughout the organisation's entire supply chain process. In addition, VSM creates a common basis for the production process to lead to incisive decision-making by management to improve the value stream. According to Mia, Nur-E-Alam, and Uddin, (2017), the relevant materials required for the finished court shoe product was not the focal concern, but the causes that were responsible for production waste and downtime.

With reference to figure 2.2 above, a case analysis of the improvement of a court shoe production line focused on reducing the lead time by applying lean tools and revamping operations by eliminating the non-value-adding (NVA) time. The lead time and process cycle efficiency (PCE) was improved through the application of processes such as VSM, Pareto Analysis, 5S, and Just in Time (JIT). In a nutshell, it is inferred that the application of a set of lean tools is an effective way to identify and eliminate the NVA activities and time-wasting (Mia *et al.*, 2017).

2.7.1 Value Stream Mapping for Goods

According to Sremcev, Stevanov, Lazarevic, Mandic, Tesic, and Kuzmanovic, (2019:563), "Value Stream Mapping (VSM) is employed for the analysis of manufacturing and operation processes. The VSM analysis improves processes through the reduction of non-value-added steps" (Sremcev et al., 2019) . It starts by mapping the present state of the manufacturing system, then it moves on to proposing improvements in order to eliminate non-value-added activities, after which the results are presented in the future state map (FSM). To develop the current state map, it is necessary to gather information concerning client orders, shipment frequency, quantities, processes involved in product manufacturing, processes' cycle times (CTs), change-over times (COs), number of operators, material deliveries, frequency and quantity inventories, quantity and places of storage, working time, and problems existing in the manufacturing system. As discussed by Antonelli and Stadnicka (2018:31)

"the VSM aims at identifying three types of activities in the production flow: non-value-added, necessary but non-value-added, and value-added. The effectiveness of VSM depends on its application to evaluate deterministic production processes. In a deterministic process, buffers do not increase the throughput rate; however, it increases the WIP that is linked to non-value-added activities." The buffers that are seen by VSM as non-value-added activity are necessary to compare variability. Among the most typical variability sources are CT randomness of manual processes, demand variability, and pre-emptive outages such as machine failure, consumables shortage, and power cuts. If buffers are allowed in the production processes, then variability leads to increasing the time-in-queue; hence, directly affecting the throughput rate (Antonelli and Stadnicka, 2018).

2.7.2 Value Stream Mapping for Services

According to Dogan and Yagli (2019), a service sector example is from the university graduation perspective, specifically the student selection process. The matriculation process is determined as the product family. Then, the current situation of the flow in this process is observed and the current state map (CSM) is created. The process consists of 12 steps. The process flow initially starts with the 'transcript control' step, and ends with 'completion of process'. In this process, various wastes stand out. For instance, unnecessary motions (step with meeting of advisor), defects (step with meeting of advisor), over-processing (steps include paperwork and head of department sign offs), waiting (head of department and filling out the survey steps), and inventory between processes (between department secretary and filling out the survey steps). A future state map (FSM) is drawn in order to eliminate these wastes. The first suggestion is that the student information system should be used accessible and actively utilised. Moreover, various lean methods are proposed to eliminate the waste generated during the processes. According to Mia *et al.* (2017), "these lean methods are 5S [*seiri* (sort), *seiton* (straighten), *seiso* (sweep and clean), *seiketsu* (systemise) and *shitsuke* (standardise)], Poka-Yoke, quality at the source, kaizen, balanced work flow, standardised work, inventory reduction, and visual controls." If the CSM and FSM are compared simultaneously, it is possible to see the wastes in a clearer manner, and then decide on how to eliminate them. This will also stimulate the use of resources in an efficient manner such that customer (e.g. student) satisfaction is ensured.

2.8 Japanese lean philosophy (causes of waste)

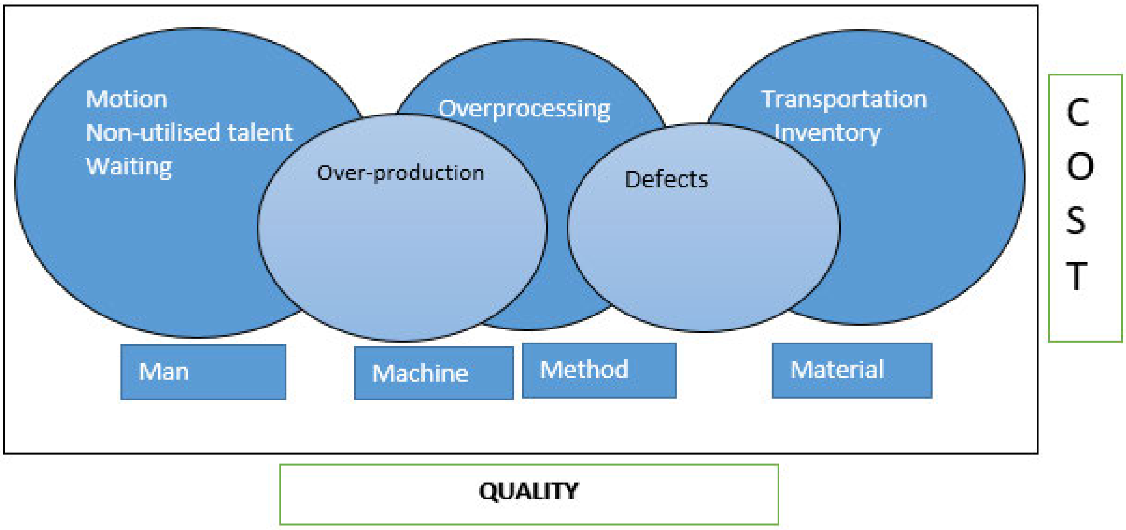
Muda is a traditional Japanese term related to activities that are wasteful, do not add value, or are unproductive. These activities significantly prolong lead times, generate extra movement to get parts or tools, creates excess inventory, or results in unnecessary waiting for preceding processes. *Muri*, on the other hand, refers to overburden, unreasonableness or absurdity caused by pushing a machine or straining an employee beyond natural limits. Overloading employees with work can result in safety and quality risks, whilst overstraining equipment causes breakdowns and defects. Lastly, *Mura* means unevenness and inconsistency in physical matter or human spiritual condition. Inequality results from an irregular production schedule or fluctuating production volumes due to internal problems such as downtime, and missing parts or defects in machinery (Wisner, Tan and Leong, 2019). According to Abu Jor, Alam and Alam (2018), manufacturing comprises of a variety of processes which causes possible vulnerability such as defects and problems which affect performance, aesthetics, and safety – these may lead to client complaints and possible rejection of the order. As such, these defects impact significantly on the company's financial flow through the loss of sales revenue or product returns.

2.9 Conceptual Framework

A research project is underpinned by a conceptual framework to explain the key concepts or variables and the relationships between them. It is the organisation of ideas that is critical necessary to achieve a research project's purpose (Afribary, 2020). The supply chain process in the shoe industry, especially in SMEs, has always been a tedious task since the processes involved are not always automated. This leads to enormous wastage. The consumer has also evolved in the sense of expecting the best service due to an elevation in his/her economic status. This has increased the demand for quality products at the shortest lead times, whilst still expecting the lowest price and the best quality. This type of manufacturing carries various types of waste that contribute to high reject rates and increased costs. Therefore, the eight (8) common wastes will be identified in the operations process to determine the extent to which a local SME can improve quality, reduce costs, and minimise waste.

Figure 2.3 below shows the activities or conditions that have a direct effect on cost. Under these circumstances, it is essential for organisations to identify the wasteful processing costs resulting from man, machine, method and material which hinder quality and performance. Therefore, the main intention in production is to cut costs, reduce waste, eliminate machine failures, and develop standard guidelines for effective planning that will meet quality standards in all categories as reflected in figure 2.3 below (Kaneku-Orbegozo, Martinez-Palomino, Sotelo-Raffo and Ramos-Palomino, 2019). A study conducted by Abu Jor, Alam and Alam (2018) identified the common defects in shoe manufacturing: crooked toe lasting, excess wrinkles on toes and heels, crooked seams, tearing of stitches, and incorrect back height. These impact adversely on productivity, cost and quality, hence contributing to operational waste. Therefore, according to Amrina and Lubisto (2017), a cause and effect diagram can be used to identify any possible cause of a problem. In this study, it can be used as a tool to categorise the eight (8) common wastes into four (4) categories: man, machine, method, and material. The diagram below (figure 2.3) was developed by conducting a series of discussions with production managers and staff.

Figure 2.3: The Four Main Categories of Waste



Source: (Adapted from Rathilall, 2011:32)

2.9.1 The Eight Common Wastes in Operations

There are eight (8) categories of non-value-added activities in manufacturing operations. These categories of waste as outlined in chapter 1 are: overproduction, inventory, transportation, motion, inappropriate processes, defects, and non-utilised talent (Bozarth and Handfield, 2019). Unused or untapped employee creativity is the latest type of waste that was identified and added to the set of non-value-added activities (Rathilall, 2011). Moreover, the footwear industry recognised the importance of improving material efficiency during the production phase. These eight (8) wastes are further divided into four (4) areas which have the most impact: man, material, method, and machine. These eight (8) waste categories serve as a framework to plan waste-minimising strategies present in shoe production (discussed below).

2.9.1.1 Waste of overproduction

Waste of overproduction is regarded as the highest form of waste in the manufacturing environment. Overproduction induces excess inventory in the form of work in progress (WIP), and is regarded as the most debilitating source of waste since it prevents immediate correction and improvement. Other forms of waste are generally easier to identify and remedy. There is no value-added advantage if parts or products are kept as unused stock which leads to extra costs for storage, excessive lead times, and difficulty in detecting defects (Bozarth and Handfield, 2019). A study conducted by Elnamrouty and Abushaaban (2013), affirmed that overproduction means high inventory levels such as the raw material component. This also affects increases in work-in-process goods which require storage of equipment and handling tools. Further, producing more products than necessary increases costs in terms of storage space for excess finished products. Moreover, because of the accelerated production rate, the probability of raw-material-defect increases. This is attributed to the operator who produces more goods than required which may lead to overtime costs. There is also the possibility that less effort will be expended on each unit which leads to the drop in quality and increased defects. Moreover, overproduction requires a greater number of workers which increases motion during processes. Also, overproduction results in increased transportation from the raw materials store to the production floor, and also between the various production stages like waiting for semi-finished products between machines; this adversely affects time and cost. Further, overproduction increases machine-breakdown, which also means waiting for maintenance, repairs, and parts.

Currently in business, the number of WIP levels that result from overproduction reflects the expanse of variability in production batch sizes. Generally, defects that remain hidden in WIP inventory will only be discovered when the downstream process demands the product. This waste might not be noticeable when the market is strong; however, when demand drops, it can lead to serious problems. The main factors contributing to this type of waste are when organisations produce finished products or WIP for which they do not have any customer orders, and if they produce parts faster than required by the downstream process (Rathilall, 2011). The concept of waste via overproduction is detrimental as it impacts on floor space capacity, potential for more rejects in the system, unnecessary resource usage, and tied-up capital. Further, reducing high inventory conditions reveal hidden inefficiencies that hinder production performance which has a negative cost-effect on the manufacturing process. Therefore, the study identified the types of overproduction waste that were evident in the Durban shoe manufacturing company.

2.9.1.2 Waste of inventory

According to Santosa and Sugarindra (2018), inventory (outlined in chapter one) is regarded as the ‘enemy’ of quality and productivity. Therefore, a relationship connected to overproduction tends to increase lead time, space, and prevents the rapid identification of problems which stifles smooth communication. The disadvantage is that unnecessary inventory creates significant storage costs which lowers the competitiveness of the organisation or value stream in which they exist. In general, inventory is an accumulation of finished products, WIP, and raw materials at all stages of the production process (Bozarth and Handfield, 2019). A study by Elnamrouty and Abushaaban (2013) affirmed that the high level of the existence of raw materials in inventory forces firms to overproduce; and not in accordance with market demands. As a result, raw materials inventory increases defects. Therefore, this increase of inventory between production processes on the shop floor increases the possibility of semi-product damage. This means the storing of finished products in warehouses for a long time which causes product damage and rejects. Additionally, the higher levels of work-in-process increase the time for searching, selecting, reaching, moving, and handling. Moreover, high levels of work-in-process inventory which increases transportation between workstations, obstruct smooth movement on the shop floor.

Therefore, the concept of waste of inventory originates from conditions that have inherent hidden inefficiencies. Therefore, according to Henny and Budiman (2018), Value Stream Mapping (VSM) aims to visually capture the manufacturing process consisting of the flow of materials and information. This allows the company's unbalanced operating times, which often has bottlenecks, to be detected and remedied by allowing an increased quantity of raw materials and semi-finished materials into the system. However, this impacts on the waiting time which becomes longer (Henny and Budiman, 2018). Therefore, the study identified the types of inventory waste that was visible in a Durban shoe manufacturing company.

2.9.1.3 Waste of transport

As outlined in chapter one, the waste of transport involves the movement of products from one location to another (Santosa and Sugarindra, 2018). Transporting parts or products from one location to another does not add any value, but rather creates added manufacturing lead times and costs (Bozarth and Handfield, 2019). A study by Elnamrouty and Abushaaban (2013) reveals that when items are produced more than needed, handling and transporting costs increase. If there is not a sufficient quantity of materials and goods for transportation, work-in-process inventory increases. Unsuitable transportation plans and unsafe equipment increase the probability of production defects; for example, the improper handling of products may cause parts to be damaged. In addition, non-standardised transportation methods increase the workers' motions by double-handling and searching. When transportation time is disrupted, waiting time for the receipt of parts increases.

According to Deesrisak *et al.* (2019), many external factors impact the efficiency of transport operations. Firstly, often the driver needs to wait for available space at the suppliers' or customers' locations due to specific service time-schedules or longer processing times. Secondly, the speed of unloading goods or loading supplies of raw materials varies due to location variables. Thirdly, since the company may allow for returning products that the customer is not satisfied with, retailers usually count returns at the same time when the products are being loaded which causes delays. Another point is the transit process which consists of transporting goods to each customer, break-time of the driver, and driving the truck back to the company with returned items. The external factor that cannot be controlled in this section is the traffic congestion and drivers' break-times. These two factors can lead to a longer time for the transit process (Deesrisak *et al*, 2019). Therefore, the study identified the types of transport waste that are prevalent in the Durban shoe manufacturing company.

2.9.1.4 Waste of waiting

The waste of waiting, as outlined in chapter one, involves different factors during the course of production. In a manufacturing environment, this type of waste occurs whenever goods are not moving or being processed according to plan (Santosa and Sugarindra, 2018). The concept of waste of waiting is significant as it identifies the gaps and delays in production which reveal hidden inefficiencies that hinder quality, production-performance, and adds to costs. Elnamrouty and Abushaaban (2013) assert that when a machine is idle and waiting, which usually occurs when the supplier is busy with another order, the machine-operator is forced to produce more parts just to keep the operation running. Hence, the risk of waiting for components between workstations increases, thus forcing high levels of work-in-process. Also, waiting for finished items in warehouses increases inventory. Waiting of parts in work-in-process inventory may also cause defects due to the surrounding conditions; and this may cause unnecessary motion of workers and machines.

According to Raaz and Aman (2020), in a garment factory, waiting as waste is found in all processes: sewing operators waiting for cuttings, and supervisors waiting for final instructions to proceed for quality approvals. Also, merchandisers wait for buyer approvals. Waiting is a visible waste in manufacturing as operators and other employees produce nothing while they wait for work (Raaz and Aman, 2020). The process is similar to shoe manufacturing where similar types of materials and employees are involved. Therefore, the study will identify the types of waiting as a waste factor that occurs in the Durban shoe manufacturing company.

2.9.1.5 Waste of motion

Unnecessary motion is a type of waste that refers to the ergonomics for quality and productivity which consumes time and energy as outlined in chapter one (Santosa and Sugarindra, 2018). This often occurs when operators search for tools and parts that are kept in various departments which may be out of the immediate proximity of the workstation, and requires time to be spent walking among machines and workstations. Elnamrouty and Abushaaban (2013) add that insufficient workers' motions cause accumulation of work-in-process. Inappropriate workers' motion during production increases the number of defect parts. As a result, when jobs are non-standardized, there will be an opportunity of over-processing. Work-in-process waste increases due to a lack of understanding of operating the available new technology. When there is no prescribed procedure concerning the standardisation of the motion of workers during the production process, the required time to process the next part increases.

According to Raaz and Aman (2020), excess in motion exists in workstations where operators sew garments, finish, and pack garments. This is due to poor management systems in terms of working methods which is exacerbated by the adherence to traditional ways of working. Furthermore, in the factories where there is no engineering department to design workstation- layout, operators may use excess motion due to poor workstation layout. Therefore, the study identified the types of motion waste that occur in the Durban shoe manufacturing company.

2.9.1.6 Inappropriate processing as waste

By definition, waste of inappropriate processing is characterised by unnecessary tasks that employees perform in the product flow as outlined in chapter one (Santosa and Sugarindra, 2018). This occurs in situations where complex solutions are found for simple procedures such as using a large inflexible machine instead of a small flexible one. As a result, this discourages ‘ownership’ in employees who implement these solutions to satisfy management but this leads to overproduction to compensate for the investment made by purchasing complex machines which generally are not efficient enough in producing quality goods. They cause unnecessary movements and thus lead to defects in parts or products. Elnamrouty and Abushaaban (2013) advise that it is important to curtail waste by operating on the principle of cost-per-machine-time which may lead to overproduction. The risk of inappropriate production processes may lead to the high rate of defects in finished products. Non-standardised processes require more worker motions, while unsuitable technology increases production times. This is also compounded by adjustments to schedules or repetitive downtimes which lead to higher waiting times.

According to Raaz and Aman (2020), in garment construction, some operations may not be essential to give the final check. These include multiple-checking in finishing (initial checking, pre-final checking, and final checking). This is also applied in shoe manufacturing; therefore, the study identified the types of wastes regarding the inappropriate processing of waste that occur in the Durban shoe manufacturing company.

2.9.1.7 Waste of defects

Physical defects directly impact on the cost of goods sold which could possibly stem from incorrect costing, faulty order-capturing, unsuitable methods of packing, or physical production faults. In addition, errors in paperwork, late delivery, production according to incorrect specifications, and use of excess raw materials lead to wastage (Elnamrouty and Abushaaban, 2013). Defects not only waste materials and labour resources, but also create material shortages, delay in meeting deadlines, encourage idle-time at workstations, and extend the manufacturing lead time. An increase in the number of defects pushes the production line to manufacture more components in order to compensate for the loss. Also, a rectification process requires for the replacement or repair of defective components which results in increased motion and transportation. In order to explore the cause of defects and to take corrective measures, manufacturers are advised to invest in quality tools and strategies; but this implies a greater financial outlay. This also means that the manufacturing chain process is halted to wait for reparations before operations can continue. As a result, defective parts increases costs, among others.

According to Raaz and Aman (2020), defects in garment manufacturing include variation, wrong cutting, stitching defects, among others. In the case of defective garments, the factory needs to alter and repair such garments before handing over to the buyer. Defects involve reworking, inspection, handling, time, and hence there is a delay in productivity (Wisner, Tan and Leong, 2019). Further, repair work wastes money and time, but in lean manufacturing factories, the aim is to produce garments the right way the first time. Therefore, the study identified the types of defect waste that occur in the Durban shoe manufacturing company.

2.9.1.8 Waste of non-utilised talent

Bozarth and Handfield (2019), assert that the under-utilisation of employees' creativity, talent, skills, and knowledge contributes to waste in the organisation, particularly in the operations department. The common causes include organisational culture, lack of respect for employees, and the absence of training programmes or initiatives which result in high employee turnover. If organisations exploit the potential of their employees' creativity, they can eliminate or minimise the other seven wastes and continuously improve their performance in terms of quality, time-schedules, profits, and branding (Ismail and Yusof, 2016). Therefore, the study identified the types of unexploited talent that were evident in the Durban shoe manufacturing company.

2.11 Conclusion

The chapter provided a detailed discussion of the conceptual framework of the eight (8) categories of waste in production by examining the literature on internal lean processes of shoe manufacturing and the value stream mapping principle. The shoe manufacturing industry across the world is expected to have effective supply chain processes in place to display the cutting edge to compete in global markets. The deviation of order quantities and increasing quality levels at the lowest price are some of the main concerns of these markets. Small and medium enterprises (SMEs) are thus tasked to deliver high quality goods at reduced prices to remain competitive against increased imports from China. The following chapter (3) presents the research approach and design guided by the objectives outlined in chapter one.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

The previous chapter discussed the literature review and conceptual framework underpinning the study. This chapter (3) explained the research design, research procedures, and the methodology that underpinned the study. The process of the research conducted is discussed throughout this chapter. The research design included the sampling technique, data collection strategies, analysis of the data, and the ethical considerations. It also outlined the population, selection of participants, and sample size. The assessment methods aimed to validate the study via the principles of trustworthiness in order to authenticate the results and findings in line with the study's aim, objectives, and research questions.

Research methodology can be defined as the study of methods by which knowledge about the research phenomenon is gained. It is the procedure by which a researcher describes, explains and predicts phenomena (Rashid, Rashid, Warraich, Sabir and Waseem , 2019). One of the aims of a research methodology chapter is to describe the work plan of the research undertaken as follows in this chapter.

The survival of the shoe manufacturing industry in the current global competitive market is dependent on an effective and efficient production process. For small to medium enterprises (SMEs) to remain in business and to be competitive, they are tasked to deliver high quality goods at reduced prices with minimal waste. Therefore, this study aimed to identify the eight common wastes in the shoe manufacturing industry, particularly the in the SMEs. Derived from this research focus, a main research question as well as four subsidiary questions (see chapter 1, sections 1.5.1 and 1.5.2) guided the data production plan. The research objectives (see chapter 1, sections 1.6.1 and 1.6.2) were executed and aligned to the research questions accordingly.

3.2 Research Paradigm

A research paradigm, according to Bertram and Christensen (2014:22), is the worldview that guides a research project, while Wagner, Kawulich and Garner (2012 :54) define it as "opinions that guide our beliefs, thinking, and assumptions about ourselves and society at large and frame how we assess the world around us." 'The first is that it is a particular way of thinking that is common to a community of scientists in solving problems in the area, and the second is that it symbolizes the beliefs, commitments, methodologies, attitudes, and outlooks shared throughout a discipline,' said Saunders *et al*. (2013 :103). The current study adopted an interpretive research paradigm. The interpretivism research paradigm, also referred to as social constructivism, naturalist and humanist holds different values and beliefs from positivism affirmed by authors Thanh and Thanh, (2015) and Kivunja and

Kuyini, (2017). Interpretivist researchers discover reality through participants' perceptions of the situation to be studied. The aim of this study was to identify the eight common factors that contribute to waste in the shoe manufacturing industry through observations and structured interviews which is in line with social research and interpretative studies.

3.2.1 Ontology

Ontology, refers to the nature of reality, According to (Seamon and Gill, 2016), there is only one real world that can be experienced and understood in different ways by human beings. Creswell and Poth, 2016) confirm that, Ontological positions located within the interpretive paradigm hold that human life can be known from within; it focuses on how people construct understanding; social life is a human product; interacting with people helps to understand how they perceive things; the mind is a source of meaning, understanding what happens as a result of in-depth exploration of a phenomenon. In addition, knowledge of the social world affects how humans behave. The research questions and objectives for the current study were designed to delve into how the participants made meaning of their roles and responsibilities within the shoe manufacturing industry.

3.2.2 Epistemology

The term epistemology refers to a search for an answer to the question, "How do we know what we know?" (Wagner *et al*., 2012: 30). Research studies within the interpretivist paradigm use participants selected through non-probability methods where the choice is deliberate, based on whether the small number of individuals and sites have detailed information fundamental to the questions asked during the interviews (Thanh and Thanh, 2015). The interpretive nature of inquiry seeks for a deeper understanding of a research problem in its distinctive environment and without generalising to a population (Antwi and Kasim, 2015). Selection methods interpretivist employ are, convenience, purposive, judgmental, and theoretical sampling (Shah and Al-Bargi, 2013). In this study a judgmental sampling was used to be able to identify the appropriate data sources who would be able to generate data that could respond to the research questions. Quality criteria for the research undertaken was determined through ensuring credibility, transferability, dependability, and conformability as is discussed later in this chapter**.**

3.2.3 Theoretical perspective

Interpretivist believe that social reality is continually changing due to shifting socio-political and cultural forces, (Wagner *et al*, 2012). A further assumption by interpretive researchers is that reality is multi-layered, encompassing both surface and deep structures. The former can be seen, whilst the latter cannot. To bring the deep structures to the fore, interpretive researchers must depend on theoretical and historical knowledge. The current study was an opportunity for the participants to reflect on their experiences and participation in the production processes of the shoe manufacturing industry that they may not have paid attention to before. Hence, involving them in the research was a way of expanding their lenses with regard to issues that influence their view of reality based on their experiences, knowledge and values from an interpretive point of view.

3.3. Research Design

According to Sekaran and Bougie (2013), a research design is a blueprint for the collection, measurement, and analysis of data based on the research questions of the study. Since the organisation under study involves a local shoe producing SME, an explorative study is appropriate as little is known about the extent to which the organisation draws on lean tools and techniques in the manufacturing of their shoes. As such, the exploration of the full nature of the phenomenon and other factors related to it, were necessary for this case study design (Abutabenjeh and Jaradat, 2018).

Yin (2009) maintains that case studies are conducted when the researcher aims to answer 'how' and 'why' questions. A case study enables the investigation of a contemporary phenomenon within a real-life context, especially when the boundaries between a phenomenon and context are not clear and the researcher has little control over the phenomenon and context (Yin, 2009). This approach enables a researcher to study a particular case in its immediate environment to find commonalities and differences, which are relevant in facilitating the exploration of the identified phenomenon (Yin, 2009). In other words, according to Patnaik and Pandey (2019), conducting case study research is considered to be appropriate when a contemporary phenomenon is to be studied in a natural setting. This was an appropriate approach for this current study as the manufacturing of shoes by the local SME presented specific circumstances based on its environment and underlying challenges. All questions stem from the motivation to explore, seek understanding, and establish the meaning of experiences from the perspective of those involved (Harrison *et al*., 2017).

3.4 Research Approach

There are three broad categories of research methodologies: quantitative, qualitative, and mixed-method. Qualitative data describes data at an in-depth level, without using statistics. It helps to explain how a person is thinking or why something occurs (Sekaran and Bougie, 2013). Qualitative research is a form of research methodology that allows a researcher to collect data that is rich in the textual description of how a target population is experiencing a phenomenon. Using qualitative research methodology, researchers can collect data about the human perspective of the research problem (Mohajan, 2018). Mixed methods research is an approach combining both quantitative and qualitative data, integrating the two forms of data, and using distinct designs that may involve philosophical assumptions and theoretical framework (Creswell and Poth, 2016). However, the qualitative research methodology aligns well with the case study approach. Besides, qualitative research enables researchers to generate new perspectives of comprehending a phenomenon from the view of the insider while grasping the significance of the local situation. This study, therefore, followed a qualitative method approach since it blends appropriately with the research design.

3.5 Study site

Durban shoe company is an SME that manufactures shoes for some of South Africa's leading retailers. This company is a family-owned and managed business located 15km from the N2 highway. Their functions include designing, producing, and supplying their shoe brands, ranging from everyday wear, high-end fashion shoes to shoes for children and babies. Their main product is the female sandal. Some of the retail stores that they supply include; Mr Price, Pick n Pay, Legit, Foschini, and Milady's. The geographic location of the factory is situated in Shallcross which is a residential suburb in Durban. The employees are mainly residents from the surrounding communities.

3.6 Target Population

Sekaran and Bougie (2013: 240) define "target population as the collection of units or people with specific characteristics the researcher is interested in". The total population of the staff in the Durban shoe manufacturing company was approximately 450. The target population, in this case, would be the staff involved in the operations department of the business including the pre-production staff which consists of 18 people who are coordinators, pre-production room staff, and factory supervisors.

3.6.1 Research Sample

Sekaran and Bougie (2013: 241, 271) define "a sample as a subset of the entire population from which data is collected by the researcher" and a "sample size refers to the total number of units or people selected to participate in the study". Since the SMEs mainly manufacture shoes worn by females in different designs including ladies' sandals and 'closed' shoes from sizes 3 to 8, the sandals and 'closed' shoe production lines were investigated. The sample was selected from the operations-team which was split into three departments A, B and C in which 6 participants per department was interviewed which equals to a total of 18 participants.

3.6.2. Sampling Strategy

According to Sekaran and Bougie (2013:241), "a sample should desirably be representative of the target population that will be used to conclude the study". A sampling strategy can follow either a probability or non-probability type of sampling design. This study adopted purposive sampling since it is a method where people selected for inclusion by the researcher, satisfy set criteria. A non-probability approach was applied to initiate judgement sampling in which subjects were selected based on their expertise on the subject under investigation (Sekaran, 2013:252). In this study eighteen (18) participants were selected according to the expertise in operations commencing from the design of the product to the final finished product. Also, and an observational schedule was designed and followed to monitor two (2) batches of ladies' shoes (Sandals and closed shoes).

TABLE 3. 2: DATA PRODUCTION SOURCES

Research Sample (18) particapants	Department A	Department B	Department C
Population distribution	**Cutting/clicking**	**closing and sewing**	**Assembling/finishing**
Product Coordinators	3	3	3
Pre production/sample room staff	1	1	1
Factory supervisors	2	2	2
Total	**6**	**6**	**6**

Source: (Researcher, 2021)

3.7 Data Collection Instruments

Information was gathered from diverse sources to respond to the research question. According to Sekaran and Bougie (2013), data collection is defined as a process of gathering and measuring information on targeted variables in a systematic form. Furthermore, data collection involved collecting, measuring, and identifying the different variables by utilising qualitative research methods (Abutabenjeh and Jaradat, 2018). The main bank of data was collected through structured interviews with the selected participants. In addition, an observation schedule was used to identify the eight (8) types of wastes during the shoe manufacturing process.

3.7.1 Interviews

Interviews allow researchers to exploit a channel of communication with the interviewees (participants) about their lived-experiences and perceptions. As such, this instrument is used to investigate and gather data from the various respondents on their perceptions and experiences about the phenomenon under investigation.

Adhabi and Anozie (2017:10) propose that "interviews are research instruments that accomplish specific objectives understudy". This instrument is used to investigate and gather data on perceptions and experiences from the various respondents. Interviews allow researchers to generate a channel of communication with the interviewees (participants) about their experiences and perceptions. According to Sekaran and Bougie (2013), based on their nature, interviews can either be classified as formal or informal. Informal interviews are part of daily living as people experience it. Formal interviews, are more structured which is held to higher standards, and used more prominently in the corporate environment. Formal interviews are carried out by an interviewer. The interviewers' part is to clarify the understanding of the phenomenon of gaps under analysis, the interviewer is in charge of the entire process (Adhabi and Anozie, 2017).

An interview can be either unstructured, semi structured or structured. An unstructured interview occurs when the interviewer does not enter the interview with a sequence of planned questions. Semi structured interviews explore and probe into the several factors in the situation that might be central broad problem area with a list of questions on hand (Sekaran and Bougie (2013). Lastly, structured interviews allow interviews to be conducted either individually or in groups with a list of predetermined questions. Therefore, based on the nature of the study the researcher adopted a structured interview. The reason for deciding to make use of structured in-depth interviews is to allow for the gathering of both rich data and focused data that's specific to answer each of the research questions (Adhabi and Anozie, 2017). Structured interviews are conducted when the information required is known. The interviewer also has a list of predetermined questions to ask respondents either done personally, through the telephone, or via a computer. Hence, the objectives of the study informed the interview questions. The questions were catergorised under each objective that links to the conceptual framework. The structured interview questions were emailed/dropped off for the respondents at the Durban shoe manufacturer. The respondents then had one week to answer to ensure that there is enough time to reflect on questions and to gain a richer response. However, due to the unrest and disruptions of Covid-19, further delays occurred in receiving all of the interview schedules (Appendix E). The researcher conducted these interviews in a non-contact way due to the coronavirus and to maintain safe distance. Each of the 18 respondents from the operations department were interviewed adopting social distancing practices.

3.5.2 Observation

The use of observation as a qualitative data production strategy allows the researcher to witness exactly what happens at a research site. Observation concerns the planned watching, recording, analysis, and interpretation of behaviour, actions, or events. There are various approaches of observation that have been used in business research. These can be identified as four key dimensions that characterise the way observation is conducted such as control or uncontrolled, participant or non-participant, structured or unstructured and concealed or unconcealed observation (Sekaran and Bougie, 2013). A controlled observation is conducted in an artificial setting and uncontrolled observation is conducted in a natural setting. Consequently, this study followed an uncontrolled observation. This study focused on identifying the wastes in the local SME that manufactured shoes for females for the South African market. The observation occurred in the factory's natural setting. During the observation, all Covid-19 stipulations were followed (Appendices A and B).

The observation schedule was created and corresponded with the conceptual framework, which included the eight (8) waste. It followed a sequence in which the selected type of shoe moved from department A to C to B. The schedule identified the various components which contributes to each of the 8 wastes, aligning back to the objectives of the study. The schedule provided a guideline which requested for the following data used for each of the departments; the number of operators, takt time, cycle time, process efficiency, total time to receive the material, the availability of the inputs, total counts of parts, defect rate, defect part, actual counts, target counts of parts, actual shoes produced, inefficiency (repeated process), total time produced, availability of output and total number of operators and machines moving between departments.

The main focus activities featured on each of the value stream mapping were cycle time, waiting time, defect rate, inefficiency, operators, actual shoes produced and total time. The cycle time is regarded as the total time that has elapsed needed to complete a process. This can also be referred to as the throughput time (Bozarth and Handfield, 2019). The waiting time is the total time that operator or machine takes to receive the material. Defects rate is regarded as the percentage of errors or damages that occurred during production. This further leads to the inefficiency rate which equates to the percentage of repeated processes that occurred during production. Lastly the actual number of shoes produced as well as the total time to complete and dispatch.

3.6 Data Analysis

Castleberry and Nolen (2018) state that data analysis is a procedure used to convert, modify and review particular information to arrive at a certain conclusion for a certain condition or problem. Various software programmes can be used to produce charts, tables, and graphs as a way to present data. This enables the researcher to reach a conclusion or to form a way forward to answer the research questions through analysis. There are two software programmes such as NVIVO and the Statistical Package for the Social Sciences (SPSS), commonly used when cleaning and sorting raw data. The SPSS is a software used in sorting information or responses from questionnaires in quantitative research. According to Sekaran and Bougie (2013), NVIVO is intended to help users organise and analyse non-numerical or unstructured data, which will assist in sorting the raw data before it is analysed. NVIVO pro 12 is a qualitative data package. Users can categorise, display and sort information, see relationships, and combine analysed information by linking, shaping, and searching. This is useful for large samples of qualitative data.

According to Castleberry and Nolen (2018), thematic analysis (TA) is a data analysis strategy that is a commonly used across qualitative approaches which is applicable for "identifying, analysing, and reporting patterns (themes) within data". It is described as a descriptive method that reduces the data in a flexible way that dovetails with other data analysis methods. It is used commonly because of the wide variety of research questions and topics that can be addressed by using this method of data analysis (Castleberry and Nolen, 2018). In this research, interviews were conducted with the operations-team and with staff (6) on the pre-production line. The raw data from the interview (questionnaire) responses and observation was recorded and sorted into themes before it was presented and analysed in a readable format through the formulation of tables on excel. These tables are displayed visually through graphs and diagrams in chapter four.

3.7 Data Quality Control

According to Leedy and Ormrod (2014), data quality control refers to how the researcher can ensure that the data-gathering instruments used to measure the data in a way that it should and ensuring quality and consistency throughout the process. The conclusions drawn should be verified by using the following categories: validity, reliability, trustworthiness, credibility, transferability, dependability, and confirmability. According to Leedy and Ormrod (2014:153), **"**the triangulation test for improving the validity, reliability, credibility, and trustworthiness of research or evaluation of findings should also be employed throughout the research". Several criteria of trustworthiness exist, but the best-known are credibility, transferability, dependability, and confirmability (Korstjens and Moser, 2018).

3.7.1 Validity

Researchers generally control validity by asking an arrangement of questions, and will regularly search for the responses and in the study of other researchers. Sekaran and Bougie (2013:206) propose that "the several types of validity tests are used to test the goodness of measure, which are grouped into three broad headings; content validity, criterion-related validity and construct validity. Therefore, validity will be proposed as the questions set out in the structured interview to give the interviewee some direction when answering the questions and to experience their views. This can be supported by literature and themes to be validated. If this study was done under a quantitative approach using questionnaires, this form of data quality control would be more appropriate.

3.7.2 Reliability

According to Gani, Imtiaz, Rathakrishnan and Krishnasamy (2020), reliability is a vital factor that is needed to ensure credibility in a study. Furthermore, reliability is also known as the extent to the consistency of outcomes over some time and an accurate depiction of the population under study is revealed (Gani *et al*., 2020). Sekaran and Bougie (2013:203), it is evident that the reliability of a measure is an indication of the stability and consistency in which the instrument measures the concept. This helps to assess the goodness of a measure. According to Drost (2011,106), "test and re-test involves the use of the same test repeatedly over time and is defined as the extent to which test material can be relied on to measure a characteristic consistently over time with the same test material". However, this form of data quality control is suitable for a quantitative research approach.

3.7.3 Trustworthiness

Trustworthiness is a blend of four criteria's and each criterion has a corresponding criterion in a quantitative study (Bryman and Bell, 2019). The following are credibility, transferability, dependability, and confirmability. Bryman and Bell (2019) state in principle trustworthiness can be understood as to how qualitative researchers ensure that transferability, credibility, dependability, and confirmability are evident in their research. In this study, the goal of triangulation is achieved by determining trustworthiness through data analysis and the selection of interview participants, as well as data collected using the batch of sandals and closed shoes' observational schedule. Triangulation is a general approach to check and establish the credibility of qualitative findings by analysing a research question from more than one perspective. Triangulation can be categorized into four classical types: methodological, data, investigator, and theoretical triangulation, along with a growingly important and prevalent fifth one called environmental triangulation (Korstjens and Moser, 2018). The use of NVIVO can assist the qualitative research process by enhancing the trustworthiness of the data (Sinkovics and Alfoldi, 2012). The observation schedule will fill in the gaps of the structured interview for the data to be trustworthy.

3.7.1 Credibility

Credibility establishes whether the research findings represent reasonable information drawn from the participants' original data and is a correct interpretation of the participants' original views. Strategies to ensure credibility are prolonged engagement, persistent observation, triangulation (Korstjens and Moser, 2018). The observational schedule in this study contributed to the credibility of the data received from the structured interview.

3.7.2 Transferability

The degree to which the results of qualitative research can be transferred to other contexts or settings with other respondents refers to transferability. The researcher facilitates the transferability judgment by a potential user through a dense description (Korstjens and Moser, 2018). In this study the transferability is achieved through the transfer of data from the interviewee and observation into the qualitative data package NVIVO which was then categorised into the various themes aligned to the objectives of the study.

3.7.3 Dependability

The involvement of participants' evaluation of the findings, interpretation, and recommendations of the study such that all are supported by the data as received from participants of the study is regarded as dependability (Korstjens and Moser, 2018). Dependability is ensured by describing how the data is collected, the type of data collected, and by giving a robust description of the methodology used. The interview schedule also provides dependability from the findings of the observation and vice versa.

3.7.3 Confirmability

The degree to which the findings of the research study could be confirmed by other researchers. Confirmability is concerned with establishing that data and interpretations of the findings are not figments of the inquirer's imagination, but derived from the data (Korstjens and Moser, 2018). This observation schedule will serve as confirmability of the data received. This is further interpreted from the interview responses. The themes from the findings will need to be linked to the objectives of the study and a signed informed consent is provided by the interviewee.

3.7.4 Reflexivity

The process of critical self-reflection about oneself as a researcher (own biases, preferences, preconceptions), and the research relationship (relationship to the respondent, and how the relationship affects participant's answers to questions) (Korstjens and Moser, 2018). The observation was conducted in an unbiased manner with random style numbers and on a batch that was in production during that time. The interviews were also completed by the respondents privately without the presence of the researcher. These processes assured reflexivity.

3.8 Ethical Considerations

Ethics enables researchers to conduct their research in a most principled way by following relevant guidelines and proper procedures. To achieve ethical approval for this study, permission was received from the University of KwaZulu-Natal Ethics Committee. The university ethical clearance application process was completed and approved before the data was collected (Appendix D Ethical Clearance letter). This process was done online through a platform called Research Information Gateway (RIG) in which the relevant documents were submitted and the process followed one after the other with feedback and amendments. Furthermore, the researcher was granted approval from all participants (signed voluntary consent forms with all details of the research process), and from the management of the SME to conduct the research. The participants of the study were assured of confidentiality. Respondents remained anonymous and pseudonyms were used. All protocols from the South African

Government and the World Health Organisation (WHO) in terms of Covid-19 were followed. The participants were emailed the interview questionnaires to complete and return to me in the stipulated time. The respondents were informed that they were at liberty to withdraw at any stage of the process without being disadvantaged in any way. The rights and dignity of respondents were maintained during the study, and an atmosphere of cordiality existed. During the observation a three (3) meter social distance was maintained, and the wearing of a face mask, and the sanitizing of hands were compulsory at all times upon entry and exit of the factory.

3.9 Conclusion

In this chapter the research design, methodology, quality control, and ethics were described. This study is explanatory in nature, and it adopted a non-probability, purposive sampling technique since units or people were selected for inclusion in the research. The chapter also described the research instruments, data collection methods, data analysis, the aspects of trustworthiness of the study. The next chapter (4) presents the data analysis, interpretation of results, and the findings by using NVIVO as a tool to sort the data into themes.

CHAPTER FOUR
DATA ANALYSIS AND INTERPRETATION OF RESULTS

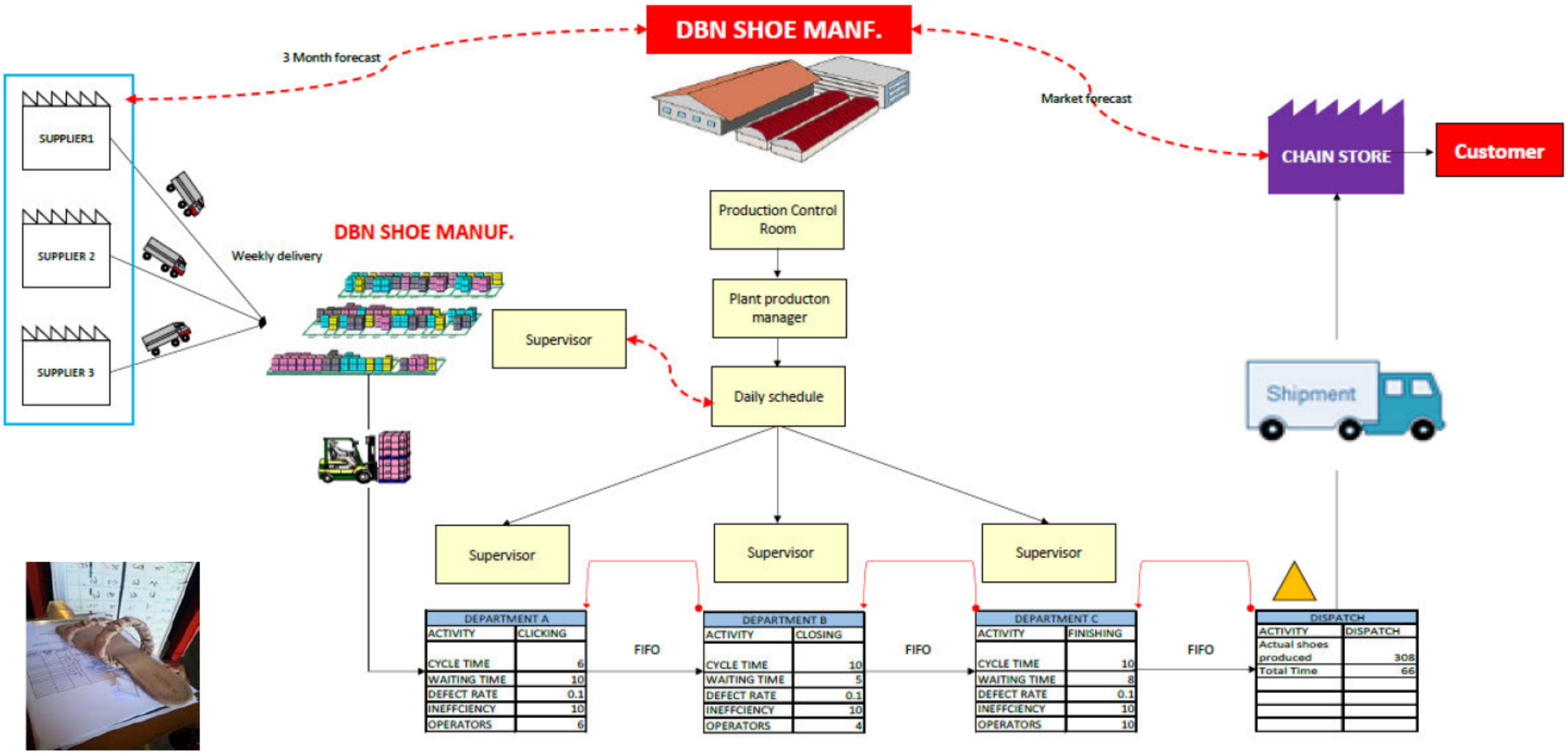
4.1 Introduction

This chapter presents the data and the use of the qualitative data analysis software package NVIVO pro 12 which assisted in sorting the raw data into themes before it was fully analysed. The data was then analysed and interpreted through the coding of nodes (themes of the study) in line with the questionnaire responses. Thereafter, it was classified, sorted, and examined through the various relationships such that themes could be drawn and dissected for interpretation. For this purpose, tables were displayed visually to outline the background information of the interviewees. In addition, a value stream map (VSM) of the present state of the operations process based on the observation conducted at the SME, was designed. The purpose of the data analysis through information from interviews and observation was to ascertain the overall perceptions of interviewees concerning their roles played in the operations department. This was in addition to identifying the eight wastes in shoe manufacturing at the Durban shoe factory. The observation was conducted during the period of Covid-19. However, production was not interrupted during the observation and all Covid-19 protocols were adhered to as per the regulations stipulated by the government of South Africa. In this regard, the research questions and objectives were aligned to the interviews and observation with the intention of identifying the eight common wastes in shoe manufacturing. Derived from this research focus, a main research question as well as four subsidiary questions (see chapter 1, sections 1.5.1 and 1.5.2) guided the data production plan. The research objectives (see chapter 1, sections 1.6.1 and 1.6.2) were executed and aligned to the research questions accordingly.

4.2 Findings from Observations

The main intention of the observation process was to accumulate more data on the supply chain process in order to identify the eight common wastes in the production process of the Durban shoe manufacturer. According to (Slack *et al*., 2013), operations create and deliver services and products by changing the inputs into outputs using an input-transformation-output process. Inputs refer to all requirements that go into a process at a given time. It is a set of resources used in the conversion process. Inputs include material, information and customer requests. Value is added throughout the transformation with the utilisation of facilities such as equipment, technology and people. The output of the process refers to the product or service. Products and services are different in nature. Products are tangible and services are activities that provide an experience to the end user. A value stream map clearly outlines the transformation process in which the main key activities were outlined in order to identify the wastes within the process. Therefore, the output is a mixture of products and services that are suitable and is of value to the end user. Observation schedules (Appendix A-Sandal, and Appendix B-Closed shoe) were followed on one (1) lady's sandal and one (1) closed shoe production line which consisted of a bundle of 25 pairs each, 400 units, and 300 units respectively. The relevant findings from the observation were populated on the value stream map represented in figures 4.1 and 4.2.

Figure 4.1: VSM of ladies' sandal batch 6906



Source: (Researcher, 2021)

Figure 4.1 demonstrates the Value Stream Map (VSM) regarding the current state of the process of manufacturing a sandal. The VSM shows the movement of the raw materials from suppliers to the Durban shoe manufacturer where the order is manufactured and ready to be delivered to the respective chain store distribution centre. Below the standard VSM process, data boxes per department A, B and C were included. Throughout the present VSM, the whole processing system of the Durban shoe manufacturer (sandal) production line was in sync with the flow of order, raw materials, labour, and information to draw the required processing from department A (clicking both uppers and bottom stock), department B (closing of uppers) department C (assembly/finishing), and dispatch. Observation was conducted on 400 units in a batch of 25 pairs bundled. The components are bundled and scanned at each department before being sent via a conveyor belt from department A to B and then manually moved by 1 or 8 operators to department C. Once the goods are finished, it is then packaged, boxed and ready for dispatch. The following tables (below) are a representation of the value stream map in the above figure.

Table 4.1: Department A- Ladies Sandal Batch 6909

DEPARTMENT A	
ACTIVITY	CLICKING
CYCLE TIME	6
WAITING TIME	10
DEFECT RATE	0.1
INEFFCIENCY	10
OPERATORS	6

Source: (Researcher, 2021)

Table 4.1 (above) shows the main data captured from department A during the observation stage (Appendix A). Department A is the clicking department in which the raw materials of the uppers (top part of the sandal) and the bottom stock (soles/base of the shoe) are cut. The supervisor receives a ticket which includes details of quantity, bill for materials, order number, quantity and a seal sample. The process begins when the raw material is available from the raw material warehouse. The material is then marked, graded (size curve) and cut accordingly. Once it is cut, they are bundled per size in bundles of 25 pairs. It is then scanned using a shoepack software and then placed onto the conveyor belt. The uppers (cut material) which forms the top part of the sandal moves to department B, and the inner sole remains at Department A until the uppers are completed in Department B. The observation covered the following variables: cycle time of 6 seconds, waiting time of 10 minutes, defect rate of 0.1%, inefficiency rate (repeat process) of 10%, and 6 operators who were occupied.

Table 4. 9: Department B – ladies' sandal batch 6906

DEPARTMENT B	
ACTIVITY	CLOSING
CYCLE TIME	10
WAITING TIME	5
DEFECT RATE	0.1
INEFFCIENCY	10
OPERATORS	4

Source: (Researcher,2021)

Table 4.2 above shows the main data captured from Department B during the observation stage (Appendix B). Department B is the closing department in which the upper bundles from department A are sewed. There were four (4) operators allocated for the purpose of manufacturing this sandal. Each operator had one component part to sew. The department is run on a multi-model system, but each row of six (6) operators work on one (1) style. There is a system (Shoepack) which indicates if an operator is occupied or not. The bundle is placed in a crate and sent down the assembly line which has a colour code - red for not occupied, or green for occupied, depicted on the monitor. Once the uppers have been sewn they are counted and bundled in units of 25 pairs, scanned, and placed on the conveyor belt or moved manually back to department A ready to proceed to department C. The observation process covered the following variables: cycle time of 10 seconds, waiting time of 5 minutes, defect rate of 0.1%, inefficiency rate (repeat process) of 10%, and a total of 4 operators were occupied.

Table 4. 10: Department C – ladies' sandal batch 6906

DEPARTMENT C	
ACTIVITY	FINISHING
CYCLE TIME	10
WAITING TIME	8
DEFECT RATE	0.1
INEFFCIENCY	10
OPERATORS	10

Source: (Researcher,2021)

Table 4.3 shows the main data captured from Department C during the observation stage (Appendix B). Department C is the finishing department where both the uppers and the bottom stock (made up of in-sole, mid-sole, and out-sole) are processed to form a shoe. The outsole is the layer of sole that is exposed to the ground. The shoe components are put together through a series of events such as lasting (a shoe last is a 3-dimensional wooden or plastic mould upon which a shoe is constructed), pre-lasting, post-lasting, gluing, heating, wiping of the shoe, quality-check, and packaging. The observation covered the following variables: cycle time of 10 seconds, waiting time of 8 minutes, defect rate of 0.1%, inefficiency rate (repeat process) of 10%, and a total of 10 operators were occupied.

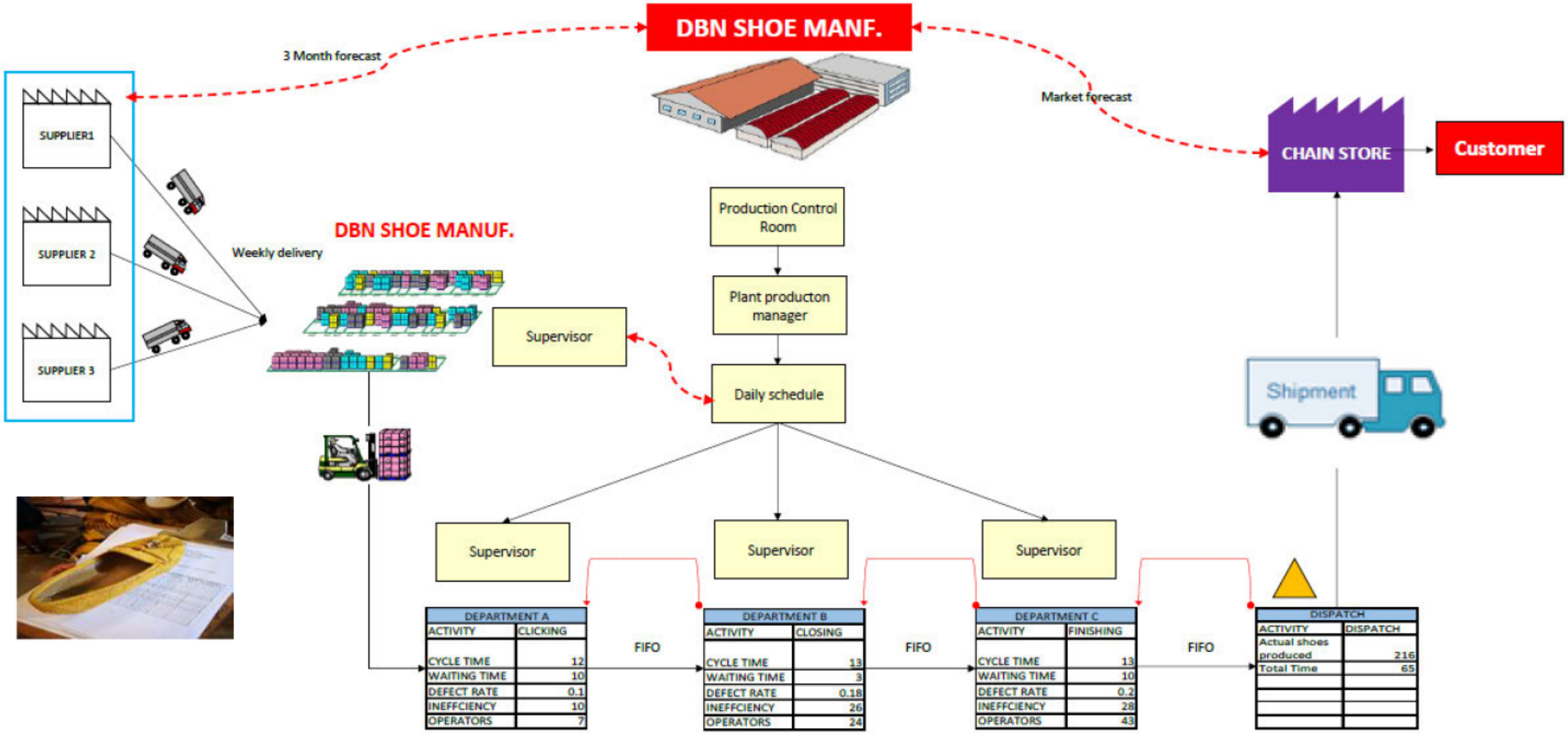
Table 4. 11: Dispatch: ladies' sandal batch 6906

DISPATCH	
ACTIVITY	DISPATCH
Actual shoes produced	308
Total Time	66

Source: (Researcher, 2021)

Table 4.4 (above) shows the actual number of shoes produced according to the researcher's observation (308), and the total time they took to be produced (66 minutes). Once the order has been checked, paired, and packaged in Department C, it was then scanned and placed into boxes. The boxes were then stored until the transport arrived. The mode of transport used is a truck, which collects the order and delivers to the distribution centre of the relevant customer.

FIGURE 4. 2: VSM – state of closed shoe; ladies' glitter 6942



Source: (Researcher,2021)

Figure 4.2 above demonstrates the Value Stream Map (VSM) for the current state of the process of a closed shoe. The VSM shows the movement of the raw materials from suppliers to the Durban shoe manufacturer where the order is manufactured and ready to be delivered to the respective chain store distribution centre. Below the standard VSM process, data boxes per department A, B and C have been included. Throughout the present VSM the whole processing system of the Durban shoe manufacturer (closed shoe production line) was depicted with the flow of order, raw materials, labour, information, drawing the required processing from department A (Clicking of bottom stock and uppers), department B (closing of the uppers), to department C (assembly/finishing), and finally dispatch. The observation was conducted on 300 units in a batch of 25 pairs which were bundled. The components are bundled and scanned at each department before being sent via a conveyor belt from department A to B and then manually moved by 1 or 8 operators to department C. Once the goods are finished, they are then packaged, boxed and ready for dispatch. The following tables represent the value stream map in figure 4.2.

Table 4. 12: Department A – ladies' glitter 6942

DEPARTMENT A	
ACTIVITY	CLICKING
CYCLE TIME	12
WAITING TIME	10
DEFECT RATE	0.1
INEFFCIENCY	10
OPERATORS	7

Source: (Researcher, 2021)

Table 4.5 shows the main data captured from department A during the observation stage (Appendix A). Department A is the clicking department where the raw materials of the uppers and the soles are cut. The supervisor receives a ticket which includes details of quantity, bill of materials, order number, quantity, and a seal sample. The process begins when the raw material is available from the raw material warehouse. The material is then marked, graded (size curve) and cut accordingly. Once cut, they are bundled per size and in units of 25 pairs. It is then scanned using a shoepack software and placed onto the conveyor belt. The uppers (cut material which forms the top part of the sandal) moves to department B and the bottom stock (soles/base of shoe) remains at the base Department A until the uppers are completed in Department B. The observation covered the following variables: cycle time of 12 seconds, waiting time of 10 minutes, defect rate of 0.1%, inefficiency rate (repeat process) of 10%, and 7 operators were occupied.

Table 4. 13: Department B – ladies' glitter 6942

DEPARTMENT B	
ACTIVITY	CLOSING
CYCLE TIME	13
WAITING TIME	3
DEFECT RATE	0.18
INEFFCIENCY	26
OPERATORS	24

Source: (Researcher, 2021)

Table 4.6 (above) shows the main data captured from Department B during the observation stage (Appendix B). Department B is the closing department in which the upper bundles from department A are sewed. There were 4 operators allocated for the purpose of processing this closed shoe. Each operator had one component to sew. The department is run on a multi- model system, but each row of 24 operators works on 1 shoe style. There is a programme (shoepack) which indicates if an operator is occupied or not. The bundle is placed in a crate and sent down the assembly line which has a colour code - red for not occupied, or green for occupied depicted on the monitor. Once the uppers are sewn, they are counted and bundled in units of 25 pairs, scanned and placed on the conveyor belt or moved manually back to department A ready to proceed to department C. The observation stage covered the following variables: cycle time of 13 seconds, waiting time of 3 minutes, defect rate of 0.18%, inefficiency rate (repeat process) of 26%, and a total of 24 operators were occupied.

Table 4. 14: Department C – ladies' glitter 6942

DEPARTMENT C	
ACTIVITY	FINISHING
CYCLE TIME	13
WAITING TIME	10
DEFECT RATE	0.2
INEFFCIENCY	28
OPERATORS	43

Source: (Researcher, 2021)

Table 4.7 (above) shows the main data captured from Department C during the observation phase (Appendix B). Department C is the finishing department in which both the uppers and the bottom stock (made up of in-sole, mid-sole and out-sole) are processed to form a shoe. The outsole is the layer of sole that is exposed to the ground. The various component parts are assembled via a series of processes such as lasting (A shoe last is a 3-dimensional wooden or plastic mould upon which a shoe is constructed), pre-lasting, post-lasting, gluing, heating, wiping of the shoe, quality check, and packaging. The observation stage covered the following variables: cycle time of 13 seconds, waiting time of 10 minutes, defect rate of 0.2%, inefficiency rate (repeat process) of 28% and a total of 43 operators were occupied.

Table 4. 15: Dispatch – ladies' glitter 6942

DISPATCH	
ACTIVITY	DISPATCH
Actual shoes produced	216
Total Time	65

Source: (Researcher, 2021)

Table 4.8 (above) shows the actual number of shoes produced according to the present observation (216), and the total production time was 65 minutes. Once the order had been checked, paired and packaged in Department C, it was then scanned and placed into boxes. The boxes are then stored until the transport arrived. The mode of transport used is a truck, which collects the order and delivers it to the distribution centre of the relevant customer.

Table 4.9: A comparison between the lady's sandal and ladies closed shoe

	Closed shoe	Sandal
DEPARTMENT A		
ACTIVITY	CLICKING	CLICKING
CYCLE TIME	12	6
WAITING TIME	10	10
DEFECT RATE	0.1	0.1
INEFFCIENCY	10	10
OPERATORS	7	6
DEPARTMENT B		
ACTIVITY	CLOSING	CLOSING
CYCLE TIME	13	10
WAITING TIME	3	5
DEFECT RATE	0.18	0.1
INEFFCIENCY	26	10
OPERATORS	24	4
DEPARTMENT C		
ACTIVITY	FINISHING	FINISHING
CYCLE TIME	13	10
WAITING TIME	10	8
DEFECT RATE	0.2	0.1
INEFFCIENCY	28	10
OPERATORS	43	10
DISPATCH		
Actual shoes produced	216	308
Total Time	65	66

Source: (Researcher,2021)

The findings of the lady's closed shoe and the lady's sandal are compared in Table 4.9 (above). The results reveal a wide range of performance measurements across the departments. A closed shoe takes a longer cycle time than a sandal, according to Department A. This necessitates the addition of more operators. This is based on the number of components or pieces required by the shoe, with the closed shoe requiring more parts than the sandal, as seen in Figures 4.1 and 4.2. Closed shoes require a longer cycle time than sandals, according to Department B. When comparing a closed shoe to a sandal, the defect rate, inefficiencies, and number of operators are all higher. This also means that there is a higher risk of faults and inefficiencies than with a sandal, which has a simpler design and fewer components. Closed shoes require a longer cycle time than sandals, according to Department C. When compared to the sandal, this results in an increased wait time since more components are grouped in department B, more operators are required, more inefficiencies, and a higher defect rate. The complexity of the shoe and the amount of components have an effect on each variable observed in each department, according to these findings. More components are necessary as the shoe becomes more complicated. The sandal is considered a fast seller since it is made in bigger quantities and in a comparable time frame as a closed shoe, which is produced in smaller quantities.

4.3 Results from Interviews Via Questionnaires

The main purpose of the interview via questionnaires was to collect information in order to identify the eight common wastes in shoe manufacturing particularly in SMEs. The information was gathered from employees of the Durban shoe manufacturer on the lean manufacturing process strategy concerning the streamlining of operations in the production of ladies' sandals and shoes. An interview schedule (Appendix E) was compiled with the intention of conducting structured interviews. The responses from the interviews (questionnaires) were categorised according to the eight common wastes found in operations that served as the emergent themes (nodes). Table 4.10 below outlines the demographics of the participants.

Table 4.10: Background information of participants

BACKGROUND OF THE RESPONDENT							
PSEUDONYM	**Gender**	**Race**	**Age**	**Qualification**	**How long have you worked in the organisation?**	**Current position**	**Daily task**
Interviewee 1	Male	African	Older than 30 younger than 50	No formal qualification	Less than 12 months	Quality controller	Identify mistakes and corrects
Interviewee 2	Male	Indian	From age 18 onwards	Still studying(Diploma business management)	Over 5 years	Manager	Tooling process with size range/factory trials
Interviewee 3	Male	African	Older 25 younger 30	Industry specific certification	Over 5 years	Supervisor	Receive materials/ensure tickets and sample correspond with bulk
Interviewee 4	Male	Indian	Older 30 younger 50	School leaving	Over 5 years	Supervisor	To ensure all insides are complete
Interviewee 5	Female	African	Older than 25 younger 30	No formal qualification	More than 1 year less than 2 years	Quality controller	Identify mistakes and corrects
Interviewee 6	Male	African	From age 18 onwards	School leaving	Over 5 years	Supervisor	Monitoring/scores/targets
Interviewee 7	Female	African	Older 30 younger 50	No formal qualification	Less than 12 months	Planner/coordinator	Costing/plan production
Interviewee 8	Female	Indian	Older than 30 younger than 50	No formal qualification	Over 10 years	Factory supervisor	Supervising
Interviewee 9	Female	Indian	Older than 25 younger 30	Post graduate	Over 2 years	Planner/coordinator	Costing/plan production
Interviewee 10	Female	African	Older than 30 younger than 50	Graduate	Over 5 years	Manager	
Interviewee 11	Female	Indian	Older than 30 younger than 50	Graduate	Less than 12 months	Administrator	Stock queries/account queries
Interviewee 12	Female	African	Older than 30 younger than 50	No formal qualification	Over 10 years	Supervisor	
Interviewee 13	Male	African	Older than 30 younger than 50	Technical diploma	Over 5 years	Operator cutting	
Interviewee 14	Female	African	Older than 25 younger	No formal qualification	Over 2 years	Sample set/QA	
Interviewee 15	Female	Indian	From age 18 onwards	School leaving certificate	Over 5 years	Manager/buyer	Purchasing officer/oversee stores/chasng components and prices
Interviewee 16	Female	Indian	Older than 30 younger than 50	School leaving certificate	Over 10 years	Manager	Planning/leading/organising/overseeing production
Interviewee 17	Female	Indian	Older than 25 younger	Post graduate	Over 2 years	Stores admin/planner/purchasing/production	Create purchase orders/liase with suppliers/plan tickets/issue to production
Interviewee 18	Female	Indian	From age 18 onwards	Graduate	Less than 12 months	Administrator	

Source: (Researcher,2021)

4.3.1 Waste from Overproduction and Inappropriate Processes

Overproduction is the wasteful process that causes organisations to produce goods before they are required. This leads to excess inventory, excessive lead times, and makes it difficult to detect defects. This type of waste decreases floor-space-capacity, adds to rejects, increases resource usage, and adds to cost per unit (Wisner, Tan and Leong, 2019). Hence, overproduction induces excess inventory, and there is no value added to these products if they are kept in stock. The study identified the following factors contributing to overproduction as waste. The following responses testify to this:

Interviewer: "**Do you keep stock of footwear? If yes, which type and for how long?"**

Interviewee 15 (excess stock):

Yes, stocks of damages, returns, complete shoes that we did not deliver.

Interviewer: "Do you keep stock of footwear? If yes, which type and for how long?"

Interviewee 16 (production changes):

Quite often. Production changes to increase targets.

Interviewer: "What is the existing lead time on production of the ladies' sandal and ladies closed shoe?"

Interviewee 3 (production lead time):

1 strap sandal=600 pairs/per hour. Closed shoe = 300 pairs per/hour.

Inappropriate processes are regarded as the use of overly complex systems when a simpler process would be able to complete a task. Therefore, the waste of inappropriate processing can be characterised by unnecessary tasks that employees perform in the product flow (Chapter 2). This leads to longer lead times, unnecessary costs, non-added-value to the process or product, and may result in re-work activities. The study identified the following factors concerning inappropriate processes in manufacturing as indicated by participants:

Interviewer: "How many processes or stages does the order go through before it is completed and ready for dispatch?"

Interviewee 12 (existing factory processes):

Cutting, assembly, closing, joining all the components together, final closing, and final assembly.

Interviewer: "What is the layout plan of the factory for the various operational processes?"

Interviewee 15 (factory layout):

A time study is done for processes, for new styles, and a good layout must be done based on machine requirements.

Table 4.11: Responses to waste from overproduction and inappropriate processes

Inappropriate processes waste	**"The waste of inappropriate processing is characterised by unnecessary tasks that employees perform in the product flow"**
Existing factory process	Interviewee 12: "cutting/assembly/closing (joining all the components together)/final closing/final assembly."
Factory layout plan	Interviewee 15: "A time study is done for processes for new styles and a layout is done based on machine requirements."
Overproduction waste	**"Over-production induces excess inventory. There is no value added to these parts or products if they are kept in stock."**
Excess stock	Interviewee 15: "Yes, stocks of damages, returns, complete shoes that we

	did not deliver."
Production changes	Interviewee 16: "Quite often/production changes to increase targets"
Production lead time	Interviewee 3: "1 strap sandal=600 pairs/per hour, Closed shoe=300 pairs per/hour"

Source: (Researcher,2021)

4.3.2 The Waste from Defects and Inventory

The waste from defects occurs as a result of poor quality work (Santosa and Sugarindra, 2018). Defects, rework, scrap, and inspection generate wasteful handling, time, and loss of effort which delays productivity and stops the smooth flow of the production process (Wisner, 2019). In particular, defects are regarded as bottom-line waste as these bear direct costs to the organisation (Chapter 2). As a result, defects create uncertainty in processes and adversely affects production capacity and time (Wisner, Tan and Leong, 2019). The study identified the following, via participants' responses, as defects:

Interviewer: "How often are defects caused by operational error (machine malfunction and operator negligence)?"

Interviewee 12 (operation error):

Operator negligence is 2%.

Interviewer: "Describe the impact on production when an order was not captured correctly"

Interviewee 15 (capturing of incorrect orders):

The soles would be ordered incorrectly. The factory would produce the wrong shoe. The material issued would be incorrect and this would cause a major impact as we might not make delivery.

Interviewer: "Describe the impact on production when an order was not captured correctly"

Interviewee 3 (incorrect costing):

Order will be extra or sizes will be off for the order and will appear incomplete. If the order is extra, it affects the cost of labour and materials and the product with the highest defect rate is the closed shoe which has more components and processes than a sandal.

Inventory is regarded as the enemy of quality and productivity (Santosa and Sugarindra, 2018). It is closely associated with overproduction as it tends to increase lead time, space, and prevents the rapid identification of problems which discourages communication (Chapter 2). This also contributes to the uncertainty with quality levels, delivery lead times, unnecessary inventory storage of excess raw material, WIP and finished goods. The study identified the following factors such as excess stock as revealed in participants' responses:

Interviewer: "Describe the impact on production when an order was not captured correctly."

Interviewee 3 (extra order or incorrect sizes):

> *The order will be extra or sizes will be off for the order, and will appear incomplete. If the order is extra, it affects the cost of labour and materials. The most common material shortage is the material of the uppers.*

Interviewer: "What are the types of material shortages that occur during production?"

Interviewee 13 (incorrect order):

> *The upper materials. Raw material is measured as per the bill of material (BOM).*

Interviewer: "How are the glue and thread measured and purchased per order?"

Interviewee 11 (extra materials):

> *...as per BOM ticket requirement.*

Table 4. 12: Responses to waste from defects and inventory

Defects waste	**"The waste of defects occurs as a result of poor quality work"**
Defects by operation error	Interviewee 12 – "operator negligence 2%"
Incorrect order captured	Interviewee 15 – "The soles would be ordered incorrectly, the factory would produce the wrong shoe, the material issued would be incorrect and this would cause a major impact as we might not make delivery."
Incorrect costing	Interviewee 3 – "order will be extra or sizes will incorrect as per order. The order and will appear incomplete. If the order is extra, it affects the cost of labour and materials."
Product high defect	Interviewee 17 – "ladies' closed shoe"
Inventory waste	**"Inventory is an accumulation of finished products, WIP, and raw materials at all stages of the production process."**

Excess stock	Interviewee 3 – “order will be extra or sizes will be off for the order and will appear incomplete. If the order is extra, it affects the cost of labour and materials.”
Material shortage	Interviewee 13 – “upper material”
Raw material measures	Interviewee 11- “As per BOM ticket requirement”

Source: (Researcher,2021)

4.3.3 Waste from Transport and Motion

The waste of transport is generally identified as moving products from one location to another (Santosa and Sugarindra, 2018). Transportation waste involves excess movements of materials in an organisation (Bozarth and Handfield, 2019). Transporting parts or products from one location to another does not add any value, but rather creates added manufacturing lead times and costs. As a result, moving products from one location to another involves many movements of material in an organisation. This also contributes to increased risk of damages and does not provide value to the customer; instead it adds to manufacturing lead times. The study identified the following factors such as logistic challenges from suppliers as enunciated in the interviewee responses:

Interviewer: “How long does it take for the raw materials to be delivered from the time an order is placed with the supplier?”

Interviewee 16 (transport challenges):

Suppliers face challenges due to changes, and are unable to deliver goods on required dates. Some raw materials take longer to purchase.

Interviewer: “Which type of raw material takes the longest time to purchase?”

Interviewee 13 (materials):

Leather and other component materials are sometimes unavailable.

Interviewer: “Which type of raw material takes the longest time to purchase?”

Interviewee 16 (waiting for imports):

Waiting for upper materials from China which is caused by import delays.

Interviewer: "How long does it take for the raw materials to be delivered from the time an order is placed with the supplier?"

Interviewee 17 (long delays in importing from China):

> *With containers from China it can take up to two months, but locally it's from a day to two weeks.*

Unnecessary motion is a type of waste that refers to the ergonomics for quality and productivity which consumes time and energy (Santosa and Sugarindra, 2018). This type of waste is most often practised by operators as they search for tools as their selection and placement of tools and parts are kept out of immediate reach of the workstation, and this consumes time spent walking among machines and between workstations (Chapter 2). As a result, a poorly designed process can lead to unnecessary motion or movement. The study identified the following factors that hinder the movement of processes:

Interviewer: "How does the materials move through to each of the operation stations?"

Interviewee 12 (unnecessary movement):

> *Transport via forklift and the conveyor belt.*

Interviewer: "How to detect if an operator has completed the allocated batch?"

Interviewee 15 (operator detection):

> *We have a scanning process, so a job-order cannot leave the department without being scanned.*

Table 4. 13: Waste from transport and motion

Transport waste	**"The waste of transport is generally identified as moving products from one location to another"**
Logistical challenges	Interviewee 16 – "Suppliers face challenges due to changes; unable to deliver goods on required date."
Raw material longest to purchase	Interviewee 13 – "leather;" Interviewee 16 – "Upper material from China delay."
Waiting for imports	Interviewee 17 - "With containers from China, it can take up to 2 months; locally from a day to 2 weeks."

Motion waste	**"Unnecessary motion is waste that refers to the ergonomics for quality and productivity which consumes time and energy."**
Movement of process	Interviewee 12 – "transport with forklift and conveyor belt."
Operator detection	Interviewee 15 – "We have a scanning process so a job cannot leave the department without being scanned."

Source: (Researcher, 2021)

4.3.4 Waste from Waiting and Under-utilised Talent

The waste of waiting can be attributed to many different factors during production. In a manufacturing environment, this type of waste occurs whenever goods are not moving or being processed (Santosa and Sugarindra, 2018). It results from ineffective use of time and whenever employees or parts wait for a cycle to be completed (Bozarth and Handfield, 2019). The waste of waiting is directly relevant to continuity because lean manufacturing is concerned with the continuous flow of the product (Chapter 2). Sometimes, goods are not moving or being produced due to an inefficient layout or inability to match demand with output levels. Idle machines and operator time contribute to excess waiting time for processing. The study identified the following factors as articulated by the interviewees:

Interviewer: "Describe the impact on production when an order was not captured correctly."

Interviewee 4 (customer delays):

Delay on sales; must pay a penalty.

Interviewer: "How long does it take for the raw materials to be delivered from the time an order is placed with the supplier?"

Interviewee 17 (imports and local delivery):

With containers from China, it can take up to two months; locally it may average from a day to two weeks.

Interviewer: "Describe the impact on production when an order was not captured correctly."

Interviewee 15 (material shortage):

Material shortages are caused by incorrect costing. Where we allocated 500 metres for an order, but 600 was actually required. interviewee 15-

Interviewer: "How does the materials move through to each of the operation stations?"

Interviewee 15 (movement to and from factory and warehouse):

> *The movement of raw materials from warehouse to factory is done manually and via a conveyor belt between departments. We sometimes use conveyors/moving with bins from department to department.*

The under-utilisation of employees' creativity, talent, skills, and knowledge contribute towards waste in the organisation particularly in operations (Bozarth and Handfield, 2019). People make processes work, and employees run these processes together with the necessary operating procedures (Chapter 2). As a result, there is a lack of communication and knowledge-sharing between staff that have 10 years' experience to under a year experience. Quality and production are impacted by human fatigue, and a lack of training and development - all contribute to waste. The study identified the following factors in the response of an interviewee:

Interviewer: "How many years of experience do you have in the company and industry?"

Interviewee 15 (training and development):

> *I have been with the company for 6 years, and this is my first job in this industry. There are training and development opportunities which need to be enacted.*

Table 4.14: Waste from waiting and under-utilisation of talent

Waiting waste	**"This type of waste occurs whenever goods are not moving or being processed"**
Customer delays	Interviewee 4 –" delay in sales; pay a penalty."
Imported raw material delivery	Interviewee 17 – " With containers from China, it can take up to 2 months, locally it averages from a day to 2 weeks."
Local supplier delivery	Interviewee 13 – " 2 to 3 days"
Material shortage	Interviewee 15 – "material shortages are caused by incorrect costing; where we allocated 500m for an order but 600m was actually required."
Movement of raw materials from warehouse to factory	Interviewee 15 – "conveyors/moving with bins from department to department."
The raw material which takes the longest to purchase	Interviewee 15 – "Upper materials which we import from China; we have to place order, wait for a month for production, and then wait for a month

	for it to arrive."
Non-utilised talent	**"When an employee stands idle and watches an automated machine, he or she does not add any value to the process."**
Training and development	Interviewee 12 – "yes, I do get training."
Years of staff experience	Interviewee 15 – "I have been with the company for 6 years and this is my first job in this industry."

Source: (Researcher, 2021)

4.4 Conclusion

This chapter presented the results of the exploratory study. Based on the interpretation of the data, the study's findings revealed the differences in opinions between positions and departments which indicate that there is a large gap in terms of understanding the actual production system. The results of the interviews and observation identified areas that require improvement. Generally, the lean manufacturing principles were not adopted within the organisation. Only significant relationships between the questions and answers were considered, questions were also phrased as open ended and based on interviewees experience. Although the lean manufacturing model has been broadly embraced to eliminate waste and to improve quality and productivity, these benefits cannot be affirmed by the employees. Based on the analysis and presentation of the results obtained, the following chapters (5 and 6) will discuss the results, and present the conclusions and recommendations of the study.

CHAPTER FIVE
DISCUSSION OF RESULTS

5.1 Introduction

This chapter provides a discussion of the results outlined in chapter four. The results are examined against the conceptual framework, guided by the objectives of the study as outlined in chapter one. This research looked at identifying the eight-common waste in the shoe manufacturing industry particularly the SMEs. A Value Stream Mapping (VSM) presented the shoe production line to determine the presence of the eight types of non-value-adding activities in the production of shoes. This represented the data gathered from the observation on Ladies Sandal Batch 6906, and Ladies Glitter 6942 (closed shoe).

The responses from those staff members who were interviewed were a mix of perceptions but confirmed that lean tools and techniques were not effectively adopted which resulted in quality issues and higher costs. It is evident from the interviews and observation that communication between departments was limited, and hence frequent errors occurred; for example, incorrect costing is not rectified in time. This study involved a qualitative method approach since it required a subjective view that captured the actual experiences of staff through the interview. However, this study can be investigated further to capture the details of implementation of suggested lean tools and the development of the future value stream map of the production process. Based on the comments from employees, the research proved to be a revelation. There are staff members who are stuck in one position for as long as 20 years with minimal training and fewer responsibilities. There are also new staff members with minimal experience and tertiary qualification who handle more than one operational role in the company. This dichotomy can impact on the 8th common waste of non-utilised talent which can be linked to poor quality, high costs, and unemployment which may lead to a failure to meet the demand of a competitive South African market.

5.1.1 Research Questions

- How does overproduction, and inappropriate manufacturing and handling processes, contribute to waste?
- How does the relationship between defects and inventory contribute to waste in shoe production?
- What is the relationship between transport and motion, and how does this contribute to waste production?
- Why does a delay in production, and the non-utilisation of talent, contribute towards waste?

5.1.2 Research objectives

- To determine what lean tools and techniques are adopted by the local SME in the manufacturing of shoes for the South African market;
- To assess the extent to which the relationship between defects and inventory contributes towards waste in shoe production;
- To explain the relationship between transport and motion regarding its contribution towards the production of waste in the shoe production;
- To investigate the causes for delays in production, and the non-utilisation of talent that contribute towards waste in shoe production.

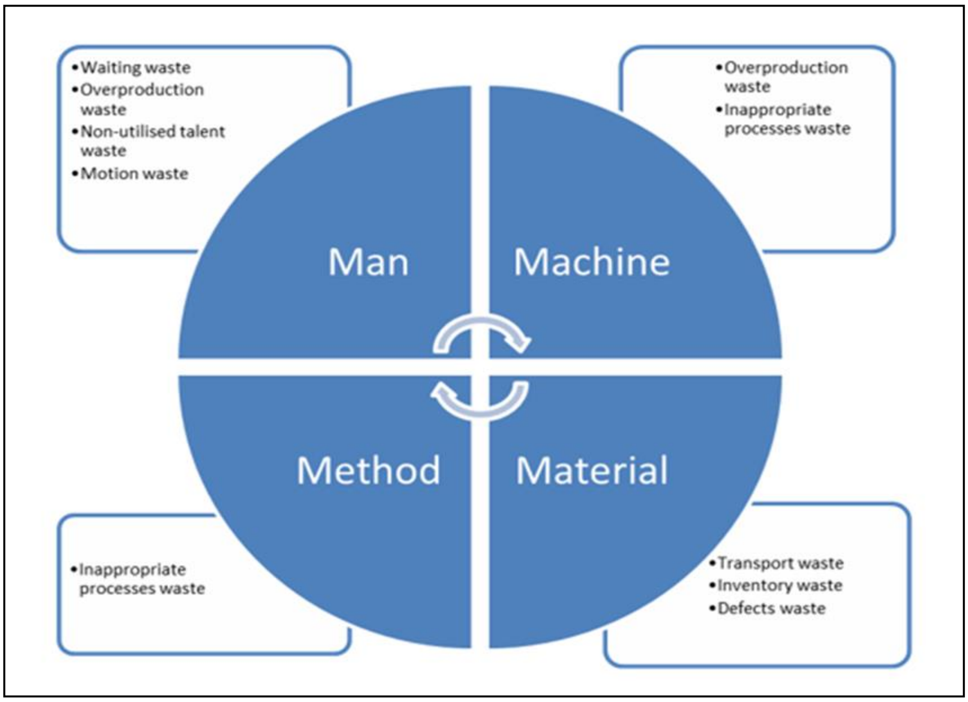
5.2 Biographical Data

All of the Durban shoe manufacturer's staff members who received the interview schedule, 18 (100%) had returned and completed it. Most of the respondents 12 (66%) were females and 6 (33%) were males; this demonstrates the dominance of females at the SME. Twenty-two per cent (22%) of the respondents were managers, 11% were operational administrators, 27% were supervisors, 11% were quality controllers, 6% were in stores, 11% were planners/coordinators, 6% were sample quality assurance workers, and 6% were operators. In terms of years of experience, 22% of the respondents had less than 12 months of experience, 38% over 5 years, over 10 years 17%, over 2 years 17%, while 6% had more than a year's but less than 2 years' experience.

5.3 Findings from Interviews and Observation

Through the observation technique and interview questionnaires, there is a clear identification of the 8 common wastes present within the production process at the Durban shoe manufacturer which were populated on the value stream map. The 8 common wastes were categorised as man, machine, method and material. According to Neyestani, (2017:13), "DR Kaoru Ishikawa was a Japanese quality specialist, who founded quality management processes in the Kawasaki shipyards, and in the process, became one of the founding fathers of modern management". Ishikawa is best known to introduce and develop many quality tools like cause-and-effect diagrams (called fishbone or Ishikawa diagram). These categories are based on the cause and effect model. The cause-and-effect diagram was an effective method tool in reducing and preventing the errors and mistakes in the organization assisting with Total Quality Management (TQM). This concept was designed to bring production workers, maintenance, design engineers and managers together in organized meetings to solve problems. It was a critical tool to complete root-cause analysis of any problem (Neyestani, 2017). Figure 5.1 below, the *man* group indicates unnecessary motion during operations, employees waiting to proceed with production, processes, and overproduction. The *machine* group represents inappropriate processing of products. The *method* group represents the processing involved which also aligns to inappropriate processes and over-production. The *material* group identifies waste from transportation, excess inventory, and defects. On closer examination, overproduction overlaps both man and machine, while defects overlap machine and material. The main sources of waste in production overlap each other. Therefore, the removal of one source of waste, can contribute to the reduction or elimination of other waste.

Figure 5. 1: Categories of the causes of waste



Source: (Researcher,2021)

5.4 Objective 1: Waste from Overproduction and Inappropriate Processes

Question: What is the contribution of overproduction and inappropriate processes to waste?

In addressing this objective, different variables were examined to identify waste contribution from overproduction and inappropriate processes. The study identified the following factors contributing to overproduction: excess stock, production changes, and production lead time. Since customer requirements and demands are uncertain, accurate forecasting is crucial in controlling the production to determine the possible order quantity. A key assumption is that overproduction can be eliminated by a firm 'pull logic' system called the Kanban which was developed by Taichi Ohno at Toyota (Triana and Beatrix, 2019). The Kanban system prevents unplanned overproduction by allowing work to move forward only when the next work area is ready to receive it (Jhanji, 2021). With relation to the *man* category, overproduction forces the organisation to consistently change the number of employees in the work force, thus making standardisation extremely difficult which results in quality problems and a waste of competencies. The over-running of machines as production changes can therefore be under the *machine* category which leads to excess stock and increased product lead times. The study also identified factors such as redundant approvals, poorly defined customer requirements, lack of standard operating procedures, and redundancy which stems from incorrect costings which impacts on existing factory processes and layout plans. This is categorised as *method* which also impacts on *machine*. This is a clear indication of inappropriate processes which impact on unnecessary production leading to overproduction. As a result, operators tend to shift their focus on the quality of parts when they are produced in excessive amounts. They somehow sense that there is enough material to substitute for defects. This equates to 'set-up' and 'change-over' costs.

5.5 Objective 2: Waste from Defects and Inventory

Question: How does the relationship between defects and inventory contribute to waste in shoe production?

In addressing this objective, different variables were examined to identify waste contribution from defects and inventory. The study identified the following: defects in operation, incorrect orders, and inaccurate inventory levels. All of contribute to defects which further impacts on inventory stock levels. The findings depicted that the product with the highest common defect was the closed shoe which has more components and processes as compared to a sandal. This is evident through the number of operators and the cycle time which show high variances between these two variables. The high defects lead to inventory wastes that use up critical raw material components which take a long time to order from suppliers. In practice, unnecessary inventory can be attributed mainly to ineffective information flow and poor batch processing. If inventory is not structured to meet customer demand, it then impacts on cash flow and uses valuable floor space. Defects and inventory are categorised under *material* as these contribute to excess stock and high material waste. The most common material shortage is from the various upper material and raw material which is measured as per the bill of material (BOM). When these stocks are used up to compensate defects, they are not easily replenished.

5.6 Objective 3: Waste from Transport and Motion

Question: What is the transport and motion contribution towards waste?

In addressing this objective, different variables were examined to identify waste contribution from transport and motion factors through an observation demonstrated in chapter 4 and verified by the interview responses. The study identified the following factors that contributed to waste: logistical challenges from suppliers, and some raw materials take a long time to arrive such as waiting for imports. In addition, the unnecessary movement of processes and operator detection contributes to motion waste. Traditionally, parts are transferred from a large storage pallet to a smaller one and then placed on the machine several times before they are finally processed. This results in moving materials across unnecessary distances, or being stored temporarily, or being re-arranged at the workstations which leads to wasteful practices. Non-standardised work methods is another common form of motion waste that results in excessive work in process (WIP), and in a higher percentage of defects. Motion waste is therefore categorised under *man*. As this is commonly contributed by operators in the production process. Value is determined by the work put in from the operator. Therefore, complexity of tasks may have a negative impact on the operator which supports the assumption that the operator is falsely busy and this does not add value (Slack et al., 2013). Transport waste can be closely linked to communication; and if these two processes are not in sync or not in a logical sequence, communication is hindered and this could affect quality which then categorises transport as *material*. According to Slack *et al.* (2013), transportation is the movement of items around the operation. Therefore, excess handling of WIP as previously indicated does not add value. However, implementing changes such as factory layout, improvements in transport methods and simple work place organising can reduce waste.

5.7 Objective 4: Waste from Waiting and Talent Non-Utilisation

Question: Why does a delay in production and the non-utilisation of talent contribute towards waste?

In addressing this objective, different variables were examined to identify waste contribution from waiting and non-utilised talent through an observation demonstrated in chapter 4 which was verified by the interview response. The waste of waiting is directly relevant to continuity because lean manufacturing is concerned with the continuous flow of the product (Chapter 2). The study identified the following factors: customer delays, waiting period of the imports of raw material, and problems in local delivery - all lead to material shortage. In addition, the movement of raw materials from the warehouse to the factory is done through a combination of manual labour and a conveyor belt system between departments. The findings depicted that the waste of waiting is caused mainly by poor communication, uneven scheduling, unreliable suppliers, and poor lead time in waiting for the next process or operation. Previous research suggests that parts or products waiting in inventory does not add value and remains idle while waiting to be transported to the next process. The value stream map highlighted the lead times between the closed shoe production line and the sandal production line. The cycle time and lead time for closed shoes took longer than the sandal. This is due to more operators being allocated for more processes and the handling of more components. This is categorised under *man.*

The study also identified factors emanating from non-utilised talent such as the need for training and development on site, and the ignoring of participants' experience in the company. People make processes work, and employees control and manage these processes (Chapter 2). In relation to non-utilised talent mainly time, ideas, skills, improvements, and learning opportunities are lost by not engaging or listening to the employees (Mia *et al*., 2017). Since employees are at the centre of an organisation, they should be trained to control wastage and solve problems at the source by repeatedly asking for reasons as to the recurrence of the problem. Significant value is added when employees participate in training programmes or perform different tasks during waiting time. Therefore, both non-utilised talent and waiting can be categorised under *man*.

5.8 conclusion

The chapter analysed and discussed the results obtained from chapter 4 focusing on the aim of this research which was to identify the 8 common wastes found in the production process of the Durban shoe manufacturer. The wastages detected were commonly found under defects, inventory and waiting. It is therefore understood that the implementation of the lean manufacturing model must be given priority to satisfy customer demands while producing quality products in the most efficient and economical manner. The objectives of the study highlighted the origins of the various forms of waste and categorised them as *man*, *material*, *machine*, and *method* as shown in figure 5.1. The impact of Covid 19 in Kwa Zulu Natal has caused a disruption in the manufacturing of goods due to closure of factories during the lock down initiated by the government of South Africa. Furthermore, a challenge of looting arose in which warehouses and stores were vandalised as a result causing a spike in demand. Therefore, Lean manufacturing has the polar opposite effect on industry in the event of looting and Covid-19, as Covid-19 forced factories to close while looting caused a demand disruption, which directly contradicts lean and the waste of overproduction and inventory. Literature says that over production leads to excess waste which therefore falls on to waste of inventory. Waste of inventory contributes to storage costs and excess material handling which is regarded as waste. In a manufacturing company that largely relies on imports of raw material this impacts on the waste of waiting which by Covid-19 and looting resulted in delays in production. Therefore, from a global and South African context a company cannot primarily depend on lean manufacturing tools but rather agility and flexibility of production and sourcing. This is necessary to mitigate future risks. Based on the analysis and results obtained, the final chapter (6) outlines the conclusions and recommendations emanating from this study.

CHAPTER SIX
RECOMMENDATIONS AND CONCLUSIONS

6.1 Introduction

This chapter (6) presents the summary, conclusions, and recommendations based on the study's findings discussed in chapter five. This is the concluding chapter of the study which ensures that the research objectives have been addressed. This research began with a case study of a shoe production line with an observation of two different styles of shoes at a Durban shoe manufacturer. This study was conducted to determine the eight most common types of waste in the shoe manufacturing process. Defects, inventory, and waiting were the three most prevalent wastes discovered. As a result, in order to address the primary study question posed in Chapter 1, "to what extent do local SMEs use lean tools and techniques to reduce non-value activities in the production of shoes for the South African market?". The interviews and observations revealed that the company does not retain sufficient stock and is heavily reliant on raw material imports, resulting in high wastage of time and posing a risk when costing errors occur or demand fluctuates. This further impacted during the pandemic Covid-19 and looting specifically in South Africa. This has a negative influence on inventory waste and defects. The present lean tools have not been embraced effectively, which leads to the realization that when dealing with specific complexities in South Africa, lean techniques must be used in conjunction with agility and flexibility. Therefore, in order to reduce the wastages identified some improvement strategies are required such as increasing skilled manpower, continuous improvement, and involvement of Just in time (JIT) philosophy within the production management system. The following provides a recommendation to each of the objectives along with suggested lean manufacturing models such as continuous improvement and standardisation of work which aim to help the company achieve agility and flexibility during production.

6.2 Recommendations

6.2.1 Continuous Improvement

As discussed in chapter two, "Kaizen is a Japanese word which indicates the continuous endeavour for bringing perfection in the production of quality and quantity" (Omoush, Moflih, and Almetrami, 2020; 44). Kaizen, also known as continuous improvement, is a "long-term approach that systematically seeks to achieve small, incremental changes in processes in order to improve efficiency and quality" as supported by Omoush, Moflih, and Almetrami, (2020:44). Therefore, Kaizen can be applied to any kind of work, but it is perhaps best known for being used in lean manufacturing which utilises continuous improvement as one of its basic tools.

In a production processing line, improvement can be achieved in many ways such as reduction of inventory, production time, and defective parts. Commencing with a number of continuous improvement tools, as previously mentioned the 5S is one of the most popular tools for effective continuous improvement concerning waste reduction. “The 5S approach consists of the Japanese words “*seiri* (sort), *seiton* (straighten), *seiso* (sweep and clean), *seiketsu* (systemise) and *shitsuke* (standardise)”. The underlying concept of 5S is to look for waste and then try to eliminate it” (Mia *et al.*, 2017).

According to Mia *et al* (2019:25), “The first ‘S’, *seiri* (sort) deals with moving items that are not currently being used on an uninterrupted basis away from those that are being used.” If every area has people assigned to it then every individual has a responsibility to maintain a high standard of tidying and cleaning. “The second ‘S’, *seiton* (straighten) relates to having the right components in the right area.” Tools must be marked and arranged as belonging in that specific area. This will make it easier to move components that are not labelled accordingly from an incorrect area to the allocated area. Arranging items in the right place will make tools, jigs, fixtures and resources noticeable, detectable and easy to use. “The third ‘S’, *seiso* (sweep and clean) deals with cleaning and sweeping the workplace methodologically.” The work place should look neat and clean, and ready to use for the next shift. “The fourth ‘S’, *seiketsu* (systemise) deals with maintaining a high standard of housekeeping and workplace arrangement.” A regular audit should be conducted, and there must be the allocation of assigned areas of responsibilities. The last and “fifth ‘S’, *shitsuke* (standardise), deals with the management’s accountability to train people to follow housekeeping rules.” Together, 5S means good housekeeping and better workplace organisation. Kaizen tools are not only a means to increase the profitability of a firm, but also encourages companies to exploit potential strengths and capabilities” (Mia *et al.*, 2017:25). An effective training session should be arranged on a regular basis before the need arises in order to incorporate 5S into the existing production management system. At each stage of the shoe production process, there should be a persistent effort to identify the problem. Therefore, the Durban shoe manufacturer should use continuous improvement as a driving force to improve the production time of the ladies closed shoe as well as to reduce the waiting time between departments. A constant effort should be made to find a means to solve the problems that arise, and if this method is successful, it should be documented; if it is not, efforts should be made to find a solution that goes beyond the eradication of problems for non-value-adding activities.

6.2.2 Standardisation of Work

As outlined in chapter two, the standardisation of workers’ role functions is the foundational principle of waste elimination. Basically, standardised work ensures that each activity is organised and executed in the most efficient and effective way. In this case, the level of quality is preferred over the worker conducting the same activity. This includes the time needed to finish a job, the order of steps to follow for each job, and the parts on hand. Thereby in conducting this, unnecessary work in process is minimised and non-value-added activities are substantially reduced. A tool that is used to standardise work is called *takt* time. According to Nassereddine (2019;), "*Takt* (German for rhythm or beat) refers to how often a part should be reduced in a product group based on the actual customer demand". The target is to produce at a pace not higher than the *takt* time. The lower it is, the faster the production is. Therefore, the Durban shoe manufacturer should use standardisation of work and JIT as a driving force to improve the takt time of the ladies closed shoe as well as to reduce the waiting time between departments.

6.2.3 Production flexibility: Recommendations Based on Objective 1

The study noted that employees over-produce to be on the safe side, and to accommodate for defects. Therefore, it can be suggested that by utilising a Kanban system, as well as designing a planned production schedule that is accurate, in line with customer demands, the waste of overproduction can be eliminated. Tools such as VSMs are commonly used to identify and eliminate non-value activities. When process efficiencies are improved, fewer resources are utilised to achieve the same customer satisfaction. It is therefore necessary to develop procedures that continuously improve and elevate processes and equipment to reduce waste. An operations ability to be both flexible and agile also contributes to minimising waste. According to Slack et al. (2013), flexibility by definition is the ability of an operation to make changes in order to accommodate any errors in production or respond to demand uncertainty. In this study flexibility with regards to delivery to the customer in the event of delays that may have transpired as a result to incorrect costing or a change in styling is necessary. Especially during situations of a pandemic such as Covid-19 lock down or during a period of unrest or looting which significantly has an impact on demand. Therefore, when an operation is both flexible and agile demand uncertainty can be responded to effectively.

6.2.4 Eliminate Waste at Source: Recommendations Based on Objective 2

Possible problems are caused by excess inventory that include defects, production disparities, longer set-ups, equipment downtime, and late or defective deliveries of raw material from suppliers. It is evident that customer demand sets the norm for inventory levels. Therefore, the main strategies should be to maintain the correct inventory level and identify problems timeously before inventory accumulates. Therefore, it is important to understand that defective parts affect every process throughout the value chain from the supplier to the customer. Possibly, the first step in producing quality products at competitive prices would be to swiftly identify and eliminate waste at the source.

6.2.55s and Cell Based Systems: Recommendations Based on Objective 3

The VSM tool is often used to identify the type of waste whilst 5S, cell designs and ergonomic workspace designs are commonly used to reduce waste motions. Lean manufacturing requires a continuous workflow with minimum or no interruptions. Unnecessary transportation cannot be completely eliminated; however, it is essential to continuously reduce it. As a means of intervention, transportation waste can be reduced by grouping products and equipment into product categories by effecting cell-based systems, better process coordination, better transportation methods, and minimising the distances materials should travel. Moving products judiciously and perhaps eliminating unpredictable or unforeseen reworking or scrapping costs, may eradicate wastage in company transportation.

6.2.6 Respect, Culture and Training: Recommendation Based on Objective 4

Employees are known to perform at their best to achieve quality goals set by management when they feel acknowledged and treated fairly for their contributions. Lean management practices help employees to fulfil their full potential and to achieve higher goals in order to make positive contributions in the workplace. The common causes that result in waste include organisational culture, inadequate respect for employees, no provision for training, and high employee turnover. When organisations capitalise on their employees' creativity, they can eliminate the other seven wastes and continuously improve the company's all-round performance.

Respect and culture are the two main determinants for exploiting human potential. It is important that employees contribute harmoniously and significantly to production. Therefore, companies can benefit from employees' creativity as it assists in identifying and removing all forms of waste from production. It can be inferred that some of the sources of wastes are more prevalent than others but can be eradicated, while there are some that cannot be completely eliminated.

6.3 Limitations and Suggestions for Future Research

This study could provide a springboard for future research. Since it is a qualitative study that aims to explore a specific phenomenon, a generalisation of the findings will not be possible; however, the findings from this study can assist other shoe manufacturing companies and SMEs that are located in similar contexts. A quantitative study can be pursued for future research. The impact of the Covid-19pandemic restricted the contact between persons, and the lockdowns in the manufacturing industry further restricted the width of the research. Conducting interviews without direct contact led to not getting the rich and incisive responses due to the lack of probing for clarity and elaboration of views on the topic under investigations. It is envisaged that future researchers utilise a greater number of participants and engage in deeper observations to unpack the potential of this topic.

6.4 Conclusion to The Study

This study aimed at identifying the 8 common types of waste in the shoe production process of the Durban shoe manufacturer. A qualitative study approach utilising questionnaire and observation techniques elicited data which was analysed to present the findings. It was the researcher's intention to offer suggestions and recommendations to improve the manufacturing of shoe processes, specifically in the management of waste. This model was expected to be cost-effective and efficient in facilitating smooth processes in the production line. Findings revealed, generally, that the Lean Manufacturing Model was not consistently applied such that waste was evident on and off-site. This affected production, time, and costs.

The framework and findings of this study should be applied to other critical areas within the shoe manufacturing industry. South African SMEs would largely benefit from these research results. Lean Manufacturing would enhance productivity and allow for quality improvements while reducing the overall cost of products. Although this is already understood, it needs to be the focal point to support the thinking behind continuous improvement. Furthermore, knowledge about the Lean and the 8 common waste should be continuously developed, practiced and shared between larger organizations and SMEs. This knowledge sharing would allow for the extension of the paradigm and benefits across the manufacturing industry allowing for extension into supply chain operations. Nevertheless, it is hoped that this study and further research endeavors motivate all industries to adopt and adapt the recommendations outlined in this study. The following aspects could be incisively interrogated by future researchers to unearth beneficial results to all in business; such as the absence of cost-effective projects; cost of raw materials in comparison to synthetic materials; inclination of the industry to become import-oriented in terms of purchasing raw materials; how to circumvent power outages, water cuts, and labour disputes; and product designing and staff development in accordance with cost-effectiveness and legal stipulations.

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APPENDICES

Appendix A: Observation Schedule Sandal

Ladies Sandal Batch no: 6906 sandal	Unit 400	Department A	Department B	Department C
	16 (25 pairs per bundle)	Clicking of bottom stock and uppers	Closing of uppers	Assembling/finishing
Waste of non utilised talent and waste of waiting				
No of operators	No. of operators	6	6	10
No of operators occupied	Number	6	4	10
takt time		5	9	9
Cycle time (Sec)	Seconds	6	10	10
Process efficiceny		83%	90%	90%
Total tme to receive material	Minutes	10	5	8
Availability of inputs(%)	Percentage	100	100	100
Waste of inventory and waste of defects				
Total counts (parts)	No.of parts(l+r)12 (400)	4800	3200	4800
Defective rate (%)	Percentage	0.1	0.1	0.1
Defect parts	No.of parts	480	320	480
Actual counts		4320	2880	4320
Target counts (parts)	No.of parts	4800	3200	4800
Waste of inappropriate processing and waste of overproduction				
Actual shoes produced		308	205	308
Inefficiency (%) repeated process	Percentage	10%	10%	10%
Total time(min)	Minutes	40	66	66
Waste of transport and waste of motion				
Availability of outputs(%)	Percentage	100	100	100
Total number of operators and machines in motion between departments	Number	1	1	8
Percentage Scale Response				
Over 50% -YES				
50% -Neutral				
Below 50% - NO				

Appendix B: Observation schedule closed shoe

Ladies Sandal Batch no: (Closed shoe Pumps)Glitter 6942	Unit 300	Department A	Department B	Department C
	12 (25 pairs per bundle)	Clicking of bottom stock and uppers	Closing of Uppers	Assembling/finishing
Waste of non utilised talent and waste of waiting				
No. of operators	No. of operators	7	24	43
No. of operators occupied	Number	7	24	43
takt time		8	10	10
Cycle time (Sec)	Seconds	12	13	13
Process efficiceny		67%	77%	77%
Total tme to receive material	Minutes	10	3	10
Availability of inputs(%)	Percentage	100	90	90
Waste of inventory and waste of defects				
Total counts (parts)	No.of parts(l+r)16 (300)	4800	3240	4320
Defective rate (%)	Percentage	0.1	0.18	0.2
Defect parts	No.of parts	480	583.2	864
Actual counts		4320	2656.8	3456
Target counts (parts)	No.of parts	4800	3600	4800
Waste of inappropriate processing and waste of overproduction				
Actual shoes produced		270	166	216
Inefficiency (%) repeated process	Percentage	10%	26%	28%
Total time(min)	Minutes	60	65	65
Waste of transport and waste of motion				
Availability of outputs(%)	Percentage	100	95	100
Total number of operators and machines in motion between departments	Number	1	1	8
Percentage Scale Response				
Over 50% -YES				
50% -Neutral				
Below 50% - NO				

Appendix C: Summary of interview responses (exported from NVIVO 12 PRO)

Name	Description
Defects waste	**The waste of defects occurs as a result of poor quality work.**
Defects by operation error	Interviewee 12 - operator negligence 2%
Incorrect order captured	Interviewee 15 - The soles would be ordered incorrectly, the factory would produce the wrong shoe, the material issued would be incorrect this would cause major impact as we might not make delivery.
Incorrect costing	Interviewee 3 - order will be extra, or sizes will be incorrect, or order appears incomplete. If the order is extra, it affect the cost of labour and materials.
Product with high defect	Interviewee 17 – ladies' closed shoe
Inappropriate processes waste	**The waste of inappropriate processing is characterised by unnecessary tasks that employees perform in the product flow.**
Existing factory process	Interviewee 12 - cutting/assembly/closing (joining all the components together)/final closing/final assembly.
Factory layout plan	Interviewee 15 - A time study is done for processes for new styles, and a layout is done based on machine requirements.
Inventory waste	**Inventory is an accumulation of finished products, WIP, and raw materials at all stages of the production process.**
Excess stock	Interviewee 3- order will be extra or sizes will be off for the order and will appear incomplete. If the order is extra, it affect the cost of labour and materials.
Material shortage	Interviewee 13 - upper material
Raw material measures	Interviewee 11- As per BOM ticket requirement
Motion waste	**Unnecessary motion is waste in the ergonomics process for quality**

Name	Description
	and productivity, which consumes time and energy.
Movement of process	Interviewee 12 - transport with forklift and conveyor belt
Non-utilised talent waste	**When an employee stands idle and watches an automated machine, he or she does not add any value to the process.**
Training and development	Interviewee 12 – yes, I do.
Years of staff experience	Interviewee 15 - I have been with the company for 6 years and this is my first job in this industry.
Overproduction waste	**Overproduction induces excess inventory. There is no value added to these parts or products if they are kept in stock.**
Excess stock	Interviewee 15 - Yes, stocks of damages, returns, and complete shoes that we did not deliver.
Production changes	Interviewee 16 - Quite often/production changes to increase targets.
Production lead time	Interviewee 3 - 1 strap sandal=600 pairs/per hour Close shoe=300 pairs per/hour
Transport waste	**The waste of transport is generally identified as moving products from one location to another.**
Logistical challenges	Interviewee 1 6- Suppliers face challenges due to changes, and are thus unable to deliver goods on the required date.
Raw material that consumes the longest time to purchase	Interviewee 13 – leather. Interviewee 16 - Upper material from China.
Waiting from imports	Interviewee 17 - With containers from China, it can take up to 2 months, but locally from a day to 2 weeks.
Waiting waste	**This type of waste occurs whenever goods are not moving or being processed.**

Name	Description
Customer delays	Interviewee 4 - delay in sales; pay a penalty.
Imported raw material delivery	Interviewee 17 - With containers from China it can take up to 2 months, but locally it takes a day to 2 weeks.
Local supplier delivery	Interviewee 13 - 2 to 3 days
Material shortage	Interviewee 15 - material shortages are caused by incorrect costing; where we allocated 500 metres for an order but actually 600m was required.
Movement of raw material from warehouse to factory	Interviewee 15 - conveyors/moving with bins from department to department.
The raw material that takes the longest time to purchase	Interviewee 15 - Upper material which we import from China. We have to place the order, wait for a month for production, and then wait for a further month for it to arrive.

Appendix D: Ethical Clearance Letter

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

18 June 2021

Miss Nikita Reddy (211509373)
School Of Man Info Tech & Gov
Westville Campus

Dear Miss Reddy,

Protocol reference number: HSSREC/00002814/2021
Project title: Lean manufacturing strategies in small and medium enterprises: A case of a Durban shoe manufacturer
Degree: Masters

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 18 May 2021 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

This approval is valid until 18 June 2022.
To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

All research conducted during the COVID-19 period must adhere to the national and UKZN guidelines.

HSSREC is registered with the South African National Research Ethics Council (REC-040414-040).

Yours sincerely,

[redacted]

____

Professor Dipane Hlalele (Chair)

/dd

Humanities and Social Sciences Research Ethics Committee
Postal Address: Private Bag X54001, Durban, 4000, South Africa
Telephone: +27 (0)31 260 8350/4557/3587 **Email:** hssrec@ukzn.ac.za **Website:** http://research.ukzn.ac.za/Research-Ethics

Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

INSPIRING GREATNESS

Appendix E: Voluntary Interview schedule

UNIVERSITY OF KWAZULU-NATAL

SCHOOL OFMANAGEMENT, IT and GOVERNANCE

M-COM Dissertation

Researcher: Nikita Reddy (08148186081)

Supervisor: Mr E. Ncube (031 260 8805)

Research Office: Mariette Snyman (0312608350)

CONSENT

I………………………………………………………………………… (Full names of participant) confirm that I understand the contents of this document and the nature of the study, and I consent to participate voluntarily in the research project.

I understand that I have the right to withdraw from the project at any time, should I wish to do so.

SIGNATURE OF PARTICIPANT: …………………………

DATE: ………………………………….

INTERVIEW QUESTIONNAIRE

(Approximate interview time: 30 minutes)

Date: --

Organisation: ---

Participant: ---

Topic: Lean manufacturing strategies in small and medium enterprises: A case of a Durban shoe manufacturer

.

Master's in Commerce (Supply Chain Management)

School of Management, IT and Governance

College of Law and Management Studies

University of KwaZulu-Natal

Researcher: Nikita Reddy (0814818608)

Supervisor: Mr E. Ncube (031 260 8805)

Research Office: Mariette Snyman (0312608350)

Introduction

The main intent of this interview is to collect information in order to identify the eight common wastes in shoe manufacturing particularly SMEs. The information will be gathered from employees of Labora Shoes concerning the application of the Lean Manufacturing Model to streamline operations in the production of ladies' sandals and shoes. The information which you provide will go a long way in helping us identify internal Lean principles applied in the manufacturing process.

Confidentiality will be applied to all responses provided.

SECTION A: BACKGROUND OF THE RESPONDENT

This section seeks to access demographic or background information.

1. Gender

 Male

 Female

2. Age

 From 18 onwards

 Older than 25 but younger than 30

 Older than 30 but younger than 50

 Older than 50

 I do not wish to answer

3. Race

 African

 Coloured

 Indian

 White

 Other (specify): ______________________________

 I do not wish to answer

4. Educational qualifications

 No formal qualification

 School leaving certificate

 Technical Diploma

 Graduate

 Post Graduate

 Industry specific certification

 Still studying (Please specify) ________________________________

□ Other (Specify):____

5. How long have you worked in the organisation?

□ fewer than 12 months

□ More than 1 year but fewer than 2 years

□ Over 2 years

□ Over 5 years

□ Over 10 years

6. What is your position in the organisation?

□ Director

□ Planner/coordinator

□ Manager

□ Supervisor

□ Other (please specify): ____________________________________

SECTION B: INDIVIDUAL JOB PROFILE

1. Please provide a brief overview of your job description.
    - ❖ Daily tasks or activities…………………………………………………………..
    - ❖ Decisions to take on a daily basis………………………………………………………
2. Provide a brief overview of your operational processes in the factory.
3. Provide a brief overview of logistical changes and challenges in the factory.

SECTION C: ROLE IN IDENTIFYING WASTE

The aim of the following questions is to gather information on the roles played by the operations department to identify the eight wastes in shoe manufacturing.

Q1. What is the contribution of overproduction and inappropriate processes concerning waste?

a. How often are there changes whilst a product is in the production line, and what changes are required?

b. How many processes or stages does the order undergo before it is finished and ready for dispatch?

Q2. How does the relationship between defects and inventory contribute to waste in shoe production?

a. Do you keep stock of footwear? If yes, which type and for how long?

b. Describe the impact on production when an order is not captured correctly.

c. Which style of ladies' sandal and ladies' closed shoe has the most defects?

d. What are the types of material shortages that occur during production?

e. How are glue and thread measured and purchased per order?

Q3. Explain how the relationship between transport and motion contributes towards production waste?

a. Outline the layout plan of the factory for the various operational processes?

b. How do materials move through to each of the operation stations?

c. How long does it take to move all of the required materials from the warehouse to the factory?

d. What is the process design of the shoe factory from the cutting room to the operators?

e. How do you detect if an operator has completed working on the allocated batch?

f. How often are defects caused by operational errors (machine malfunction and operator negligence)?

Q4. Explain how a delay in production, and the non-utilisation of talent contribute towards waste?

a. How many years of experience do you have in this company, and in the industry?

b. Did you undergo any additional training on supply chain management processes, specifically regarding lean manufacturing?

c. How long does it take for the raw materials to be delivered from the time an order is placed with the supplier?

d. Which type of raw material takes the longest time to purchase?

e. What is the existing lead time on the production of the ladies' sandal and ladies' closed shoe?

I greatly appreciate your valuable time and input. Thank you.

Appendix F: Informed Consent

UKZN HUMANITIES AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE (HSSREC)

APPLICATION FOR ETHICS APPROVAL
For research with human participants

Information Sheet and Consent to Participate in Research

Researcher: Nikita Reddy (08148186081)
Supervisor: Mr E. Ncube (031 260 8805)
Research Office: Mariette Snyman (0312608350)

Date: 19 March 2021

My name is Nikita Reddy a MCOM (Supply Chain Management) student, at the School of Management, IT & Governance in the University of KwaZulu-Natal invite you to participate in research project "Lean manufacturing strategies in small and medium enterprises: A case of a Durban Shoe manufacturer."

You are being invited to consider participating in a study that involves research that is case study designed and qualitative in nature. The aim and purpose of this research is to identify the eight common wastes in shoe manufacturing particularly SMEs. The study is expected to include 18 participants in total that will be split into three departments, a, b and c as follows; 9 product coordinators, 3 staff from the sample set room, and 3 factory supervisors. It will involve the following procedures structured interviews and an observation schedule. The duration of your participation if you choose to participate and remain in the study is expected to help us identify internal Lean principles applied in the process and contribute to the body of knowledge that will help many other SMEs globally.

The study may involve your time in answering the interview questions. The study will provide no direct benefits to participants. The study hopes to gain knowledge that will in hopes to grow other SMES and help identify the 8 wastes that may occur in manufacturing of shoes. A Zoom session may be arranged or the 9 respondents will be contacted telephonically if further clarity is required.

This study has been ethically reviewed and approved by the UKZN Humanities and Social Sciences Research Ethics Committee (approval number_____).

In the event of any problems or concerns/questions you may contact the researcher at 0814818608, email on 211509373@stu.ukzn.ac.za or the UKZN Humanities & Social Sciences

Research Ethics Committee, contact details as follows:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION
Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban 4000 KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604557- Fax: 27 31 2604609
Email: HSSREC@ukzn.ac.za

Your participation in the study is voluntary and by participating, you are granting the researcher permission to use your responses. You may refuse to participate or withdraw from the study at any time with no negative consequence. There will be no monetary gain from participating in the study. Your anonymity will be maintained by the researcher and the School of Management, I.T. & Governance and your responses will not be used for any purposes outside of this study.

All data, both electronic and hard copy, will be securely stored during the study and archived for 5 years. After this time, all data will be destroyed.

If you have any questions or concerns about participating in the study, please contact me or my research supervisor at the numbers listed above.

Sincerely
Nikita Reddy

[redacted]

CONSENT TO PARTICIPATE

I Nokwanda have been informed about the study entitled Lean manufacturing strategies in small and medium enterprises: A case of a Durban Shoe manufacturer by Ms. Nikita Reddy.

I understand the purpose and procedures of the study.

I have been given an opportunity to ask questions about the study and have had answers to my satisfaction.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any of the benefits that I usually am entitled to.

If I have any further questions/concerns or queries related to the study I understand that I may contact the researcher on 0814818608 /211509373@stu.ukzn.ac.za.

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION
Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604557 - Fax: 27 31 2604609
Email: HSSREC@ukzn.ac.za

Consent to:

AUDIO-RECORDING YES/NO

[redacted] 30/08/2021

Signature of Participant Date

Signature of Witness (Where applicable) Date

Signature of Translator (Where applicable) Date

Appendix G: Gatekeeper Letter

LABORA
- SINCE 1989 -

T +27 31 409 1096 F +27 31 409 1803
A Durban, South Africa
www.labora.co.za

CONFIRMATION LETTER

To whom it may concern

This letter serves to confirm that Labora Shoes (Pty) Ltd has authorised Nikita Reddy student number **211509373** to conduct her research required for her masters qualification.

[redacted]

Desmond Chunderlal

Director

flourish ichume

Labora Shoes (PTY) LTD | Reg Number: 2015/085518/07 | Vat number [illegible] | Directors: D Chunderlal [illegible]

Appendix H: Language editor certificate

590 Miami Road
Hibberdene
KZN
4220
Cell: 0842843401
brian.naidoo25@gmail

PROFESSIONAL LANGUAGE EDITING SERVICES

STRIVING FOR EXCELLENCE

Brian Naidoo (BA Hons English; BA Hons TESOL; BEd Hons.
BA- English major; Univ. Dip. in Ed.[English special];UCT Cert.in
Legal and Business Writing; UCT Cert. in Copy-Editing; PG Research Prog. UFS. Assessor's Cert. UFS. Unisa
Counselling Certificate; Evaluator of Schools for Umalusi.

SPECIALISING IN THE LANGUAGE EDITING OF THESES, DISSERTATIONS, JOURNAL ARTICLES, PROPOSALS, POLICIES AND PUBLICATIONS.

CERTIFICATE FOR LANGUAGE EDITING A DRAFT MASTER'S DISSERTATION

Lean manufacturing strategies in small and medium enterprises: A case of a Durban shoe manufacturer

Nikita Reddy

Student number: 211509373

University of KwaZulu-Natal

WHOM IT MAY CONCERN

This certificate confirms that the above-mentioned student submitted her draft master's dissertation to me for language-editing, which included correcting in-text citations and the mistakes in the list of references. This was duly edited by me and sent back to the student for revisions as per suggestions from me. I make no claim as to the accuracy of the research content. The text, as edited by me, is grammatically correct. After completion of my language editing, the student has the option to accept or reject suggestions/changes prior to re-submission to the supervisor who will check the content and instances of plagiarism, if applicable.

[redacted] ID: 5606255134081 **DATE: 26/11/2021**

Professional EDITORS Guild

Brian Naidoo
Associate Member

Membership number: NAI001
Membership year: March 2021 to February 2022

084 264 8401
brian.naidoo25@gmail.com

www.editors.org.za

THANK YOU FOR YOUR SUPPORT