THE TECHNOLOGICAL CHALLENGES FACED BY SELECTED DURBAN WAREHOUSES IN THE ERA OF E-COMMERCE

by

GORGEOUS YENZIWE SHOZI

SUBMITTED IN FULFILLMENT OF THE REQUIREMENTS OF THE DEGREE OF MASTER OF MANAGEMENT SCIENCES: BUSINESS ADMINISTRATION (ENTREPRENEURIAL STUDIES AND MANAGEMENT) IN THE FACULTY OF MANAGEMENT SCIENCES AT DURBAN UNIVERSITY OF TECHNOLOGY

Supervisor: Dr S. Govender

2021

APPROVED FOR FINAL SUBMISSION

_____ 18 NOVEMBER 2021

Dr Saths Govender (PhD.) Date

Supervisor

ABSTRACT

The use of technology in this current era is constantly evolving. From smartphones to online purchasing, banking transactions to virtual meetings, the digital world has become part of people's lifestyle and is expanding quite rapidly. This has resulted in a lot of pressure on companies to keep their systems technologically up-to-date. Electronic commerce (e-commerce) is one of the major ways that technology has been used in the world of business. It has become an important factor in today's world of business for both developed and developing countries, making it a driving force for economic growth. Electronic commerce, an attribute of the internet, has become a convenient way of doing business, communicating with potential customers as well as buying online. As businesses grow and the demand to fulfil customers' orders increases, the role of the warehouse becomes significant and more visible. In this case, the warehouse needs to ensure that proper storage is available to accommodate large supply of goods. The aim of this study was to investigate the technological challenges facing selected warehouses in the Durban region regarding to e-commerce whilst being guided by the aim of determining the technological challenges affecting warehouses in the era of e-commerce.

The researcher used a qualitative approach to investigate these challenges by using an interview instrument. The sample size for the study was 16 participants. However, due to the pandemic, only 8 participants in total were available. The findings were linked to both primary and secondary data. The study found that e-commerce is essential for business. It is a business platform that needs to be utilised successfully, considering the rapid change and development in technology. The future of the warehouse is automation. Therefore, having technology in the warehouse will improve productivity. The study recommends that warehouses need to consider adopting a warehouse executes system (WES) in the future. This system combines both warehouse management system and warehouse control system.

DECLARATION

I, Yenziwe Shozi, hereby declare that the information presented in this dissertation has not been issued nor submitted to any other higher learning institution for a qualification. All authors mentioned have been fully referenced accordingly.

The research described in this dissertation was supervised by:

DR. S. Govender – MPA, D. Admin.

11 JUNE 2021

Yenziwe Shozi **Date**

21031465

DEDICATION

I would like to dedicate this piece of art to my parents. I am forever indebted to them for their support on this journey. It has been a rollercoaster ride, but nothing impossible to conquer. They have been my support structure mentally, psychologically, spiritually, and financially. Their never-ending encouragement to keep the FAITH and never lose HOPE will always be remembered. Indeed, they have been my strength and for that reason I shall continue to make them proud. Mom and Dad thank you; I love you both, unconditionally.

ACKNOWLEDGEMENTS

Firstly, I would like to thank Almighty God for carrying me through this journey. It has been frustrating on some days, and blissful on others. I have conquered what seemed impossible through grace. At times it was always as if supernatural strength and wisdom was bestowed upon me to press on when I seemed to run out of steam. Indeed, God's plans are not to harm us, but to make us prosper.

I would like to thank my siblings for the words of encouragement and for being the greatest cheerleaders. You guys are a blessing, I appreciate you.

To my supervisor Dr. Saths Govender, a huge thank you for the consistency and patience you showed me throughout this challenging journey. Thank you for your wisdom and guidance. Not forgetting how you address me by my first name- "lol", it's been a great one, thanks.

My sincere appreciation goes to my church at large, Family Worship Center (FWC) under the leadership of Bishop I.B Doyisa and Pastor O. Doyisa. Thank you for the prayers and support, I am eternal grateful.

To all the participants, I am extremely grateful for your contribution towards the study. Even amidst the pandemic, you made yourself available still. Your valuable input, time, and knowledge contributed to the success of this dissertation. I thank you.

To all my friends and family, I thank you for the support, the constant check-ups, and good food. A big thumbs up. I love you all.

A big thank you to the faculty research officers (Jeslyn and Phindo) and Dr Emem, for their continuous assistance. Sara Mitha, our postgraduate librarian, and the W&RSETA (Wholesale & Retail SETA) bursary for the financial support.

Lastly, a big thank you to myself, for not giving up. It is done-like my name -YENZIWE.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

ACRONYM	FULL DESCRIPTION
3PL	Third-Party Logistics
4IR	Fourth (4^{th}) Industrial Revolution
AI	Artificial Intelligence
APS	Advanced Planning & Scheduling
AR	Augmented Reality
B2B	Business-to-Business
B2C	Business-to-Consumer
B2G	Business-to-Government
C2B	Consumer-to-Business
C2C	Consumer-to-Consumer
DC	Distribution Centre
DOI	Diffusion of Innovation
E-commerce	Electronic Commerce
EDI	Electronic Data Interchange
EFT	Electronic Funds Transfer
E-retailing	Electronic Retailing
ERP	Enterprise Resource Planning
G2C	Government-to-Consumer
G2G	Government-to-Government
IoT	Internet of Things
J-I-T	Just-In-Time
LSCM	Logistics & Supply Chain Management
OC	Omni-channel
QR codes	Quick Response Codes
RFID	Radio Frequency Identifiers
SA	South Africa

SCM	Supply Chain Management
SKU	Storage Keeping Units
TAM	Technology Acceptance Model
TMS	Transport Management System
TOE	Technology-Organization-Environment
TRA	Theory Reasoned Action
USA	United States of America
VR	Virtual Reality
WCS	Warehouse Control System
WES	Warehouse Executes System
WMS	Warehouse Management System
WWW	World Wide Web

CHAPTER ONE
INTRODUCTION AND ORIENTATION TO THE STUDY

"Research is creating new knowledge" – Neil Armstrong

1.1 INTRODUCTION

Introducing technology to the supply chain industry has had a major impact on companies, playing a major role in facilitating change, resulting in companies transforming their processes (Coyle 2017: 9). And one of the main ways that technology has impacted the supply chain industry is through e-commerce, which has essentially transformed the way transactions are done.

There is no universally accepted definition of e-commerce, as various authors share their own understanding of the concept. Nisar and Prabhakar (2017: 137) describe e-commerce as any business activity that operates via the electronic medium, namely the internet. They further elaborate that e-commerce is not only centred around the function of providing services online, buying, and selling goods, but it also simplifies the entire purchasing and selling processes for both sellers and buyers. Aydin and Savrul (2014: 1269) define e-commerce as the process of exchanging goods and services amongst four wide groups using the internet, which are businesses to consumers, businesses to businesses, intra-companies, and consumers to consumers. For an e-commerce transaction to occur, there needs to be internet access, which means any individual having access to a desktop or mobile device, has the funds to purchase goods or services is eligible to conduct an e-commerce transaction (Vermaat 2016: 82). Sharma and Lijuan (2015: 468) refer to e-commerce as the conduct of business transactions or managerial activities using the internet.

Companies introducing online sales encounter several challenges i.e., logistics and processes of delivery, namely enormous volumes of very small orders, short lead time deliveries, flexible delivery (night-time and 24-hr shipping) and the tedious process of picking and packing individual unit orders amidst conventional business (Alawneh and

Zhang 2018: 84). This means that an increase in the labour force needs to be considered if demand is to be met timeously. However, processes such as order picking are said to be labour-intensive, contributing to the poor health, fatigue and absenteeism of staff. Automation as a possible solution to boost productivity may be considered by companies to reduce challenges associated with online sales.

To be well ahead of competitors, the concept of e-fulfilment needs to be adopted by the supply chain/logistic entity. According to Callarman (2020:1) e-fulfillment is a short phrase for ecommerce fulfilment, which involves the process of fulfilling and shipping orders to customers. This process is part of retail supply chain, involving the receiving and storing of inventory, order processing, picking, and packing items, shipping packages, and simplifying ecommerce returns. The supply chain entity not only comprises the suppliers and manufacturers, but also includes transporters, warehouses, retailers, and customers themselves (Minculete 2014: 21).

Pressure mounting for warehouses to shift their strategies and management systems to an automated approach if they intend to improve their processes. This applies to retailing as well, in order to emerge in these changing times, where advancements in technology are of particular interest. These are times where the omni-channel, AI, VR and IoT are gaining ascendancy. Unfortunately, no one anticipated the disruption of brick-and-mortar retailing. However, the signs were evident as the world kept evolving through industrial revolutions. Change, being inevitable, compels warehouses to re-look and re-think their business strategies, aligning to technology improvements, with a focus on adaptation to these technologies and sustainability. It is for this reason that the research was undertaken.

This chapter explains the context of the study and the underlying problem/s being investigated. The aim and objectives of the study are explained and lastly, the structure of the study, possible limitations and ethical matters are discussed.

1.2 CONTEXT OF THE STUDY

According to (Mardikyan and Ozel 2017: 2) the usage of the internet is no longer bounded as a networking media. Instead, it has assumed the role of a marketing and sales transaction medium for people, creating opportunities to do business worldwide, lowering expenses, and attracting new customers. Internet adoption has made it inexpensive and easier for firms to expand their markets, manage operations, as well as manage value chains across borders (Aydin and Savrul 2014: 1267).

Agarwal and Wu (2015: 198) state that the revolution of e-commerce has not only occurring in developed countries but is also disseminating to emerging economies such as Brazil, Russia, India, and China. The authors (Agarwal and Wu 2015: 198) studied the case of India closely, being a developing country and found that drastic adjustment in the purchasing and selling activities of several goods and services during the last 15 years were gaining precedency. With the introduction of e-commerce, the effect on both global and domestic economies has been revolutionized (Agarwal and Dixit 2017: 114). The Nigerian e-commerce industry has also experienced a tremendous growth rate in the past year with the increase in internet usage, popular shopping websites such as Konga.com and Jumia.com.ng have gained more visibility, activity, and sales (Chiejina and Olamide 2014: 121).

According to the latest figures shown in a report of the U.S Department of Commerce (2018: 1), the sales for e-commerce in 2017 accounted for 8.9% of total sales, as opposed to 2016 which accounted for 8.0% of total sales. The advancement of technology has created a platform for consumers to make purchases from the luxury of their own homes.

According to the third annual cross-border commerce report by Paypal and Ipsos (cited in Smith 2017: 1), the concept of online shopping has been slow to take off in South Africa. However, in recent years it has picked up steam. The report indicates that South African adults constituted 58% of online shoppers over the past 12 months, which amounted to an estimated total spend of R37.1bn. E-commerce is rapidly becoming

the most accepted and preferred means of doing business in this world (Reddy and Divekaar 2014: 553).

Furthermore, it is without doubt that e-commerce has impacted on business operations, whether in a positive or negative way. With the internet being the primary enabler for transactions, new technologies such as drones, AI, IoT and many more have emerged.

Pillay and Mafini (2017: 1) echo the sentiment that the South African economic environment is presently confronted with various burdens that pose a threat to the viability of most businesses across various industries. Take for instance the cotton industry (cotton fibre, textile and apparel production) seeing a drop in production and employment over the past decade (Cao, Scudder, and Dickson 2017: 82). Furthermore, consensual trade between SA and China has increased rapidly, allowing for China to become SA's largest export market and import supplier in 2009, thereby impacting on SA's textile sector and employment.

1.3 PROBLEM STATEMENT

Consumers all around the world are searching for simpler ways to do shopping, whether it be groceries, gadgets, or clothing. The millions of daily transactions using internet business or e-commerce has become a key feature of modern life (Stoyan 2017: 603). E-commerce is big business, and it relies on the right channels and models to succeed. In an article published by Foster (2017: 1-4), stated that challenges such as outdated distribution models; a lack of process efficiency; expenses in going digital; and not investing in the future are some key headings that need to be addressed for successful e-commerce. Leung *et al.* (2018: 387), on the other hand, mention that one significant problem that exists in operations is that of the frequent and discrete arrival of e-commerce orders, resulting in e-commerce order handling being inefficient.

Therefore, introducing e-commerce into the warehousing system entails those respective changes need to be made to previously handled orders (Zuchowski 2016:

100). Drawing from Sainathuni, Parikh, Zhang, and Kong (2014: 690) the warehouse plays a significant role in alleviating disparities in supply and demand, also with producing value-added services within the supply chain. In order to maintain these value adding services, warehouses must take into account the numerous impacts of e-commerce. For the consumer, e-commerce entails a seamless and convenient online shopping experience, which alters the role of warehousing, requiring to become complementary and compound. Warehouses find themselves in a compromising position to refine operations and reduce costs to accommodate the demands of customers. Increase in consumer demand and e-commerce escalates the greater need for warehouses to improve their processes, resulting in more warehouses opting to adopt technologies that will assist in faster, efficient, and smarter operations.

With consumers seeking convenience and variety in products, high volumes of stock mount in the warehouse, ready to be packed and stored, awaiting the delivery day. However, the constant change in consumer needs and demands makes it challenging to fulfil instant expectations. Depending on the location of the warehouse, same-day delivery maybe impossible due to high transportation costs. Additionally, the upsurge for convenience, efficiency and a seamless experience for the consumer puts pressure on the warehouse to continuously have stock that is readily available; quick delivery; impact on value chain; and apply new expensive technologies in order to maintain a competitive advantage within the market.

This study therefore investigates the technological challenges confronting warehouses in the era of e-commerce, with specific reference to four warehouses in Durban.

1.3.1 Aim of the Study

The aim of the study is to investigate the technological challenges faced by selected Durban warehouses in the era of e-commerce.

1.3.2 Objectives of the Study

- To determine the impact of e-commerce on warehouses.
- To investigate the technological challenges affecting warehouses regarding e-commerce adoption.
- To identify the role of the internet as a domain factor for successful e-commerce; and
- To make recommendations on how to effectively implement warehouse management systems for improved business operations.

1.3.3 Research Questions

In line with the above research objectives, the following research questions were modelled:

- How has e-commerce impacted the warehouse?
- What technological challenges affected the warehouses regarding e-commerce adoption?
- How has the internet enabled the success of e-commerce?
- What recommendations have been established to implement warehouse management system for better-quality business?

1.4 RESEARCH METHODOLOGY

Drawing from Maree (2020: 57) this research adopted a method/methodology that underpinned the theoretical/philosophical orientation to address the phenomenon under study. The researcher adopted a qualitative case study design and interviewed participants from four Durban warehouses. The researcher extracted in-depth information from eight participants to reflect on the key technological challenges in e-commerce warehousing. The qualitative approach was appropriate to answer the “how” and “why” question of the technological challenges facing warehousing, a case study method was used.

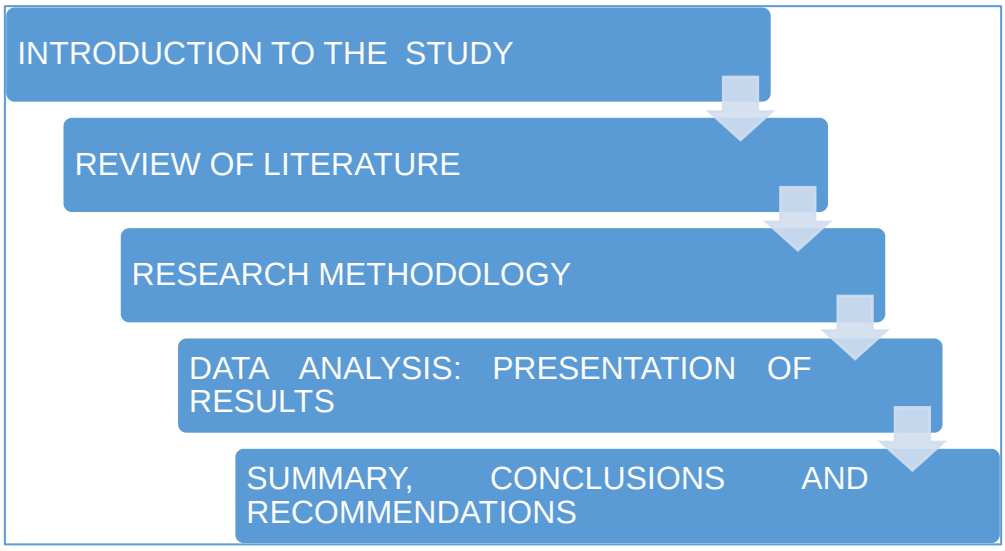
1.5 POSSIBLE LIMITATION OF THE STUDY

The focus of the research was only limited to four warehouses within the Durban area. Had the study extended to other cities such as Cape Town, Port Elizabeth and Richards Bay, much inference and commonality in challenges might have existed. These three cities are well-known for ports and harbours. Where ports and harbours exist, there is a high chance of warehouses within the area or city. Furthermore, due to the pandemic the country is currently facing, the researcher had minimal access to some premises, both for observation and interviews.

1.6 OUTLINE OF THE STUDY

The study consisted of five chapters that were arranged from the introductory chapter to the conclusion. Figure 1.1 below depicts the layout of the study as follows:

Figure 1.1 A graphic outline of the chapters in the study



Chapter 1 –Introduction to the study

The purpose of this chapter was to present an introductory overview of the study. It described the evolution of the internet and how it enabled e-commerce activities to

materialise. The context of the study, problem statement, aims, objectives, and research methodology were addressed.

Chapter 2 – Review of the Literature

The chapter provides insight into literature previously written by various authors at large. The authors' perspectives, arguments, contributions, and opinions were tabled, linking information back to research aims and objectives. The literature review further highlighted key challenges affecting warehouses with the advancement of technology in this era and how e-commerce affects business operations. It also attended to the theoretical framework used for the study (Rogers' Diffusion of Innovation Model).

Chapter 3 –Research Methodology

Chapter Three outlines the research methodology used and the rationale behind the choice of research design. The selected research design was exploratory and qualitative in nature. The chapter contains details about the target population, sampling method, data analysis, and delimitation. The study used interviews as a data collection instrument, by use of purposive sampling. Lastly, the transcribing and coding of data was initiated using the Nvivo software system.

Chapter 4 –Data Analysis: Presentation of Results

This chapter delivers the findings in the form of data analysis and interpretation. Data was collected from four Durban-based warehouses. The study uses thematic analysis to assist in generating themes.

Chapter 5 –Summary, Conclusions and Recommendations

This chapter presents a summary of the study, discussion and recommendations.

1.7 CHAPTER SUMMARY

The initial chapter presented an overview of the background, problem statement, research aims, objectives, and methodology of the study. All five chapters were outlined. The following chapter will expand in-depth on literature that is scholarly and

peer reviewed. The aim of the next chapter is to provide knowledge and perspectives on what various authors have written. Their contribution to the study topic and reasoning will be elucidated. Aspects such as the internet, omni-channel, warehouse management systems, and many more will be expanded upon.

CHAPTER TWO
LITERATURE REVIEW

"Research is to see what everybody else has seen, and to think what nobody else has thought" – Albert Szent-Gyorgyi

---

2.1 INTRODUCTION

The previous chapter introduced the study by presenting the research problem, aim of the study, objectives, and methodological approach. According to Hart (2018: 3), the purpose of research is to contribute in some way to one's understanding of the world. A review of literature forms an integral part of academic and policy development.

According to Booth (2016: 12), a literature review appears in three specific contexts: the main component would be a dissertation, thesis, or other academic work. Secondly, in the form of a peer-reviewed publication, which normally is found in a journal or depending upon the discipline, as a book chapter; and lastly, as a report stemming from a research project that is funded, or another appointed research. Fink's (2005) definition of a literature review was echoed by Okoli (2015: 880) and Booth (2016:9-10), stating that a literature review is understood to be a systematic, comprehensive, and reproducible method used for the process of identifying, evaluating and synthesising existing work, that is completed and produced by researchers, scholars, and practitioners.

Therefore, this chapter will examine previous studies completed and peer-reviewed, relating to e-commerce in its broader view within the warehouse; the effects it imposes in South Africa and other countries; the shift from brick and mortar to an advanced technological experience; and warehouse management. The concept of e-commerce and warehousing is covered within the context of this dissertation.

Diamantidis, Koukoumialos, and Vidalis (2016: 2628) explain that supply chain management entails flow of management which are products, capital, and information amongst the stages of the supply chain, for the maximisation of total expected

profitability. Moreover, the designing of the supply network must take into consideration the different factors that may affect the decision-making process, such as the total number of suppliers, the capacity, capability of factory and buffer, control of the proficient flow of raw materials, in-process inventory, and finished goods.

According to Mruma, Ngussa, and Parveen (2020: 9), part of the supply chain is all parties, engaged directly or indirectly in satisfying a customer's demand, not only manufacturers and suppliers but also including transporters, warehouses, retailers, and the customers themselves. One focus for supply chain management (SCM) is to improve the flow of products, information, and services as movements from origin to destination occur. Basically, SCM is understood to be an integrated system, consisting of interrelated sub-systems, processes and activities that continuously need improvement in order to bring significant enhancement to all parties engaged in it (Erceg and Sekuloska 2019: 158).

Living in a global world technology, especially information and communication, is continuously altering the way business is created and value is captured, the structure of work (how and where we work) and how we network and communicate (Cascio and Montealegre 2016: 349). The internet, being the primary channel for online activities to occur, has had a substantial growth rate over the last few years, being recognised as the worldwide medium for communication, is gradually being used globally as an innovative tool for marketing goods and services (Clemes, Gan, and Zhang 2014: 364). Additionally, the internet being an enabler for e-commerce encompasses all aspects of business and market processes (Fayad and Paper 2015: 1001). An exponentially high number of customers, in recent years, prefer ordering products online with the expectation of fast delivery to be dispatched directly to their doorsteps. Due to this novel experience of online shopping, Al-Yahya (2017: 1) states that numerous traditional stores or warehouses are incapable of fulfilling such high demands of the online shoppers who need the service.

Electronic commerce has revealed an applauding growth in the past decade in all the main markets (Melacini *et al.* 2018: 391). E-commerce sales have witnessed incredible

growth in recent years (Ardjmand *et al.* 2018: 169). E-commerce occurs over the internet using applications such as electronic mail and web browsers, not forgetting private networks. Clemes, Gan, and Zhang (2014: 365) mentioned that the first western multinational to penetrate the e-commerce market in China was eBay in 2003, followed by Amazon. Primarily, the concept of e-commerce is about using the internet to do business faster and more efficiently (Kinuthia and Akinnusi 2014: 13). According to Huang and Benyoucef (2013: 248), the effectiveness of an e-commerce website design depends on its:

Usability: aimed at addressing website efficiency, effectiveness and satisfaction and user-friendliness.

Information quality: as a source of customer value, this becomes an important design principle for e-commerce. It addresses the accuracy, relevance, cognizance, and usefulness of information delivered by e-commerce websites.

Website quality: an e-commerce performance system for the delivery of information and services. It impacts customers' purchase decisions, satisfaction, and trust.

Service quality: encompasses a broad range of assistance, such as commonly asked questions, tracking of orders, and complaint management.

Supply chains are becoming more dynamic in a globalised society (Vokhmyanina, Zhuravskaya, and Osmolski 2018: 163). The core practice of supply chain management according to De Villiers (2017: 5) is to operate successfully in today's volatile global business environment, hence a firm's involvement with their suppliers and customers is paramount. As a matter of fact, vertical integration no longer exists as the situation today is totally different as firms sell their business units or outsource most of their activities in order to build strategic partnerships with other firms.

Kwak, Zhang and Yu (2019: 116) mention that consumers, sellers, suppliers, and government are key stakeholders that influence the growth of e-commerce in the

future. The trick to successful e-commerce is not merely the ability to capture an order and thereafter fulfilling it. It is in fact the way the company addresses problems when they arise (Business Times 2019: 19). That said, e-commerce impacts supply chain management immensely across-the-board. Fortunately, the Internet of Things, big data and fully combined supply chain systems will potentially meet these demands, and e-commerce will successfully change supply chain management forever (Mruma, Ngussa, and Parveen 2020: 11)

Warehouses play an important part in the supply chain and requests for warehousing operations have increased significantly (Accorsi, Manzini, and Maranesi 2014: 175). In concurrence, van Gils *et al*. (2018: 243) confirm that warehouses are vital aspects of supply chains and for that reason, warehouse operations need to work efficiently. A similar view is shared by Hassan *et al.* (2015: 1025), stating that a warehouse is a crucial component linking all chain parties in a supply chain. Technological revolution over the years has been an extensive development, changing the way business activities are being conducted both in developed and developing countries (White, Alfolayan, and Plant 2014: 25).

Warehouses are a vital component within the supply chain. Even though it is labour intensive and space consuming, warehouses continue to actively match supply with customer demand and achieve economies of scale in transport (Mirzaei, De Koster and Zaerpour 2017: 6423). The function of the warehouse has changed though, as expounded Lee *et al.* (2018: 2753), due to reasons such as intricacy and the assortment in customer orders, demand for accuracy in data and real-time information. This elevates the problem relating to traditional manual operations that lead to low warehouse operation efficiency and non-responsiveness to customer requirements. Additionally, moving production to lower cost countries, growth in e-commerce and increases in consumer demand have contributed to the change in warehouse operations (Richards 2018: 7).

A warehouse, according to Lopienski (2018: 1), is a big storing centre or manufacturing space crafted to store inventory in bulk. Equipment such as forklifts and containers

exist, with large quantities of products stacked high in shelves. The increase in fulfilment centres for e-commerce is surely affecting the warehousing landscape, allowing for advancements relating to the increased use of technology and automation; accuracy and speed; enhanced performance measurement; and the effective supervision of resources (Richards 2018: 2).

With the 4th Industrial Revolution (4IR) penetrating warehouse operations, it cannot be ignored because business operations will be impacted.

According to Philbeck and Davis (2018:17), 4IR is the confirmation that change in technology is the operator of transformation applicable to all industries and parts of society. The term is used to frame and analyse how influential upcoming technologies are on almost the whole range of human development in the 21st century, stemming from social norms that have evolved and national political approaches to economic development and international relations (Philbeck and Davis 2018:17). Furthermore, blending potent machine-learning algorithms, advanced insights and low-cost sensors permits technologies to be effortlessly embedded into humans' physical environment. Robotics, advanced materials, genetic modifications, autonomous vehicles, artificial intelligence, and machine vision have become embedded into the social, political and physical spaces, changing behaviours, meaning, and relationships (Philbeck and Davis 2018: 18).

The study conducted will add insightful knowledge by using a pervasive framework established by Rogers to understand the adoption process by individuals and organisations. Bhattacharya (2015: 521) wrote that diffusion refers to the process by which an innovation could possibly be a novice technology communicating via specific channels over time amidst the members of society. In addition, the theoretical framework proposes a model of innovation adoption and implementation addressed in five-stages, expanding on the definition of adoption being the method through which an adopter unit passes first knowledge of an innovation, establishing an attitude towards the innovation, leading to adoption or rejection following the implementation of new ideas, to the final stage of confirmation of a decision.

2.2 THE INTERNET

The success of e-commerce is contingent upon the internet (Kamil 2015:14). In other words, the advent and popularity of e-commerce is perpetuated by the internet. If one had an encounter with the Internet in the late 1990s, one would have probably used most of one's time-consuming audio and video clips that were prominent in commercial media and reading what other individuals had written. Now, all that has changed as it has become more interactive, intuitive, and communication-oriented, with feedback responses easily available (Obar and Wildman 2015: 750). The background of the internet stems way back from the 1960s, prior to the existence of modern e-commerce (Kamil 2015: 14). With the increasing popularity of the Internet, consumer enquiries and purchases using this stream have become more common (Chen and Teng 2013: 2). The existence of the internet and web made it simpler, easier, affordable, and more available for both consumers and businesses to network and carry out commercial transactions electronically, hence the internet is changing the nature of consumer shopping and behaviour, having numerous benefits over traditional delivery shopping channels (Clemes, Gan, and Zhang 2014: 364).

The internet has been defined in different terms by various academics from the perspectives of their disciplines. One definition provided by Chaffey (2015: 4) refers to the internet as a physical network that connects computer devices across the globe, consisting of the infrastructure of network servers with wireless and wired communication linkages amongst them, used to pin and export data between web servers and client devices. The emergence of the internet, precisely e-commerce applications, presents new scenarios in conducting business (Mruma, Ngussa, and Parveen 2020: 10).

The web, a popular service offered by the internet, is the instrument that revolutionized access to the internet, creating platforms for information sharing, online auctions, electronic hubs, selling products, businesses building relations with consumers and much more (Dinu and Dinu 2014:470). Additionally, the web or internet is a network consisting of millions of computers around the world via telecommunications systems, permitting the almost instantaneous transfer of data (Kinuthia and Akinnusi 2014: 13).

On the other hand, Chaffey's (2015: 4) definition is limited to the activities the web offers, viewing it as the most known technique used for distributing information on the internet, accessing information through the computer or mobile web browsers which show collaborative web pages of embedded graphics and HTML/ XML- encoded text.

According to Zhang *et al.* (2017: 24), the prevalent use of social networks presented a popular and economically important online activity: e-commerce.
Amrouche and Yan (2016: 258) implied that without a doubt, the numerous advantages of internet had an impact on the achievements of online stores. Some achievements mentioned include fast response to consumers, low distribution costs, large accessibility, quick shipping, personalized customer service, and many more. The internet, according to Saskia, Marei, and Blanquart (2016: 825), presents possibilities for retailers to draw nearer to consumers, thus adding another distribution channel.

Below is a table representing the increase in the number of users of the internet over a 5-year period, extracted from the Internet World Stats (2018). In as much as the table below makes no mention of countries specifically in terms of the percentage of humans using the internet, Cooke (2018) is of the view that customers in South Africa enjoy the internet as a resource, preferring to browse and shop there. A recent e-commerce report released by Effective Measure in South Africa surveyed more than 11 000 internet users in South Africa in December 2014 in order to reveal some of their online habits. The results were up 94% from 2013 for people making regular purchases online of at least once a week (Harding 2015).

Table 2.1 Increase in internet users over a 5-year period

DATE	NUMBER OF USERS	PERCENTAGE OF WORLD POPULATION
Dec 2013	2,802 million	39.0%
June 2014	3,035 million	42.3%
Dec 2014	3,079 million	42.4%
June 2015	3,270 million	45.0%
Dec 2015	3,366 million	46.4%
June 2016	3,631 million	49.5%
Dec 2016	3,696 million	49.5%
June 2017	3,885 million	51.7%
Dec 2017	4,156 million	54.4%

Source: Internet World Stats (2018)

2.3 RETAIL STORES

Online shopping is transforming the future of business (Blazquez 2014: 111). Consumers are no longer compelled to visit stores for item purchasing. At their convenience, they can shop anytime, anywhere, without any physical touch. With a click of the button, an order is processed. According to Richards (2018: 7), in today's world, the way consumers shop, their behaviour and expectations contribute significantly to how retailers engage with their customers. The author further states that, as the need to become more innovative within their supply chains increases, pressure on managers to escalate productivity and accuracy, cost reduction and stock whilst refining customer service poses a challenge.

The use of mobile connectivity by smartphones and tablets allows for consumers to peruse and make purchases anytime, anywhere, with mobile commerce expanding rapidly (Blazquez 2014: 111). Dey, D'Souza, and D'Souza (2015: 190) indicate that the advancement in technology is mirrored by a rising shift of consumers from brick-

and-mortar outlet purchasing to online purchasing. Consumers are in search of convenience and simpler ways to get things done considering affordability and something that does not require much time and effort, hence Sethi and Sethi (2016: 12) agree that online shopping is convenient because it is free from stress, especially having to hunt for information as opposed brick and mortar retail shops.

Offering products via the internet is affecting traditional “bricks and mortar” retail structures (Saskia, Marei, and Blanquart 2016: 825). Until the 1990s, the leading players in the sector were brick-and-mortar retailers. In the late 1990s, the emergence of pure-play online retailers, such as Pets.com and Webvan, appeared to be a threat to the long-standing success and dominance of these brick-and-mortar retailers (Lim and Winkenbach 2019: 132). Customers are the main influencers of trends, resulting in technological evolution and compelling retailers to shift from brick-and-mortar retailing to a more personalized, seamless, and customer-focused omni-channel retailing style (Adivar, Huseyinoglu and Christopher 2019: 257).

Brick and mortar stores are referred to as businesses that deal with customers with face-to-face interaction, typically in an office or store (Dey, D’Souza and D’Souza 2015: 190). Whether or not it is true that brick-and-mortar stores will no longer exist completely is a statement that can be argued. Why? Because customers still want that interaction of seeing, feeling, touching, and trying the product, as well wanting to feel the shop atmosphere despite the need to move across channels (Piotrowicz and Cuthbertson 2014: 10). This indicates that some customers still prefer the traditional way of shopping for items. Value to them includes visiting the physical store, picking out the item and fitting it on before the decision to purchase. Bond (2015: 24) elucidates that the belief that brick-and-mortar stores will be eradicated completely by e-commerce has largely been confuted as businesses have different levels of success, converting their retail footprint into a strategic advantage.

Danderpan, Gupta, and Lassar (2013: 7740) mention that consumers tend to opt for online shopping because it provides a broader selection, price competitiveness, convenience and ease, and saves time. This is an indication of consumer preferences:

how a shopping experience should be, whether purchasing online or physically being present at a store. If a consumer requires something, they will get it, despite the activity involved.

According to Cooke (2018: 1), with most South Africans online, retailers are witnessing a shift from pure brick-and-mortar retail in South Africa to a more considered omni-channel environment where more than 70% of the shopping journeys start on the internet but end up as a store cash back. The present era of e-commerce is proof that numerous retailers have adopted OC retailing and efforts are made to enhance channel integration (Jin, Li, and Cheng 2018: 613). Unfortunately, this affects the customary brick and mortar stores, seeing a severe decline in sales over the past years, compelling some completely out of business (Clark 2018: 1). Furthermore, it results in many businesses preferring an online existence.

2.3.1 Omni-Channel (OC)

The rise of emerging technologies encompassing alternate channels becomes a major hurdle for some retailers when compared to other members of the supply chain (Adivar, Huseyinoglu, and Christopher 2019: 257). Growing technologies and on-the-move devices have presented a platform for the establishment of various shopping channels, sparking the interest of customers. Retailers gradually combine their physical stores and online channels into a seamless environment for shopping, a concept commonly referred to as omni-channel (OC) retailing (Kembro, Norrman, and Eriksson 2018: 890). Another definition presented by Govindarajan, Sinha, and Uichanco (2017: 2) refers to OC as the integration of a retailer's sales channel in a seamless manner, comprising possible brick-and-mortar stores, online stores and many more (e.g., pop-up stores).

E-commerce has undoubtedly simplified the way customers browse the internet, having access to different online stores, acquiring information, opinions, and large available stock (Marmol and Fernandez 2019: 57). The merging of stores and online retailing has resulted in numerous retailers shifting towards OC retailing for the

purposes of providing customers with a shopping experience that is seamless across all its sales channels (Ang and Tan 2018: 519). Adivar, Huseyinoglu, and Christopher (2019: 258) confirm the above statement by agreeing that there is an increase in the number of retailers adopting an OC strategy. The early adoption of OC by retailers means an increase in online sales and the retention of customers.

However, numerous business challenges emerge, according to Ang and Tan (2018: 520), where attention is directed to security issues, technology investments, and marketing, rather than finding innovative ways to enhance performance and long-term success. Ishfaq *et al.* (2016: 550) relate the challenge with the OC distribution process, stating that the various sales channels make separate demand streams which are diverse regarding delivery requirements, order size and customer expectations. Therefore, these differences lead to serious difficulties for retailers in organising their distribution operations regarding the stocking of inventory and its allocation to diverse demand streams. In addition, a growing matter for various warehouse and distribution centre operators is the inability of their existing solutions to keep up with the volume and speed of orders (Krebs 2015: 42).

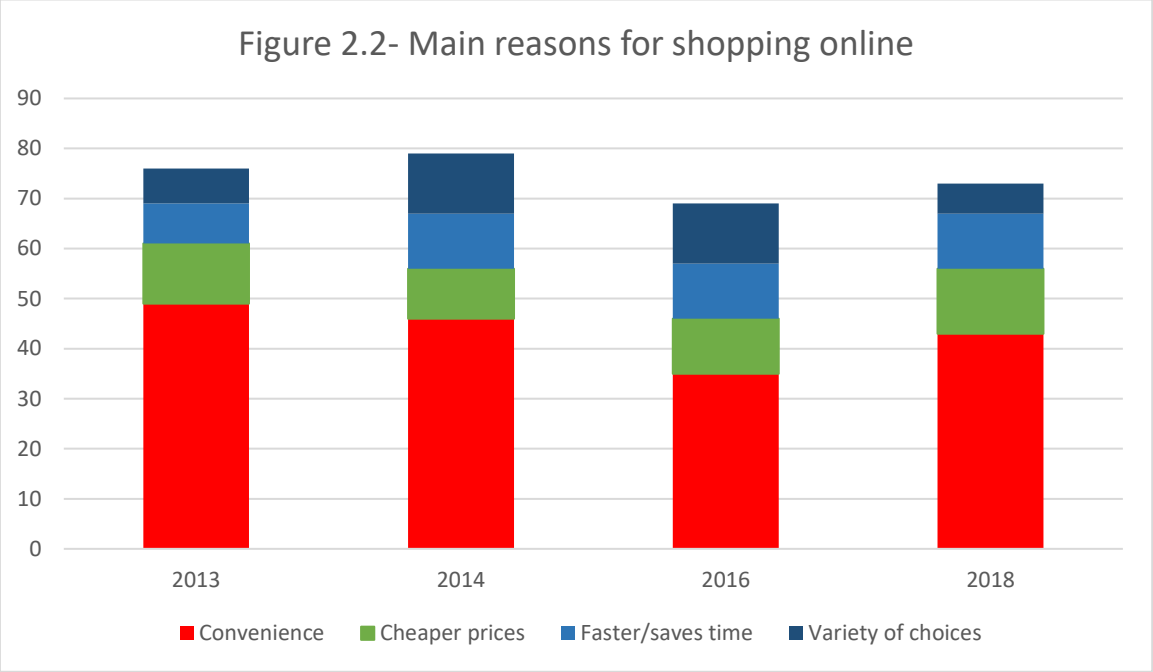
With that said, retailers involved in an OC environment encounter a mutual issue of handling product returns from dissatisfied customers, leading to the main problem of inventory management. Where will the inventory come from? If returned, where does one store it? Will it be found in-store or in the warehouse, in the e-commerce distribution centre, or in the physical store's distribution centre? Saghiri *et al.* (2018: 362) add that being aware that customers no longer interpret the e-commerce channel of business as a separate entity raises the question: "why can it not be purchased online and delivered in-store, or bought in-store but delivered directly home, or bought online and returned to the store?" Having to meet consumer expectations and demands in an OC environment is challenging and strenuous. With some returns being small quantities, reiterating the process of re-ordering, packing, and shipping becomes cumbersome, costly and time-consuming.

Figure 2.1 Overview of fulfilment-related areas for customer steering

Source: Wollenburg *et al.* (2019: 541)

Wollenburg *et al.* (2019: 542) provide a comprehensive explanation of the diagram above. The authors established that the customer's buying decision influences the fulfillment process. The next step of checking inventory availability is completed, which in omni-channel retailing ought to be promising for all products across online and store channels. Once the online purchase and transaction are completed, the product gets delivered to the consumer's homestead or made available for pick-up at the store. Lastly, the same process with combined channels can be found for product returns.

Figure 2.2 Main reasons for shopping online



Source: Prinsloo (2018: 5)

Figure 2.2 is an extract from a research report by Prinsloo (2018). The author provided the following findings:

- Consumers' online purchasing has been consistent since 2013.
- Convenience remains the number one reason for 43% of shoppers purchasing online.
- An increase in smartphone usage further improved the level of convenience.
- The second most significant reason why online shopping is preferred (13%)- cheaper prices.
- It is efficient and less time-consuming to conduct online transactions.
- Another evident reason for online shopping is variety of choice, although it became less important than it was in 2016.

The bottom line for retailers in the current era of business is the need for advanced solutions, not only to assist in the satisfaction of customers' ever-evolving expectations, but also to help with global issues such as persistent national labour shortages, increasing real estate costs and a general drop in brick-and-mortar retail sales (McCrea 2020: 43).

2.4 CHALLENGES FOR SOUTH AFRICA AND NEIGHBOURING COUNTRIES

Due to the potential of electronic commerce, numerous countries across the globe have rapidly adopted it, resulting in the substantial growth of electronic commerce in developed countries over the last two decades and more recently in developing countries (Kurnia, Karnali, and Rahim 2015: 518). For a developing country like India, e-commerce presents a considerable opportunity for growth. In its promising stage, the country experienced some challenges to e-commerce sites, where the delivery of goods to consumers by couriers and postal services is not entirely reliable in smaller cities, towns, and rural areas (Patel and Soni 2013: 357). E-commerce makes up about 0.12% of all retail sales in India, when compared with over 4% in China and United States of America (Reddy and Divekar 2014: 555).

In Nigeria, the e-commerce industry has been growing at a tremendous rate over the past year, as observed by Chiejina and Olamide (2014: 121), reflecting a positive factor. However, there are several factors impeding growth in the country such as a lack of computer literacy; the poor design of e-commerce websites; high pricing on online sites; slow internet; and being unable to have credit/debit cards usable for online transactions. In China, e-commerce business is increasing rapidly, leading to big company's such as JingDong (second largest e-commerce company) achieving more than 95% positive feedback ratings, whilst maintaining a zero-complaint rate from customers (Yu *et al.* 2016: 181).

Narrowing it down locally, Du Plessis (2018: 1) states that e-commerce is growing stronger in South Africa, resulting on more consumers making purchases online confidently, purchases not solely limited to books, CDs, electronics, airline tickets and the like. Now is the time for e-commerce in South Africa, asserted Harding (2015: 1). With the e-commerce services sector maturing and becoming well-integrated with modern technology solutions, shortfalls exist more around the country's slow economy limiting consumer growth, as well as the poor implementation of e-commerce shopfronts that do not take advantage of the available logistics technologies (Business Times 2019: 20). Additionally, the increased prices and unsatisfactory quality of internet services and the reliability and cost of delivery mechanisms were identified as

hindrances to the successful growth of e-commerce (Goga, Paelo, and Nyamwena 2019: 5)

Variety is what consumers enjoy and having the ability to select from a range of options contributes to a favourable shopping experience. A well-developed and effective e-commerce strategy is of fundamental importance for success in domestic and global markets (Khan, Liang, and Shahzad 2014: 435).

Another school of thought adds that it is essential to observe South Africa as one of the most substantial contributors to electronic commerce on the continent, as the country may probably take a lead position in the next stage of e-commerce adoption (Anon 2017). Additionally, expectation in sales are set to increase by 40% in the next ten years as consumers continue to change their buying habits to gradually favour the convenience of online platforms (Anon 2017). Harding (2015: 1) adds that South African consumers are becoming more comfortable with e-commerce, with customary retailers joining the trend. The notorious players are aggressively marketing and attracting new customers with sales increasing year-on-year. However, the question remains as to whether all retailers can successfully deal with customer demands and expectations of same day delivery or next-day delivery, and maintaining a competitive position remains unknown.

2.5 E-COMMERCE

Electronic commerce is becoming more and more imperative in people's everyday shopping habits (Aulkemeier *et al.* 2016: 26). With the rise of e-commerce comes the challenge for traditional brick-and-mortar retail and distribution organizations to adapt to new fulfilment methods. Leveraging existing assets and retail footprints to create a true omni-channel customer experience is a necessity (Triantafilo 2017). The growth of e-commerce, alongside the impact of order fulfilment, is changing the way in which companies plan and design distribution facilities, with more variables being considered than ever before, namely: a) labour, b) automation and speed, c) expansion d) flexibility and e) business case (Business Times 2019: 2-3).

Lee *et al.* (2017:2753) state that the role of the warehouse has radically changed over the past years, which is caused by the intricacy and assortment of customer orders, high demand for real-time information and accuracy in data. Furthermore, it presents a difficulty with traditional manual operations, leading to lower warehouse competence operations and organisations no longer being responsive to customer requirements. With the growth of e-commerce in today's market, warehouses are bound to face problems relating to customers' orders due to the high demand for same-day delivery, competitiveness in innovation, and technological changes. This situation is exacerbated by the fact that E-commerce can take place between B2B, B2C, C2B, C2C, B2G, G2G and G2C (Kamil 2015: 16).

Aulkemeier *et al.* (2016: 26) mention that an individual activity comprises various software components that offer diverse services such as searching and browsing products, starting a transaction or the payment of an order. E-commerce warehouses need to deal with high volumes in customer orders, constant fluctuations in demand, and a large proportion of product returns (De Koster, Johnson, and Roy 2017: 6329). Part of the e-commerce warehouse is large numbers of small orders that need to be picked, packed, and prepared for shipping in reply to customers' orders (Wruck, Vis, and Boter 2017: 6453). However, Lee *et al.* (2017: 2753) caution that the inefficiency and inaccuracy in the order picking process has opposing effects on order fulfilment and adding more staff is not an ideal solution due to the costs involved (Wruck, Vis, and Boter 2017: 6453).

According to Melacini *et al.* (2018: 391), there has been impressive growth in the e-commerce market over the past decade across all main markets. Amazon, being a cloud computing and e-commerce company, is the largest internet retailer in the United States of America (USA), starting off as an on-line bookstore then diversifying into video games, electronics, furniture, food, toys, jewellery, and much more (Yu *et al.* 2016: 180). Without doubt, e-commerce has drastically affected the way in which companies operate, but it has also presented some limitations (Sawmy and Damar-Ladkoo 2015: 172). Currently, numerous problems facing e-commerce relate to internet speed, a lack of government support, customer relations management, safety,

and behavioural parts needing consideration at the time of execution on an agency-to-agency basis (Mruma 2020: 20).

Numerous definitions of e-commerce exist through various authors or writers in different contexts. Hence, it is imperative that these definitions be explored for a clearer understanding.

2.5.1 Definition of E-Commerce

According to Aydin and Savrul (2014: 1269), e-commerce entails the interchange of data to expedite the financing and payments relating to any activity that is commercial, occurring directly between a business, its partners, or its customers by a combination of communications and computing technologies.

Dey, D'Souza, and D'Souza (2015: 189) indicate that e-commerce relates to websites that directly sell products or services from their online site by use of a shopping cart or a shopping basket and in turn, payments are made via credit or debit cards, internet banking and cash on delivery. This definition makes no mention of the parties involved in making transactions of buying and selling goods or services.

Awa, Ukoha, and Emecheta (2012: 572) state that electronic commerce can be defined as a business innovation encompassing non-physical and electronic interactions, whilst the maintenance of business relationships is conducted via information-sharing and knowledge. However, this definition makes no mention of the activity involved electronically, nor the end-to-end parties involved.

Patel and Soni (2013: 357) differ by saying that e-commerce is a highly expansive concept that does not have a definite and clear meaning. However, they present the definition as e-commerce being a way of conducting business transactions via the internet, further stating that it is the use of technology to conduct financial transactions online, occurring between three basic participant groups, namely government, business, and individuals.

Chaffey (2015: 13) is of the view that e-commerce must be regarded as every mediated transaction done electronically between an organisation and any third party it deals with. This definition, according to the author, eradicates the narrow view focusing on buying and selling using the internet, presenting a broader view involving non-financial transactions such as support for customers and requests for further information, which would form part of e-commerce.

Furthermore, Aribawa (2016: 130) refers to e-commerce as all commercial transactions that relate to organisations and individuals based on digital processing founded on the internet.

Examining the definitions cited above, Zuchowski (2016: 96) concludes that e-commerce varies from the known traditional mail-ordering activity. The difference lies between the method of placing orders and mail-order catalogues, which were once commonly used for decades, are now replaced by another medium.

2.5.2 Impact of E-Commerce on Warehouses

Significant changes occurring in warehousing and fulfilment markets are evident as companies incorporate e-commerce into their overall strategy (Burnson 2012: 1). Clark (2018: 1) states that a business selling physical products in any capacity requires an efficient and functional warehouse for the success of their operations. However, the author raised a concern stating that, the upsurge of e-commerce has led to enormous technological and operational changes, forcing multiple businesses to modify their entire business models to remain relevant and competitive.

According to Zuchowski (2016: 97-98), introducing electronic systems into retail trade increased the quantity and disintegration of orders handled by warehouses, needing to deal with returns from the buyer and additional work for the warehouse staff. This change concerns factory warehouses and the smallest retailers' warehouses. Equally, e-commerce alongside other digital technologies provides consumers with various

ways to select, buy and receive goods simultaneously, fuelling an expectation for this all to occur in a shorter timescale (Matthew and Dawson 2014: 1).

For several years, different forms of automation have been used in the warehouse, but the escalating e-commerce demands are such that its now a complete necessity and robots are beginning to play a dynamic role, a trend begun by Amazon (Bogue 2015: 583). Current estimations reveal that Amazon's operations have over 45 000 robots in over 320 warehouses throughout the U.S., which is alleged to be the biggest installation of robots in the country (Futch 2018: 18). In Washington DC alone, the company (Amazon) is using over 30 000 of these robots in their facilities (Banker 2016).

With holistic models, the requirement to unify a complete order fulfilment process is essential (Boysen, de Koster, and Weidinger 2018: 14). Zuchowski (2016: 97) concludes that there are sectors in which well-developed mail ordering systems prepared warehousing technologies for e-commerce. Furthermore, expectations around the time taken to process orders in the warehouse are probably the most visible change, but not all industries adapted to electronic commerce.

2.5.3 Challenges with E-Commerce Adoption for the Warehouse

With the increase in sales volumes of e-commerce in the past years, numerous challenges affect operations within the warehouse. Findings presented by Boysen, de Koster, and Weidinger (2018:1) concur with Weidinger, Boysen and Schneider (2018: 1), indicating that a few of these challenges relate to small orders, large assortment, tight delivery schedules, and varying workloads. Boysen, de Koster, and Weidinger (2018: 1) add that these challenges are mostly evident in conventional warehouses, thereby experiencing difficulties in meeting requirements. Another challenge identified by Weidinger, Boysen, and Schneider (2018: 1) relates to the assembling of large numbers of time-critical picking orders, with each typically consisting of just a few order lines and low order quantities. The major weakness of these traditional warehouses is

the unproductive picker walking process when manoeuvring from shelf to shelf and back to the central depot (Boysen, de Koster, and Weidinger 2018: 1).

2.5.4 Challenges with Technological Adoption in the Warehouse

According to De Villiers (2017: 4), technology is a major force, changing the dynamics of business by permitting consumers and firms to access information at any time. Furthermore, technology makes it possible to tap into a whole new dimension, creating unbelievable opportunities for collaboration, with the foundation for a global economy for developing economies in the Far East and Africa. Technology is steering the future of warehousing, ensuring that customers receive products in the quickest time possible (Allias 2018: 20).

Evangelista, McKinnon, and Sweeney (2013: 967-968) state that immense changes in technological development exerts pressure on businesses to continuously search for innovative strategies to improve their competitiveness. However, with every technological benefit follows a challenge, in relation to which Bhattacharya (2015: 517) expounded that the decision to adopt technology is complex due to several other factors such as business strategy compatibility; combination with existing legacy systems and infrastructure; globalised competition; and the influences of suppliers, partners, and customers. Mahroof (2019: 179) inputs that technological advancements continue to rise in an era where industrialized robots and computers are used more excessively than their customary scope in performing highly precise repetitive tasks, routine physical work tasks and difficult tasks that need cognitive capabilities.

The development of new information technology, according to Kembro, Danielsson, and Smajli (2017: 624), affords the opportunity to improve the efficiency of warehouse operations. These technologies vary, including radio frequency identifiers (RFID), barcodes, electronic data interchange (EDI), and electronic funds transfer (EFT) (Kurnia, Karnali, and Rahim 2015: 518). In addition, Kembro, Danielsson, and Smajli (2017: 624) found that implementing ERP and WMS systems creates possibilities of storing and tracking information to lever and coordinate operations quicker with less

resources which has become a relief. Their studies further expound on introducing RFID and barcodes that enable better product identification and automatic storage locations throughout the warehouse, resulting in shortened handling times and cost savings. However, Lim, Bahr, and Leung (2013: 409) found that RFID research in warehousing operations has been less eminent than in other application domains.

Rafique *et al*. (2016: 1586) define RFID as an identification system that occurs automatically. It can identify objects through radio waves within its collection without any interference, along with the ability to enhance the real-time database facility; warehouse management, inventory, and production control; improve customer order delivery; and minimize lead times. RFID is not limited to firms such as manufacturing and retail, but institutions such as hospitals also realise the importance of this system. Tian (2016: 69) adds that RFID can identify multiple high-speed moving objects automatically at similar times, even under poor environments, requiring no manual intervention. Indeed, it is a promising technology with full benefits that need to be adopted by all industries in the future (Liukkonen 2015: 861).

Dey, Vijayaraman, and Choi (2016: 399) state that the healthcare industry in the USA is faced with a dilemma of high operating costs and the solution to overcome this. Hence, the industry, specifically hospitals, are adopting new technologies such as RFID. In the view of Rafique *et al*. (2016: 1587), RFID is a highly automated system and way better than the manual barcode scanning system. Tian (2016: 69) compares barcoding to RFID by highlighting the various advantages of RFID such as convenience, anti-pollution, mass-capacity, and recyclable.

In addition, Zhong *et al.* (2013: 284) report that the emergence of RFID is viewed as an important Automatic identification technology which owns various advantages as opposed to barcoding, including longer reading distance and larger data storage. Barcoding as a visual technology requires the reader to be in direct line of sight, whereby the barcode reader can process only one code at a time compared to the RFID, which reads multiple tags simultaneously (Kembro, Danielsson, and Smajli 2017: 626).

On the other hand, RFID and barcoding are not the only automated systems advancing the warehouse. The introduction of artificial intelligence (AI) continues to be both a benefit and threat to the warehouse, impacting on human capital. Mahroof (2019: 179) asserts that whilst numerous organisations are pursuing innovative warehouse practices, e-commerce giants such as Alibaba are treading the path by discovering opportunities offered by technology through AI and machine learning to optimise its LSCM. Allias (2018: 20) examined 3 important changes expected in the future warehouse, namely robotics, artificial intelligence, and shipping automation technologies.

It is unfortunate that some warehouses that are not well-established battle to implement and adopt technological systems like RFID due to unforeseen reasons. This poses a threat to their competitive position because RFID technology is expensive (Feng *et al*. 2014: 2174). It must also be remembered that automation is not defined by replacing stock pickers with robots only. It relies on the effective digital transformation of an entire business, meaning further stretching the walls of the warehouse (Business Times 2019: 53).

2.5.4.1 Radio Frequency Identification (RFID)

With the RFID's well-perceived capability and acceptance in the business world, interest within the academic community across different disciplines has increased rapidly (Lim, Bahr, and Leung 2013: 409). The emergence of RFID witnessed an increase in operations efficiency in warehouse management and inventory monitoring. When compared to traditional barcoding, the identification of tagged products without line of sight and tracking of product status when received or shipped away from the warehouse in real-time, is one major benefit of such technology (Wei, Lowry, and Seedorf 2015: 628). Even though there may be similarities between the two, the primary difference lies in the execution of reading a RFID tag. Barcodes need visual inspection equipment, reading ranges either in inches or centimetres (Feng *et al.* 2014: 2173). RFID technology is commonly adopted in warehouse management, as it allows the tracing, tracking and identification of specified objects (*Lee et al.* 2018: 2755).

Based on a review conducted by Reyes, Li, and Visich (2016: 804), it was found that four barriers were linked to the delay of implementing RFID: cost issues, lack of understanding, technical issues; and privacy concerns. Sooksaksun and Sudertsin (2014: 429) discovered three significant problems during their study of RFID applications in the warehouse, namely: inaccuracy of inventory location; long cycle time of the receiving process; and non-real-time empty storage location.

The emerging of RFID in the past 10 years has seen various researchers share their views and opinions. Some examples are: Wang, Chen, and Xie (2010), who conducted a study that proposed the use of digital warehouse management systems to be adopted and used in the tobacco industry established on RFID technology; Liukkonen (2015) looked at enhancing efficiency with RFID technology in manufacturing and supply chain management; Uphold and Liu (2010) revealed that the retail sector in South Africa understands the benefits of adopting RFID technology, but the identification of various barriers has hindered full adoption; and Musa and Dabo (2016) present a systematic literature review of papers published in academic journals pertaining to RFID in supply chain management between the period 2000 and 2015. The results reveal that the adoption of RFID by various enterprises enhances operational processes; facilitates the realization of organizational change; and the creation or enhancement of economic performance and competitiveness.

2.5.4.2 Artificial Intelligence (AI)

Artificial intelligence is not new (Antonescu 2018: 15). In today's world, AI has become one of the most disruptive technologies for/in this era, with some global giants such as Amazon, Siemens, Alibaba, and Apple combining elements of AI into their products (NEDSI 2019: 807). The concept was first introduced in 1955, with the proposition that computers may be able to learn, do things, make decisions, and exercise judgement based on what they learn (Socha 2017: 6). It is understood to be a group of computer disciplines that tend to imitate natural intelligence. Therefore, AI is defined as a study encompassing ideas that enable computers to perform certain functions, such as

natural language processing; knowledge representation; and automated reasoning to use information, with the conception that people are smart (Antonescu 2018: 15).

NEDSI (2019: 816-817) state that using AI technology can establish efficiency and cost savings in warehouse management in numerous ways: Reduction in waste by improving material retrieving; reduced shipping errors; and decreases in shipping defective material by early detection in the retrieval process.

Allias (2018: 21) is of the view that numerous discussions on how artificial intelligence will improve warehouse operations have been surfacing, which there might be some truth to, but a downfall for human workers may exist. One needs to understand that AI is an electronic intelligence stemming from chomping enormous quantities of data to recognize patterns and make predictions. A potential disadvantage is the quality of data collection, the good and bad. There is a possibility that AI will transfer into a modern way to track human workers in the warehouse doing their jobs and predicting their performance.

The adoption of AI and machine learning into the warehouse may be useful in enhancing operations. However, it goes without saying that implications or challenges may surface, such as cost factors, resistance, as well as skilled personnel that can be hard to find and retain. Overcoming some of these challenges means that organizations need to understand AI strategy clearly, building top management support and placing trust on the environment around to lessen any resistance to technology that is at times contentious (NEDSI 2019: 806).

2.5.4.3 Robotics

Over several decades, a trend in robotics in the warehouse penetrated through the supply chain sector (Wunderlin 2017: 40). Organisations are looking at how the warehouse can shift from a lost capital expenditure to a profit centre and the response normally involves the tallying of a piece of technology (Allais 2018: 20). Robotics are continuously paving new pastures in the logistics environment together with stock

management systems, making warehouses smarter, faster, and more efficient than before. Having these systems in place may also assist in determining what warehouses may look like five years from now (Woods 2019: 13). A study conducted by Tractica (a market research firm) estimates that warehouses will spend $22.4 billion on robots alone in the upcoming three years (Allais 2018: 21). This then raises a concern that costs to implement new technology (robotics) is high because even though they may be decreasing, logistics providers with outsourced warehouses on short-term contracts are unlikely to proceed with investing if the payback time is a few years (Hogg 2015: 43).

According to Allais (2018: 21), using robotics in the warehouse will supplement workers, not replace them entirely. Additionally, robotics provide the flexibility necessary for handling the vast variety and variability involved in e-commerce orders (Huang, Chen, and Pan 2015: 69). However, analysis in a study conducted by Oxford University and Deloitte anticipates that 35% of jobs in the UK currently are at high risk of computerisation in the upcoming two decades, especially those working as assemblers, routine operatives, inspectors, and testers, with the risk being as high as 97% (Hogg 2015: 45). In contradiction to the above statement by Allias (2018: 21), Miebach and Surtees (2018: 32) confirm that robots are replacing humans, with the current thinking being within the next 10 years, foreseeing more than 50% of warehouse staff being replaced by robots.

Furthermore, the use of specialised robots within the warehouse is all reliant on economic viability, but as the standardisation and mass production of robots is making the prices low, costs relative to labour and associated costs will become more attractive. Inasmuch as several warehouse jobs will be abolished, others will be created, like robot manufacturing, commissioning, and maintenance.

The implementation of change in the warehouse is not an overnight decision. There are factors that influence decision-making, requiring management to evaluate considering the aspects that will benefit the warehouse. Wunderlin (2017: 40) outlines several reasons that lead to companies opting to implement robots in their facilities,

namely low cost, high productivity and minimal risk. Robots automatically locate, pick, and transport the items needed to a station where other robots are packaging them for dispatch and delivery. Deliveries may even be pursued with aerial robots (drones) (Bogue 2015: 587). Collaborating robots enable the completion for about a 50-item order in a few minutes, compared to a two-hour human transaction (Miebach and Surtees 2018: 32).

In the case of AMAZON, possessing a fully automated warehouse that uses robotics indicates the urge to satisfy customer demands, services and understanding the concept of J-I-T. How so? Simple. When an order enters the warehouse, it is recorded on the warehouse management system. The software detects the nearest robot to the item and directs it to recover it. The robots manoeuvre everywhere in the warehouse by following sequences of barcode stickers marked on the floor and each is armed with a collision avoidance sensor. As the robot approaches the targeted location, it slides underneath the storage unit, carries it off the ground and moves it the designated human operator to pick the items (Bogue 2015: 583). In their final words, Comparik, Gravier and Farris (2018: 39) state that the immense implementation of warehouse robotics and its impact depends on the skill to execute tasks performed by humans of identifying products on the shelf, picking products in non-standardised packaging and knowing the human context of the goods for packaging and presentation to human customers effectively.

2.6 WAREHOUSING OPERATIONS AND PROCESSES

According to Davarzani and Norrman (2015: 1), one function within the logistics process of product flow is warehousing. Warehousing is a system for storing products at a specific point in the logistics system, starting from the goods' point of origin through production to the point of usage/consumption (De Villiers 2017: 57). Lu (2016: 107) indicated that warehouse management is a long-established area, both in terms of industrial practices and academic findings. Additionally, the warehouse is a major element within LSCM, even though warehousing research remains an understudied area within overall supply chain research, which constitutes only a fraction of the

overall research within this field (Mahroof 2019: 176). Liu *et al.* (2019: 86) postulate that warehouse management is an essential part of the goods supply chain, which ultimately is an important network to join manufacturers, distributors, retailers, and consumers. Thus, the objective of warehouse management includes finished goods, raw materials, and semi-finished goods.

The management process in a warehouse is the overall optimization of warehouse resources, which includes inventory, material handling equipment, loading/ off-loading operations, ensuring innovative solutions and that staff are in place (Abushaikha, Salhieh, and Towers 2018: 781).

A study conducted by De Koster, Johnson, and Roy (2017: 6327) allude that warehouses do not only operate as centres for adding value in the present world, which was in contrast to the past perspective where warehousing had been viewed as a non-value adding entity to the business/organisation. Recent studies indicate that for profitability, warehousing management is critical in the supply chain process. Warehouses continue to play a pivotal role within supply chains and will continue to do so for the foreseeable future, even though the appearance is different (Richards 2018: 2).

According to Boysen, de Koster, and Weidinger (2018: 2), a warehousing system comprises hardware that can be sub-divided further into storage devices; for example, a rack; material handling systems such as a conveyor belt; and picking tools like a pick-by-voice solution or a picking workstation and practices defining the workflow alongside the applied hardware elements. According to Mahroof (2019: 178), the process of goods arriving at the warehouse undergoes various activities. Thus, the difficult aspect of the warehouse according to Faber, De Koster, and Smidts (2013: 1231) involves storage and order picking, which is labour-intensive, contributing to the performance of the warehouse. This agrees with Lam *et al.* (2014:1283) findings which also indicate that the order picking process is a labour-intensive and costly activity, especially when handling those small orders separately.

Sooksaksen and Sudsertsin (2014: 423) provide a breakdown of the processes occurring in the warehouse: the first being the receiving, storage being the next followed by the picking process, with the last being the shipping. Lee *et al.* (2017: 2756) refer to warehouse processes as warehouse activities that encompass inbound and outbound area activities such as receiving, storage, quality inspection, picking, and shipping.

Research reflects that considering warehouse design and management principles can assist greatly in improving the efficiency of operations, reducing employee fatigue and turnover and improving customer service levels (De Koster, Johnson, and Roy 2017:6327). However, to understand warehouse design and management principles, operations within the warehouse need to change, according to Lee *et al.* (2017: 2753), due to the increasing challenges and variety of customer orders. Accorsi, Manzini, and Maranesi (2014: 175) share a different view by stating that literature has disputed the issues of warehouse design and management on a broader scale, which is aimed at reducing the operations time and costs and increasing performance in the supply chain.

In addition, Wruck, Vis, and Boter (2017: 6453) state that the platform created for customers to easily purchase products online at any time with rather short delivery times impacts on increased planning uncertainties and fluctuating labour demand in supply chains. However, numerous organizations do not have the resources nor capacity to implement completely new systems (Triantafilo 2017). Systems and software packages such as ERP, WMS, TMS and APS impact the warehouse (Reaidy, Gunasekaran, and Spalanzani 2015: 29).

In the current business environment, the competence of warehouses can be critical for the effectiveness of the overall supply chain they belong to (Stoltz *et al*. 2017: 12979). With the existence of numerous intertwining business processes, complexity induced errors are common in warehouse management (Zhou *et al.* 2017: 99). According to Horn *et al*. (2014: 93), two main objectives exist within warehouse management- the first being to increase profits and the second to increase customer service levels. This

is determined by categorizing the warehouse based on the customers it serves and the operation/s conducted (Kembro, Danielsson, and Smajli 2017: 6240). Therefore, the warehouse is faced with challenges and restrictions such as flexibility, agility, responsiveness, and consolidation of warehousing (Reaidy, Gunasekaran, and Spalanzani 2015: 32).

Existing methods today seem not to solve the growing challenges of the warehouse and production site management complexities. In this case, RFID-enabled tracking technologies can assist in the reduction of these problems, with increased information transparency in real-time (Zhou *et al.* 2017: 100). van Gils *et al*. (2018: 258) conclude that serving e-commerce markets compels warehouses to handle an increasing number of orders in shorter times. Being aware of the impact of an individual warehouse's operations based on the overall warehouse performance is needed to manage warehouse operations more efficiently, resulting in improved services to customers.

The following section delves into the history or existence of the warehouse, the processes therein; and how e-commerce affects warehouses holistically, resulting in the establishment of fulfilment centres for the purposes of same-day delivery and cost reduction.

2.6.1 History of the Warehouse

In understanding the history of the warehouse, Kamil (2015: 26) wrote that:

"Warehousing history started from the establishment of sea trade routes between Europe and other continents. The twentieth century was indeed a crucial period in the development of warehousing. Approaching the late 20s and early 30s, the first pallet was introduced. Later in the 50s when the mass-production of forklifts began, pallets became vital in transportation and handling operations. At the end of the century, warehouse management systems facilitated the eradication of paper-intensive warehouse coordination. This is where IT solutions started carrying out these activities. Computer-based solutions help to optimize the full spectrum of the warehouse."

2.6.2 Importance/Relevance of the Warehouse

Warehouses, according to Gattuso, Cassone, and Pellicano (2014: 52), undertake a dual role in the logistics matrix. They are both vessels of goods in stock and transformers of inbound flows into outbound flows. In logistics operations, warehousing is an essential component that ensures consistency in supply from manufacturers to end consumers, with the objective of increased levels of productivity and quality (Micklesson, Thai, and Halim 2019: 4). Warehouses also establish essential networks amongst suppliers and customers by overcoming space, time, and distance between them; ensuring the maintenance for desired customer service levels; combining various orders into one delivery; and lastly, supporting just-in-time agreements between suppliers and customers (Lim, Bahr, and Leung 2013: 412).

Kim, Dekker, and Heij (2018: 93) share a brief meaning by stating that warehousing serves as the prime link between producers and consumers in the supply chain. They are grouped according to the customers they serve and the operations they conduct (Kembro, Danielsson, and Smajli 2017: 624). Receiving large quantities of products, re-organizing and packaging and sending them out in smaller quantities occurs on a day-to-day basis in the warehouse. Broadly, warehouse operations entail inbound processes such as the receiving and storing of goods and outbound processes such as order picking, packing, and shipping (Kim, Dekker, and Heij 2018: 95). Moreover, Micklesson, Thai, and Halim (2019: 5) found that warehousing consists of three key processes, namely inbounding, storage and out-bounding. In the case of e-commerce warehouses, big numbers of small orders need to be picked, packed and prepared for shipping as a response to customer orders (Wruck, Vis, and Boter 2017: 6453). Some of these customer orders are unique, specific, and challenging, resulting in high-cost land and labour, pressurising warehousing companies to be competitive and search for innovative methods of improvement (Micklesson, Thai, and Halim 2019: 5).

2.6.3 Processes within the Warehouse

Davarzani and Norrman (2015:3) mentioned that it would be advisable for the warehouse to follow a proper strategy that will assist towards determining how operations be conducted, as well as a suitable design for the warehousing activities for better performance and resources such as space, employees, equipment and technologies must be provided for the success of the business. Due to production movements to lower cost countries, the rise of e-commerce and increasing demands from consumers resulted in changes to warehouse operations (Richards 2018: 7). Accorsi, Manzini, and Maranesi (2014: 175) state that the main function of the warehousing systems is to receive products either from inbound or manufacturing lines, to storing materials until they are requested, followed by the extraction of products from inventory to shipping as per the customers' orders.

Processing individual orders placed by consumers has resulted in drastic changes within warehousing, increasing the number of orders daily, with each order consisting of small numbers of products, which in turn affects the overall order lines parameters (Kamil 2015: 17). Kembro, Norrman, and Eriksson (2018: 892) mentioned receiving, put-away, storage, picking, sorting, packing, and shipping as warehouse processes. Rao and Adil (2017: 327) share similar views, stating that receiving, storing, picking, accumulation, sorting, cross-docking, and shipping construe major activities in the warehouse. Furthermore, activities vary depending on the warehouse services and layout.

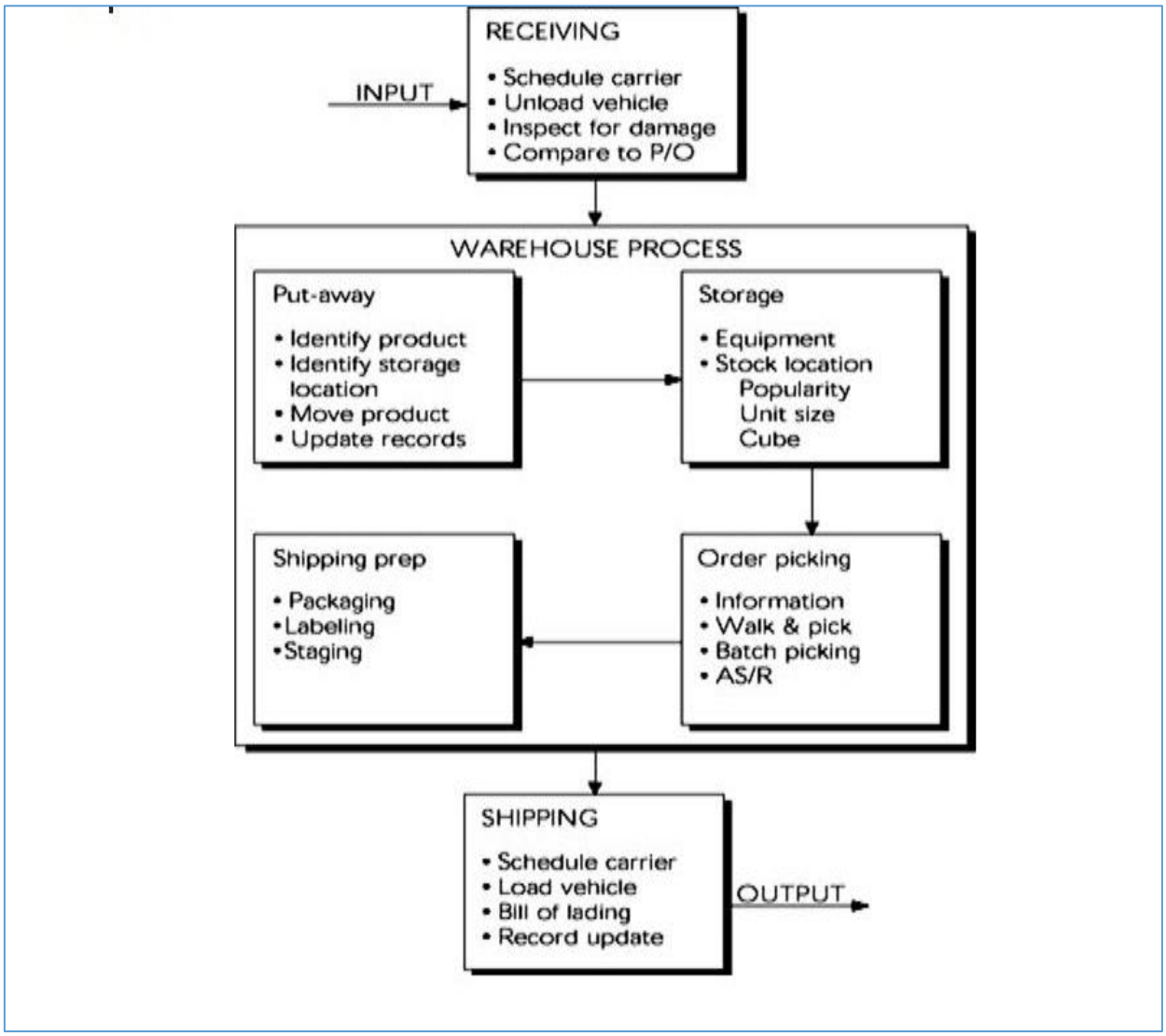
The receiving stage, according to Lim, Bahr, and Leung (2013: 412) is the starting point, where items arrive and are unloaded from the transport carriers. At this stage, the identity, quantity, and condition are checked, and items may be re-packed to different stock keeping units. According to Staudt *et al*. 2015 (citing De Koster and Warffemius 2005) this may imply that the difficulty of the activities in the warehouse depends mostly on the amount and range of items to be handled; daily volume of the workload to be completed; and the number, nature and variety of processes that are compulsory to fulfil the needs and demands of the customers and suppliers.

Order picking exists due to goods being received in large quantities and customers ordering small quantities of different products (van Gils *et al.* 2018: 244). The process accounts for about 60% of total labour cost, whilst 90% of picking time is spent on travelling (Li, Huang, and Dai 2017: 447). However, this process is found to be the major bottleneck of the warehouse operation (Lee *at al.* 2018: 2754). Li, Huang, and Dai (2017: 447) highlight some of the factors that disrupt the efficiency of order picking, namely; warehouse design, storage location, storage allocation, and picking policy. The solution to this disruption and impediment on an efficient, less time-consuming order picking process is introducing the internet of things (IoT) devices.

According to Lee *et al.* (2018: 2754), the Internet of Things equipment can detect the pickers' information on the items in terms of location, resulting in an enhanced order picking process. A manual operation is commonly used in the warehouse where products are randomly placed, relying on the memory and experience of the workers to track products. This is said to be time-consuming, and the workload of the worker is increased, resulting in poor work morale and fatigue, in turn leading to high turnover rates. Therefore, Woods (2019: 14) suggests that automating the warehouse will make picking activities four to five times more efficient than human performance.

Briefly explaining the concept of IoT, Karimova and Shirkhanbeik (2015: 3) state that the term was introduced by Kevin Ashton, known for creating a global standard system for RFID in 1999 and co-founding the AUTO-ID Centre at the Massachusetts Institute of Technology. He had envisioned a world where the internet is connected to the physical world via global sensors. Even though IoT has no single universally accepted definition, different scholars continue to write about the concept, presenting various definitions within their context/field of writing (Tran 2017: 264). With various scholars developing an interest in IoT, the concept became broader and comprised more of the evolving technologies. With the concept assuming billions of everyday "things" being entrenched with software, microprocessors, sensors and connected to the internet, participating in this huge network occurs by sensing their environment, generating, collecting, and exchanging information (Mijac, Androcec, and Picek 2017: 41).

Figure 2.3 A typical warehouse process



Source: www.slideplayer.com

Figure 2.4 Example of storage (packed and shelved) goods

Source: www.123rf.com

Figure 2.5 Example of modern warehouse

Source: www.123rf.com

2.6.4 Fulfilment Centres

The existence of OCs established the need for the integration of online channels with physical stores, giving rise to fulfilment centres. Richards (2018: 15) states that the rise of e-retailing has witnessed an increase in the volume of customer fulfilment centres. These types of warehouses have been designed and equipped mainly for the management of big volumes of small orders. Consequently, as the demand for same-

day deliveries continues to increase, fulfilment centres become a relief for warehouses in terms of location, transportation costs and labour factors. This not only impacts the competitive advantage position of the company, but also attends to customer satisfaction and loyalty. Information regarding OC is found in section **2.3.1**.

According to Biederman (2013: 34), the determinacy of e-commerce is being steered by the overall surge in the consumer's ability and comfortability with online shopping and the use of mobile devices, namely smartphones and tablets for purchasing, which contributes to its remarkable growth. Key retail chains are also investing heavily in OC strategies, including fulfilment centres. This presents countless opportunities for customers to buy what, where when and how they want, with the merging of e-commerce and brick-and-mortar into OC (Hubner, Kuhn, and Wollenburg 2016: 228).

In addition, it is important to understand the difference between a warehouse and a fulfillment center. The perception might be similar, but Lopienski (2018) provides a clear description of the difference, stating that the terms warehouse and fulfillment center, are usually used interchangeably, but may differ in meaning. Both are huge buildings that house inventory for businesses that sell goods. However, the services provided are generally quite different.

Looking at traditional fulfilment models, items are usually picked, packed, labelled, staged, and sent to the dock, where they might sit. The single process flow is used in rapid e-fulfilment to understand products right from picking and packing to shipping (Biederman 2013: 39).

Due to increased environmental pressure, grocery, home shopping and delivery will increase rapidly, resulting in more fulfilment centres and returns processing facilities (Richards 2018: 30). Selling food directly to consumers is not a new concept and purchasing from vendors and farmers is an ongoing activity currently. However, to meet the expectations of the consumer, numerous supporting activities need implementation, namely added value to products, control shipments and the fulfilment of administrative duties (Kamil 2015: 17).

In the view of Lopienski (2018), a fulfilment centre is understood to be the physical location from which a 3PL provider fulfils customers' orders for e-commerce retailers. The existence of a fulfilment centre is to get online orders to customers in a timely manner and to relieve e-commerce companies managing this crucial yet challenging process. Additionally, after a customer completes an order purchase on an e-commerce store, the inventory is picked, boxes are packed and then labelled for shipment. Fulfilment centres reduce the processes that normally occur in the warehouse (receiving, put-away, storage, picking, sorting, packing, and shipping) narrowing it down to just picking, packing and shipping. This results in cost reductions; is less time-consuming and is a faster way to get the order to the customer.

2.6.5 Warehouse Management System (WMS)

Designing a proper warehouse management system, according to Davarzani and Norrman (2015: 6), is an important aspect to consider. The WMS is known to be a stock tracking software-based system that processes incoming or outgoing transactions, including receiving, stock allocation, order picking, shipping, and fulfilment (Al-Yahya 2017: 15).

A study conducted by Atieh *et al. (*2016: 568) found that a WMS is a necessity for every warehouse. Introducing technology in the warehouse can potentially improve productivity, reduce costs, increase utilization, and increase customer satisfaction. For a company to remain competitive, Richards (2018: 233) avers that it must introduce a real-time warehouse management system. This WMS will be used to register incoming and outgoing goods. The importance of having a system to track goods throughout the warehouse makes it simpler to achieve a better outline of completed and upcoming tasks, reducing the time required to look for activities in the warehouse; minimizing inventory deviations; causing a reduction of inventories and the improvement of space utilization; and increased service levels (Kembro, Danielsson and Smajli 2017: 625).

Having an autonomous warehousing system requires less effort and provides more efficient and reliable results compared to manually handled systems (Atieh *et al.* 2016:

568). The control of automatic facilities needs control software such as WCS, MFC, EMS/ECS (Son, Chang, and Kim 2015: 1435). The concept of WMS and WCS are different according to functionality. Son, Chang, and Kim (2015: 1435) draw a comparison between both concepts, stating that WMS focuses on the management of an order and is generally interfaced with the ERP system, whereas WCS is more focused on the controlling of machines and deals with dynamic data with shorter timing.

Mahroof (2019: 178) indicates that the design of a WMS needs to consider physical facility characteristics and product movement to maximise benefits. Triantafilo (2017) found that in today's world, several warehouses are still stuck with the legacy systems. These are impeding workflows, bottom-lines, and operations. These inefficiencies are old, cumbersome, and expensive to maintain, and software applications are grown throughout the entire warehouse. Moreover, basic warehouse management system functionalities are incapable of effectively managing operations such as small orders, individual picking, bulky item count, unspecified order arrival patterns, seasonality, and high service level expectations. These operations require added tools and system improvements to run efficiently (Ardjmand *et al.* 2018: 169).

A study conducted by Liu *et al.* (2019) found that operating or building a warehouse centre grounded on RFID and sensor technology was a remarkable resolution. Their findings were based on a study conducted on a new model for a superstore in China. Using RFID and sensor technology has the potential to improve warehouse management levels of the superstore, thereby reducing the cost of warehouse management. Furthermore, it possesses a meaningful implication for improving business efficiency and enhancing the brand image and competitiveness.

According to Al-Yahya (2017: 15-16), a WMS monitors the warehouse development of items as follows:

- Assignments pertaining to inventory location;
- Fulfilment management and order picking;
- Management of warehouse capacity;
- Competence for data management;

- ❖ Management of cross-docking;
- ❖ Put-away and picking and put-away optimisation; and
- ❖ Utilisation of labour.

2.6.6 Future of Warehousing

Banker (2016: 1 wrote: “In 2009, I saw the Kiva robots for the first time and knew it would eventually change the face of warehousing”. Introducing new technologies comes with rapid changes in operations across the supply chain and the traditional role of a warehouse is being challenged (Hammant 2017: 44). Concerns about manually operating warehouses lurks, as operators physically walk to a pick location, pick goods, and move these goods to delivery stations. Furthermore, operators may engage with forklifts and conveyors to transport these goods to certain locations in the warehouse. A warehouse of this sort may lead to several challenges, namely:

- ❖ Inefficiency in handling material;
- ❖ Reduced space utilisation;
- ❖ Staggering processes with stacking and dispatching;
- ❖ Reduced variety and high levels of SKUs;
- ❖ Common human errors;
- ❖ Costs of training labours;
- ❖ Accidents;
- ❖ Outdated inventory information; and
- ❖ Poor stock visibility

As a result, various companies plan to replace traditional warehouses with automation (Al-Yahya 2017: 17). Banker (2016: 1) is of the view that technologies in the warehouse that support high volumes of small, multi-line orders are receiving significant attention from practitioners as they adjust their capabilities to fit the altering warehouse demand profile. Clark (2018: 1) assures that warehouses in the future will not be obsolete as their significance, role and services will always be required to store and ship physical products. With the advancement in technology and consumer expectations, warehouses need to be innovative and adaptive to the changing landscape. However,

from the assessment of warehouse performance and how they have reacted in the last decade, they are more than capable if they have the right employees, technology, and equipment at their disposal.

Richards (2018: 31) inputs that warehouses will be anticipated to be carbon positive, which in future will be backed up by legislation. Futch (2018: 18) adds that as technology improves and applications become broader and more flexible, robotics are being adopted by a larger number of warehouse operations throughout the U.S. Automation and robotics will be used increasingly in warehouses to reduce reliance on manual labour, reduce errors in picking and improve efficiencies (Futch 2018: 20).

Boysen, de Koster, and Weidinger (2018: 13) found that some emergent common trends in e-commerce warehousing need further scientific consideration, applying the correct system suited for their specific situation. Therefore, evidence shows that technologies such as AI, automation, and machine learning are now increasingly securing a residence within warehousing and logistical distribution centres (Mahroof 2019: 180).

Atieh *et al.* (2016: 568) are of the view that the need for automation in the warehouse stems from the fact that manual operations may lead to human errors that can affect warehouse utilization. Automation in the warehouses is referred to as both material handling solutions and ICT-based devices (Marchet, Melacini, and Perotti 2015: 85). However, in their findings, some concerns emerged regarding warehouse automation, such as the risk associated with disrupting warehouse operations in the event of failure to the system; loss of flexibility in the long term; and a decrease of customer service levels in the shorter term. Huang, Chen and Pan (2015: 69) add that the high variety and variability of orders arising from e-commerce make the implementation of automated facilities more complicated.

Having a combined warehouse management system (WMS) can assist an organization to build a backbone to their warehousing, inventory and logistics function (Triantafilo 2017). This includes being aware that several problems affect the

warehouse, especially if mismanagement prevails. These are storage space utilisation, product handling, warehousing equipment problems, labour intensity, information gaps between warehousing and manufacturing or retailing, and difficulty in costing and budgeting (De Villiers 2017: 75-76).

In the upcoming months and years, technology will alter how people learn, make decisions and relate with the physical world. It will also transform how enterprises serve customers; conduct training for employees; design and create products; and manage their value chains, not forgetting their competitiveness (how they compete) (Porter and Heppelmann 2017: 48).

At DHL, the adoption of technology has resulted in fewer errors, more involved workers, and productivity gains of 25%. Intel is said to be using AR in their warehouses and have achieved a 29% drop-in picking time, with rates in error dropping to near zero. Moreover, the AR application is allowing new Intel workers to achieve immediate picking speeds of 15% faster than those of workers who have had only customary training (Porter and Heppelmann 2017: 53).

Richards (2018: 13-14) inputs that cross-dock centres and fulfilment centres are the future of the warehouse. Competent consumer responses and speedy responses within retail needs operations to be able to manoeuvre goods quickly through the supply chain. Cross-docking needs deliveries to be already labelled and ready for onward delivery for these types of centres. Items are branded and joined with other deliveries and made ready for despatch. Items should remain in the warehouse for as limited a period as can be. A same-day receipt and despatch is the target.

2.6.6.1 Drones

In an ever-evolving technological environment, drones have filtered through to some parts of the warehouse. Miebach and Surtess (2018: 31) found that there are three technological trends revolutionising the supply chain world: 3D printing, robots, and drones. The word ‘drone’ according to Fernandez (2016: 1) is a well-known term used

to describe an unmanned aerial vehicle, which is a robot that integrates flight with sensors, for the allowance of uncommon freedom in observation and interaction with the world. Chen (2017: 519) wrote that using drones as a delivery mechanism that promises to improve the modern-day online shopping experience appears to be a main competitive business advantage that U.S. e-commerce companies are well-aligned to seize. Although the adoption of drones is still in its early stages (Miebach and Surtees 2018: 32), there is no doubt that its usage and existence will enhance operations in the warehouse.

Duric, Jovanovic, and Sibalija (2018: 49) identified a set of advantages with using drones in the warehouse as opposed to manual work, namely:

- Using unmanned aircraft decreases the inherent security risk involving raising people to high racks for code scanning. Using drones affords a safer environment for employees.
- Drones can visually inspect labels, captures photos, registers barcodes and use RFID tags to read the inventory location and other data.
- The cost linked to warehouse processes is minimised due to improved inventory management.
- The employer's cost is streamlined.
- The integration of automatic drone systems with the information systems of a company, such as WMS and ERP system software, is easier.
- Drones can operate at night-time, which in the case of people is significantly more difficult to organize and much more expensive.

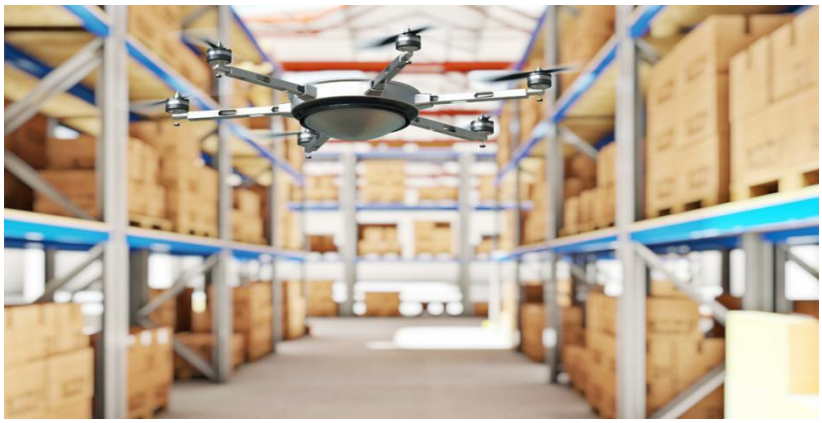
The sudden attention to warehouse drones by companies such as Wal-Mart and Amazon seek to leverage on drone strength by maintaining inventory accuracy and shortening response times for picking regarding consumer orders, whilst maintaining a conducive environment for U-flow warehouse layouts (Companik, Gravier, and Farris 2018: 38). In their conclusion, Duric, Jovanovic, and Sibalija (2018: 51) state that drones, with their specifications, present an advanced solution for a nearly complete automation of inventory operations in warehouses. This results in drones guaranteeing improvements in productivity, no breaks needed, improved accuracy, alleviated injury,

fewer repetitive tasks, maximized use of 3D space utilization, and other worker quality of life issues (Fiveash 2016: 40). Drone-based technology is anticipated to progress alongside other global technologies, such as IoT (Duric, Jovanovic, and Sibalija 2018: 51). Companik, Gravier, and Farris (2018: 43) conclude that warehouse drone technology is a vital component for the supply chain's competitive position, as well as for supply chain assimilation and reduced cycle times to maintain customer service stages and supply chain awareness.

Figure 2.6 Example of a drone

Source: Miebach and Surtees 2018

Figure 2.7 Different type of drones



Source: www.google.com

2.6.6.2 Internet of Things (IoT)

"The Internet of Things is taking place everywhere. From home thermostats to cars, to machinery in factories. Now IoT is penetrating into the warehouse, though more slowly. But with more warehouse-focused vendors contributing to pre-tested sensors, pre-built analytics and alerting around IoT-connected equipment, IoT should become more widespread in DCs."

Michel (2019: 26)

Figure 2.8 Extracted image of IoT

Source: clearspider.com

According to Duric, Jovanovic and Sibalija (2018: 51), IoT looks at virtually connected objects communicating with one another via networks, using state of the art processors and software technologies. The concept combines both hardware and software aspects, connecting hardware with data and computer systems, thereby enhancing visibility in processes. Additionally, Singh and Singh (2015: 1577) mention that the increase of intelligent devices will contribute significantly to a network enriched with information, allowing supply chains to gather and communicate in novel ways. Therefore, the integration of drones and IoT can potentially impact areas such as tracking inventory, vision picking, data analytics; and automated tasks (Duric, Jovanovic, and Sibalija 2018: 51).

The definition presented by Singh and Singh (2015: 1577) establishes that IoT, known as a computing concept, defines a future where daily physical objects are connected to the internet, with the ability to recognise themselves to other electronic devices. The use of RFID, quick response codes (QR), sensor or wireless technology enables intercommunication between devices. The evident issue with evaluating the condition of IoT in the warehouse is that several systems create data by using sensors and can disseminate information in the Cloud, but it is a stretch to call every such system IoT (Michel 2019: 26).

In summary, Zhang, Zhang, and Guo (2020: 512) share that by adopting IoT, enterprises involved in e-commerce will not only manage and share the process of circulation of products in the supply chain, but also analyse and foresee the data of each stage of the supply chain. This advances the ratio and ability of reaction of e-commerce to the market, making e-commerce more advanced and favourable.

2.6.6.3 **Augmented Reality (AR)**

AR is known to be the “next big thing” to transform operations within the warehouse, combining both physical and digital worlds through wearable device(s) in real time and seeks to ease processes in logistics and enhance turnaround time. According to Porter and Heppelmann (2017: 48), AR entails the transformation of high data and analytics

into images or animations that are overlaid and reflecting on the real world. Furthermore, the effects of AR will be experienced in every industry and various organizations, stemming from universities to social enterprises. Most commonly, AR is confused with VR, which are two different concepts. In clarity, Porter and Heppelmann (2017: 50) referred to the two concepts as ‘cousins’, as VR is a complementing but distinct technology, whilst AR covers the electronic information on the physical world, hence VR replaces the physical reality with an environment that is computer generated. AR is slowly becoming the novel connection between humans and machines, connecting the electronic and physical worlds (Porter and Heppelmann 2017: 48).

In estimate, warehouse processes account for almost 20% of all logistics costs, while item picking from shelves denotes up to 65% of warehouse costs. Consequently, most warehouses still perform tasks that involve manual transactions (paperwork) for searching and collecting. As a result, this method is prone to errors and is slow (Porter and Heppelmann 2017: 53). Stoltz *et al.* (2017: 12980) contribute that AR, as a solution, enables fast and efficient picking, free from errors and user-friendly, whilst directing a human operator.

Logistics company DHL and several other companies have adopted the usage of AR to elevate the efficiency and accuracy of the picking process. This has eased operations as AR instructs workers on the location of each product and then proposes the best route to the next product (Porter and Heppelmann 2017: 53). However, applying AR to processes such as receiving, storing and shipping may possibly lead to benefits like those experienced by order picking, such as minimised error rates and the quicker execution of operations (Stoltz *et al.* 2017: 12980).

The table below, crafted by Stolz *et al.* (2017: 12980), summarises the potential use of AR in the warehouse.

Table 2.2 Potential use of AR in the warehouse

Operation	Potential use
Receiving	-Will show offloading dock to incoming truck driver - Received goods will be checked against delivery note -Confirm where items are to be put and how to position accordingly in the waiting zone
Storing	-Notify the operator about a new task being allocated -Show where incoming items should be stored -Specify the current status as well as the next step of the process for the pickers -Scout locations needing to be replenished while in storage
Picking	-Notify operator about new allocated task -Show images and information of the item(s) that need picking -Provide a view of storage location of item to be picked -Show route for picking -Show the physical place with the item needed -Advise on mistakes and interruptions -Scan items using barcodes to assign to picking cart for sorting while picking -Supply information to prevent congestion in aisles
Shipping	-Observe picker's performance and condition -Indicate what type of cardboard to be used -Suggest useful ways to place picked items in a package -Specify the correct location or pallet for shipment -Direct where to put each order on a pallet or in truck according to order type, destination and fragility -Specify correct loading area and double check products/orders to be loaded

2.7 THEORETICAL FRAMEWORK

According to Motlhale (2018: 24), research projects are directed by a precise and related theory that allows similarities with the topic under study. One can infer that the key characteristics of a theory in qualitative research, according to Gibbs (2018: 12), are that it holds the ability to explain some phenomena as well as outcomes and commonly, it uses terminology that is not being used by the participants one is investigating. Kivunja (2018: 45) explicitly asserts that, normally, a theory emerges from a lengthy process of research using empirical data to make statements based on a deductive and inductive analysis of the data. Additionally, the emergence of the

theory affords a knowledgeable and research-grounded foundation aimed at understanding, applying, analysing, and designing innovative ways for investigating relationships and solving problems in educational and social science contexts (Kivunja 2018: 45).

Therefore, a theoretical framework encompasses theories conveyed by experts for a research study of interest, which provides a theoretical “coat hanger” for the analysis of data and interpretation of results (Kivunja 2018: 45). The theoretical framework for any form of study cannot be viewed as a summary of the researcher’s personal thoughts about the study. Instead, it undertakes a synthesis of thoughts by various authors in the field of research as relations are made to the proposed research or thesis; the in-depth understanding of those theories; and how those theories will be used to understand data (Kivunja 2018: 46).

Various theories have been developed in academic research, with the intention of understanding the decision-making of humans and organisations with technology; what influences their decisions; and why choose to adopt or reject a given innovation or technology. Theory plays a critical role in informing strategic thinking towards bridging existing study gaps. This study identified that there is still a critical gap in the identification of critical technological challenges affecting the warehousing industry in Durban and the broader South African context. Thus, the in-depth exploration from warehouse experts played an important role in unpacking insightful perspectives that is often missing from dominantly quantitative studies in e-commerce. The adoption of Diffusion of Innovation theory (DOI) offered a critical perspective to analyse loopholes and opportunities when it comes to technological issues in the Durban warehouses. The researcher was guided by DOI to ask “how” technological challenges in Durban warehouses can be addressed using innovation lenses through the DOI framework.

2.7.1 Diffusion of Innovation Theory

Diffusion of Innovation theory was adopted as a theoretical framework to reflect on the diffusion and adoption of technology in the warehousing industry. As stated by

Bhattacharya (2015: 517), the DOI theory/model is recognised as one of the universal and primary theories of innovation adoption, explaining the process of adoption and how it progresses in various stages. Doyle, Garrett and Currie (2014: 776) notes that this the DOI theory was pronounced initially in 1962, characterizing people by their possibility to adopt technology and group organisations based on their stage of adoption of a new technology. According to Nguyen and Waring (2013: 828), the definition of diffusion ties into the process of an innovation that is communicated through selected channels over time amongst the members of a social system. Moreover, the innovation is an idea, object or practice understood to be new by an individual or other unit of adoption. Kentrus (2017: 33) shares the same sentiment by mentioning that diffusion is the process involving an innovation perceived as new technology or an idea that spreads through certain channels of communication over a period to members of society.

According to Kurnia, Karnali, and Rahim (2015: 520) the diffusion of innovation process is a function that involves four elements: innovation, communication channels, time, and social systems. Diffusion of Innovation theory entails innovative ideas diffused via the four elements of (i) innovation, (ii) communication channels, (iii) time and (v) social systems (Kentrus 2017: 33). These elements importantly helped the researcher to understand (i) how technological innovation is a critical aspect in warehouses, (ii) understand the communication channels being used, (iii) how the time is being managed and committed towards driving technological innovation, and (iv) the different social systems that have been adopted to guide desired technological solutions (Kentrus 2017: 33; Kurnia *et al*. 2015: 520).

Studies by Rogers (2003), and Anand *et al*. (2015: 155) provide a different view and understanding of the DOI theory in evidence that the adoption process is inseparable from the diffusion process. Anand *et al.* (2015: 155) further explained that the process of diffusion is seen as an innovation communicated through definite channels over a period of time between members of a social system. Additionally, the innovation is perceived as something new by an individual or other unit of the social system and adoption. Anand *et al.* (2015: 155) make an additional note that the categorization of

stages through which a consumer progresses from their first perception to the final acceptance of the innovation is part of the diffusion process.

Scholars identify that DOI theory is built on two factors, namely the insight of the characteristics of the technology and the user's view of the system (Al-Zaubi 2013: 63; Kurnia *et al.* 2015: 520; Hameed *et al.* 2012: 262). The major concern revolves around how innovations are accepted and the reasoning behind the different rates of innovation adoption or acceptance. This thinking guided the researcher to understand the different technological characteristics being used in the Durban warehouses during this era of e-commerce. More so, this prompted the researcher to engage how managers and supervisors of warehouses view and identify the need for innovations in the technologies they are using. Hence, this understanding gave the researcher insight on the technological challenges being experienced in warehousing and how the solutions can be achieved.

As e-commerce continues to upsurge, understanding how and why people choose to use this channel becomes paramount. The researcher selected the DOI model for the study as it allowed for further investigation into how new innovations such as e-commerce disseminate amongst groups of people. According to Bhattacharya (2015: 521), Rogers' diffusion of innovation is the most universal and primary of the theories of innovation adoption. Both Anand *et al.* (2015: 155) and Bhattacharya (2015: 521) agree that diffusion of innovation is measured in five stages, namely knowledge, persuasion, decision, implementation and confirmation.

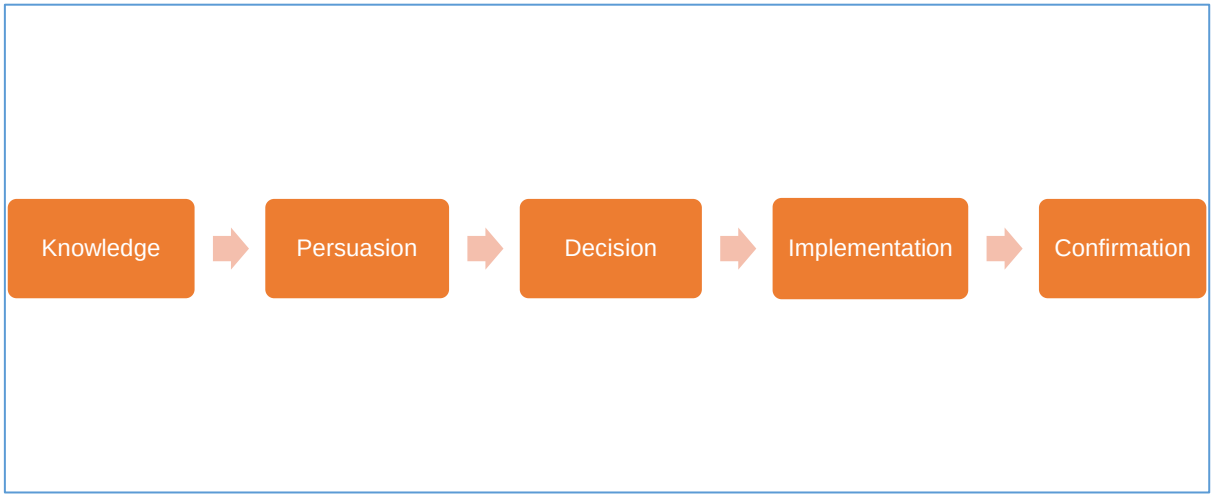
Scholars such as Kurnia *et al.* (2015: 521) and Hameed *et al.* (2012: 363) argue that for diffusion to occur, an innovation must exist, hence they co-exist. The scholars identify that there are five attributes that affect diffusion, playing a major role in an individual's attitude towards innovation adoption. These are identified as relative advantage, compatibility, complexity, trialability and observability. The way individuals in a social system understand the five attributes of an innovation influences its rate of adoption (Oturakci and Yuregir 2018: 53). Such perspectives helped the researcher to

identify how these attributes are being demonstrated in the Durban warehouses towards promoting e-commerce technological innovations.

2.7.1.1 Characteristics of the DOI theory

The characteristics of DOI theory provides important steps that were used in analyzing the perspectives that were shared with the participants in this study. It is essential to note that every company is open to all kinds of innovation and the resolution to accept or reject the innovation is available (Nkemkiafu 2019: 51). The choice to adopt an innovation for some companies is instant, whilst for others, it is an extensive process requiring additional investigation into the anticipated outcomes of the innovation. By engaging the DOI characteristics the researcher sought to understand the individual's knowledge about the innovation filters through the decision-making process to accept or reject. Prior to the adoption process, the organization, persons or firms make sure that adequate information about the technology (advantages are greater than the disadvantages) is at their disposal before the decision to fully adopt the information (Nkemkiafu 2019: 52).

Figure 2.9 Five stages of innovation



Source : Authors own

Doyle, Garrett, and Currie (2014: 776) summarises the characteristics and attributes of the framework, alluding to Rogers' suggestions on the five kinds of adopters based

on their respective possibilities to try out new things, including: innovators, early adopters, early majority, late majority, and laggards. Rogers' framework at the different levels occurs in five stages: knowledge, persuasion, decision, implementation and confirmation, alongside the five characteristics of innovation that impact on the individual's conclusion as to whether to adopt or reject an innovation. These are relative advantage, compatibility, complexity, trialability and observability.

Knowledge: in this stage, awareness about the existence and use of an innovation is drawn to the member (Bhattacharya 2015). The adoption of technology will start once people have an idea/knowledge about the innovation and its existence, spread through by employees, competitors, social platforms and other channels (Nkemkiafu *et al*. 2019). Hence the researcher sought to understand the extent at which key actors within the e-commerce warehousing are demonstrating technological knowledge and understanding.

Persuasion: with this stage, a member shows a favorable or unfavorable attitude towards the innovation. Persuasion to adopt the innovation escalates (Bhattacharya 2015). Gathering information on the type of innovation that allows firms to arrive at a solid decision or prepares them for the decision process is acquired. Continuous information seeking by individuals permits them to not only know about the technology, but also to become well informed. At this stage, Nkemkiafu *et al.* (2019) states that the individual uses the information to decide on whether to become a potential adopter or not.

Decision: at this stage, a member participates in activities that aid towards making an informed decision to adopt or reject the innovation (Bhattacharya 2015). Similarly, the company needs to decide whether to adopt or not to adopt. Hence the critical nature of this stage as the influence of cash flow streams becomes an important factor apart from customer demand. In addition, Roger alludes that the decision process occurs silently, and it is often challenging to know precisely when a decision was taken (Nkemkiafu *et al.* 2019).

Implementation: in this stage, a member starts using the innovation (Bhattacharya 2015). Nkemkiafu *et al.* (2019) negate that the organization implements the new idea or innovation, but it may decide to alter certain aspects of the innovation to align or be compatible with the company.

Confirmation: finally, this stage decides whether the member accepts or rejects the innovation. Bhattacharya (2015) mentions that this stage is for evaluating the actual outcomes with expectations. When a technology or innovation is deemed useful, confirmation and adoption by the organization is evident. In this case, adoption entails the company being comfortable with using the innovation. Having such innovation increases the value offered by the company until the time when repairs, modifications or replacements are needed (Nkemkiafu *et al.* 2019).

Innovation adoption looks at technology adoption in five groups of determinants (Ngah, Zainuddin, and Thurasamy (2017: 163). The researcher in this case has combined both Rogers' (2003) explanation of the five characteristics of innovation adoption with Ngah, Zainuddin, and Thurasamy's (2017: 163).

Table 2.3 Characteristics of the innovation stages

Characteristics	Rogers (2003)	Ngah, Zainuddin and Thurasamy (2017)
Relative advantages	The degree to which an innovation is perceived as being more suitable than the idea or practice it replaces.	The degree to which an innovation is observed to be more suitable than the current method.
Compatibility	The level to which an innovation is understood to be consistent with the existing values, past experiences and requirements of potential adopters. Individually, the innovation needs to be compatible with an individual's values, ideas and needs.	The level to which an innovation is being viewed as consistent with the existing values and business operation activities of potential adopters.
Complexity	The point to which an innovation is understood to be difficult to comprehend and use. The more complex the innovation, the slower the rate of adoption.	The point to which an innovation is seen as relatively difficult to understand and apply.
Observability	The level to which the outcome of an innovation is evident to others. The possibility of others seeing the results of an innovation increases the likeliness of adoption.	The level to which the outcome(s) of an innovation is/are visible to the others.
Trialability	The point at which an innovation may be tested on a limited basis.	The point at which an innovation may be tried.

Source: Rogers 2003; Ngah, Zainuddin and Thurasamy 2017

2.8 CHAPTER SUMMARY

It is undeniable that the growth of e-commerce is escalating to greater heights. This is due to the ability to access the internet, mobile devices, continuous upgrades in technology and staying ahead in the competitive environment. This chapter consolidated information from various writers, dissecting the views and understanding of e-commerce and warehousing in a broader spectrum of impact, challenges, history, processes and the future of warehousing.

The need for innovative models in e-commerce is increasing. Traditional warehouses are compelled to shift to an automated setting in order to be on par with technological advancements. In a developing country such as South Africa, consumers are becoming more comfortable with online purchasing. However, much work needs to be done by retailers. Platforms such as OC require that participants involved in last mile delivery attend to customers' needs of same-day delivery. This means establishing closer fulfilment centres, cutting down on transportation costs and easy access to return items due to defects and other issues. The future of the warehouse all depends on the systems adopted to manage operations.

The next chapter unpacks the methodology aspect of the research. The methods and procedures used to collect data, as well as the population and sampling size that formed part of the primary data, are explored.

CHAPTER THREE
RESEARCH METHODOLOGY

"All research ultimately has a qualitative grounding" – Donald Campbell

3.1 INTRODUCTION

This chapter unpacks the key steps that were utilised by the research in conducting this study. It outlines the purpose of adopting certain research tools in aiding to answer certain difficult questions particularly on technological challenges in Durban warehouses. The chapter unpacks the systematic procedures that were followed by the researcher in answering the key study questions to establish a broader base of insightful knowledge (Lune and Berg 2017: 15; Devlin 2018: 4; Trochim 2016: 5).

This chapter provides an informed description of the methods and procedures used to collect data. These include the research paradigm, research design, sample size, data collection, and research instrument. This study undertook a case study exploratory design. The use of the case study design assisted the researcher in investigating the technological challenges that exist in the warehouse due to e-commerce. The study interviewed 8 participants with informed knowledge of the day-to-day operations within the four selected warehouses in the Durban area. This formed part of the primary data. Interviews were conducted using purposive sampling. The sections in this chapter will detail the key procedures that were followed by the researcher towards the completion of the study.

3.2 RESEARCH PHILOSOPHY PARADIGM

In the pursuit of conducting research, the philosophical paradigm provides critical guidelines that reflect the key beliefs and assumptions that guide the researcher in deciding the appropriate research approach (Neuman 2014: 2). There are four dominant paradigms namely:

- Positivism / post-positivism- paradigm is often associated with quantitative designs that seeks to generate statistical results.
- Interpretivism / phenomenological- is often associated with qualitative or mixed methods studies that seeks to explore new knowledge
- Critical theory- is associated mostly with discourse analysis research or secondary data analysis whereby the researcher seeks to challenge certain ideas that might be hindering the desired progress in society.
- Grounded theory- is more concerned about generating theory using 'grounded' data which can be qualitative or quantitative.

This research made use of interpretivism or phenomenological research paradigm with the interest to embark on an in-depth exploration of technological challenges faced in Durban warehouses in the era of e-commerce. The study sought to distance itself from some of the usual quantitative studies that dominate e-commerce research, by engaging in a in-depth inquiry of information through quantitative interviews. Thus, the use of interpretivism guided the researcher to engage in a more in-depth exploration of key study challenges (Creswell 2014: 17). The study was limited to warehousing operations, interviewing participants with experience, and understanding the daily operations within the environment. The use of semi-structured open-ended interview questions allowed for the researcher and participants to engage effectively in a flexible environment, establishing a trust relationship. The next section discusses how the case study design was adopted towards the completion of this study.

3.3 RESEARCH DESIGN

According to Venter (2017: 75), the research design is a framework or guide for the researcher to follow. This process includes the approach, methods and techniques that will be used to carry out the research. Additionally, Gray (2014: 128) refers to it as the principal plan for the collection, measurement, and analysis of data. Furthermore, the research design will unpack the aim of the study; the types of questions to be addressed; techniques for data collection; approaches for sample selection; and how the data are going to be analysed. Essentially, a research design is a plan that shows

how the researcher will systematically collect and analyse the data that is required to address the research question (Bertram 2014: 40).

Case study research design, according to Venter (2017: 88), is one of the most common methods used. In this design, a unit of analysis (such as an individual, an organisation, an event) is studied in-depth for a specific period. Creswell (2014: 14) states that this design of inquiry is found in several fields, especially evaluation, where the researcher develops an in-depth analysis of a case which in some cases constitutes a program, event, activity, process or one or more individuals. Therefore, in the quest to find out the technological challenges within the warehouse (the “why and how” effects), the researcher used the case study as a mechanism to gain insight into the phenomenon of interest.

The use of a case study design allowed to researcher to engage in an in-depth approach to ask critical and many questions that helped in answering different study components solicited in the 4 Durban warehouses that were explored. Devlin (2018: 94) postulates that a case study refers to a research method for the in-depth exploration of an event, program, and process, or of one or more individuals. They are pervasive components of qualitative research that are used in a wide variety of disciplines to answer many different types of questions (Mills 2014: 145). In this era, technological use is often considered an advantage and a solution, thus few studies have been engaged to explore technological challenges. Hence, the adoption of a case study approach, allowed the researcher to engage in an extensive research to provide an in-depth picture on the key technological challenges using a case approach (Trochim 2016: 64).

The researcher chose a qualitative cases study design a means to gain an insightful understanding and richer contextualisation of the phenomenon being researched. The study selected a particular group of individuals from the warehouse department. The specification of the warehouse resonated with the field of study of the researcher, as well as igniting a passion for the field. The case was useful, providing a better

understanding of the common and novice challenges infiltrating the warehouse due to e-commerce and how this affects customer service now and in the future.

3.4 RESEARCH APPROACH

According to Creswell (2014: 3), research approaches are understood as plans and procedures for research that reduce expansive assumptions to more detailed methods of data collection, analysis, and interpretation. This plan includes several decisions and needs to be analysed in the way they make sense and the order of their presentation. Furthermore, the decision for selecting a research approach is also based on the nature of the research problem or issue being handled, the researcher's personal experiences and the audiences for the study (Creswell 2014: 3).

There are three commonly known approaches to research, namely qualitative, quantitative, and mixed methods. Researchers involved in qualitative studies are focused on observing, describing, interpreting, and analysing the way that people experience, act on or think about themselves and the world around them (Bazeley 2013: 4). Similarly, Myers (2017: 168) writes that this type of research uses various interpretive techniques which try to describe, translate, decode, and interpret the meanings of things, rather than the frequency or numbers. In addition, qualitative data can be presented in the form of text, photographs, sound bites, and videos (Trochim 2016: 20).

The researcher in this study used the qualitative approach because it was useful to acquire information about participants' diverse views and experiences, being able to observe behaviour and attitudes during interview, as opposed to the quantitative approach. Moreover, this approach entailed collecting more detailed information from a smaller scope of people (Harding 2019: 16). However, understanding other approaches and why the researcher could not adopt them for this study is importantly discussed in the following section.

3.4.1 Quantitative

According to Creswell (2014: 4), the quantitative approach is for testing objective theories by evaluating the relationship amongst variables. Usually, these variables can be measured on instruments so that data consisting of numbers can be analysed using statistical procedures. Therefore, quantitative research refers to totals and measures of things, scope and allocation of one's subject matter (how large a thing is), quantity (how many of them exist), or how likely one is to encounter such (Lune and Berg 2017: 12). However, despite the numerical and statistical advantages this approach offers, the researcher sought to understand the experiences which demands open-ended questions rather than closed-ended questions which are often used in quantitative research. More so, existing studies that were reviewed in developing this study have been mostly conducted using quantitative approach, with very few studies having been done using quantitative instruments. Considering that the researcher sought to bridge the existing knowledge gaps, utilising a quantitative research approach could have simply served to confirm and reproduce existing knowledge.

3.4.2 Mixed methods

The mixed methods approach involves analysis in collecting both quantitative and qualitative data by combining the two types of data, using separate designs that may involve philosophical assumptions and theoretical frameworks (Creswell 2014: 4). In essence, it is an approach to research that typically combines quantitative and qualitative approaches (Devlin 2018: 195). Though the approach is often advantageous in conducting an in-depth exploratory study, it is often tasking and time-consuming. It also works effectively in situations whereby there is limited information on a subject which was not the case in this study. Therefore, the researcher opted not to use mixed methods approach because of the reasons cited above. Thus, the use of qualitative research was more suitable and viable for this study.

3.4.3 Qualitative

Drawing from Nxumalo (2015: 64-65), the adoption of the qualitative approach provided an improved understanding of the phenomenon as defined and discussed under problem statement in Chapter 1. Additionally, it assisted in attaining new perspectives on things that are already known, gaining more in-depth information that could have been challenging to convey quantitatively. The definition presented by Creswell (2014: 4) states that qualitative research is useful for understanding and exploring the meaning that individuals or groups ascribe to a social or human problem. Unlike the other two approaches discussed above, the adoption of a qualitative research approach was crucial in guiding the researcher to engage both existing literature and participants on the core technological challenges that are uniquely experienced in warehousing across Durban in the era of e-commerce. The in-depth qualitative interview features a series of open-ended questions which probe a topic with some focus allowing and guiding the researcher to develop an in-depth exploration of information on technological challenges being experienced in Durban Warehouses (Pajo 2018: 261).

3.5 POPULATION/TARGET POPULATION

Population is understood to be the total number of people, groups or organizations that can be included in a study (Bertram 2014: 59). Neuman (2014: 252) states that it represents the specific collection of elements that will be studied. It attends to the entire collection or every case, involving people, places, behaviours, things, and time (Loseke 2017: 110). The study was conducted on four selected warehouses. All four warehouses are situated in the Durban area. Initially, the researcher intended to interview 16 participants on company premises, with the intention being to eliminate any travelling costs directed to the participants. However, due to the misfortune with the Covid pandemic, the number of participants decreased. Of interest, the targeted population for the study is made up of 1 warehouse manager, 1 floor supervisor, 1 warehouse clerk and 1 shipping and receiving associate. This breakdown applied to all 4 selected warehouses, with the intention to unravel whether similar challenges

exist within the different warehouse divisions. Job titles varied according to each company.

Table 3.1 Targeted population of the study

Position	Required Participants
Warehouse manager	4
Floor supervisor	4
Warehouse clerk	4
Shipping and receiving associate	4

Source: Authors own

3.6 SAMPLING METHOD

The reason for using a sample, according to Lune and Berg (2017: 38), is to make conclusions about a larger population from a smaller one. Such insinuations succeed or fail according to how well the sample characterises the population. This involves making critical decisions about which people, settings, events, or behaviours to include in the study and how many individuals, groups or objects will be observed (Lune and Berg 2017: 38). Similarly, Trochim (2016: 80) refers to sampling as the process of selecting units (participants) from a population of interest. In that way, the researcher can generalise the results stemming from the population from which the units were chosen. Collins (2019: 78) makes known that the two types of sampling strategies, non-probability, and probability, allow the researcher to target data-collection techniques, hence they may need to be of a specific size or composition. Therefore, a non-probability sampling method was used by employing a purposive sampling technique. The method was suitable to the study as all selected warehouses were relevant for the study.

3.6.1 Purposive Sampling

Purposive researchers use their distinct knowledge or expertise about some group to select subjects who represent this population (Lune and Berg 2017: 39). Purposive sampling was used by the researcher as an advantage to make definite choices on specific people in the warehousing industry that were known and accessible to her.

The researcher was thus able to engage relevant people that are in specific positions and experienced in the warehousing industry. Purposive sampling offered an appropriate advantage as the researcher selected cases, she considered to be highly informative for the study (Neuman 2014: 274). The researcher was able to solicit relevant information on the technological challenges within the warehouse, with the hope of providing credible and insightful knowledge, as well as providing linkages to the study objectives and problem statement.

3.7 DATA COLLECTION

According to Collins (2019: 78), data collection is a technique that uses approaches and tools to acquire data to answer the research question or hypothesis (more than one can be used) but most commonly, questionnaires and interviews are used. Data is referred to as the evidence or information that researchers gather in order to retrieve answers to the specific questions they are asking (Bertram 2014: 71). This study used the interview approach to collect data. The researcher followed protocol prior to collecting data. This entailed issuing a request letter for participation; a letter of information and consent form; serving as proof of confirmation and agreement to partake in the study.

Flick (2015: 131) reveals that there are three main forms of data collection in social research. This is done through asking people (through surveys and interviews), observation or studying documents. Data collection steps involve establishing restrictions for the study, information collected using unstructured or semi-structured observations and interviews, documents, and visual materials, as well as establishing the protocol for recording information (Creswell 2014: 189). The proceedings of interviews were dependent upon the availability of participants, as well as consent. Information about the study being voluntary was well communicated to participants and anonymity and confidentiality were assured. Hence their right for the research not to divulge any personal information that may taint or harm the participant. Participants were informed that they could withdraw at any stage of the interview should they feel any discomfort in the continuation of the process.

3.7.1 Data Collection Instrument

Qualitative interviews allow for the researcher to unearth what lies beneath the surface of a personal encounter, political opinion, issue, situation, or process, meaning that qualitative data collection tends to be lengthy - approximately one hour for an interview. (Jensen 2016: 173). Scaling down to the type of interview to be used is the most important decision to be made as various modes of data collection exist, such as face-to-face interviews, telephonic and many other forms of electronic interviews (Harding 2019: 67).

The researcher used in-depth interviews to unearth what lies beneath the surface. These were in a semi-structured approach, with open-ended questions allowing for the respondent to engage in the topic freely and interactively. This allowed flexibility, the expression of self and a clarification of questions from the participant.

3.7.1.1 Interviews

Interviews are known to be the most used form of qualitative data collection in the case of more experience and novel researchers (Harding 2019: 64). Therefore, it is paramount that the researcher be aware of some fundamental issues to be considered, decision-making and skills to be used when carrying out the interviews (Harding 2019: 64).

According to Loseke (2017: 97), an interview is a data-generating technique. At minimum, it allows respondents to construct their own answers to questions asked by interviewers. Creswell (2014: 190) adds that the researcher may conduct face-to-face interviews with participants or hold telephone interviews or engage in focus group interviews with about six to eight interviewees in each group. Bertram (2014: 80) describes it as a conversation between the researcher and the respondent. The collection of data was done through an interview process, which was initially intended to provide face-to-face interaction with participants.

However, due to the pandemic and strict government rules and regulations, the warehouses could not afford the researcher any face-to-face interaction. This meant that the researcher had to reconsider other alternatives to collect data. This also meant that no setup of the venue was required, nor any travelling to the premises. The researcher, along with the companies, agreed on the use of Microsoft Teams which constituted an online interaction. These were successfully conducted by both parties. The researcher encountered a few challenges, i.e. the availability of participants as most warehouses were nearing the shutdown period (October-December). Another participant for instance was on the road for half the day, resulting in the interview being done on-the-go.

Harding (2019: 68) discusses that various options are available for conducting online interviews, such as email, chat rooms and instant messaging services. Synchronous online interviews entail both parties (researcher and participant) being online simultaneously to engage in 'real-time' dialogue. The use of online interviews allows researchers to reach participants worldwide. Unfortunately, there are certain groups of individuals who cannot be interviewed in this manner, for example prisoners and persons from the poorest parts of developing countries. The disadvantage of online interview(s) is the lack of communication through body language, voice and facial expression, as opposed to the advantage of face-to-face interviews where communication in full range is possible and the ability for both parties to respond to the non-verbal signs set by the other (Harding 2019: 67).

Loseke (2017: 97) describes an interview as a conversation with purpose and that can be conducted in person over the phone or through Skype. In observation, the use of electronic interviews will increase as an ever-growing number of technologies become available, for instance Skype (Harding 2019: 69). Gray (2014: 383-384) posits that interviews are a basic way of human activity, where language is used between two human beings in the quest of cooperative inquiry. They are also useful in instances where people may enjoy conversing and engaging about their work, families, communities, feelings or relationships, rather than filling in questionnaires. The author

further states that an interview allows participants to reflect on events without committing themselves in writing, often due to confidential information/reasons.

Questions intended for the participants were guided by the aim and objectives of the study. The researcher structured the research guide into two parts. The duration of the interview was 30-45mins for each participant. The interviews were conversational, clear and open-ended, allowing the researcher to dissect the views of participants. Some probing techniques were used by the researcher to further understand their experiences and input on the subject matter, as well as seeking clarity. As mentioned by Harding (2019: 70), semi-structured interviews rely heavily on the use of probes.

Table 3.2 Structure of the interview guide:

Part A:

Age	X
Direct involvement in the warehouse	X
Years of service	X

Part B:

Opening questions	1-3
Key questions	1-10
Closing questions	1-2

Source: Researcher's own

Bertram (2014: 83) established a few advantages and disadvantages relating to interviews, namely:

Advantages:

- With the researcher being present during the interview, the respondent can ask questions for clarity should there be any uncertainty or lack of understanding.
- More questions can be asked by the researcher and probed deeper if the respondent has not given enough details on the subject matter.
- In some instances, it becomes easier for respondents to talk to an interviewer than jotting down long responses in a questionnaire.
- Interviewing is a useful method to use when seeking in-depth data from a small scale of people.
- Interviews assist in collecting more detailed and descriptive data as opposed to using a questionnaire.

Disadvantages:

- Interviews yield high volumes of textual data. When transcribed, a 45-minute interview can become 15 pages of text. This can be overwhelming for the researcher unless he/she has a very clear idea of how the data will be analysed.
- Interviewing is not merely a data collection activity, but is also a social, interpersonal encounter. The researcher needs to be observant of how their own position may influence the type of information that the respondent provides.
- Interviews result in self-reported data. This means that the interviewees are reflecting and expressing their own behaviour or beliefs and reporting these to the interviewer.

3.8 DELIMITATION

The participants involved in the study were delimited to employees involved in decentralised operations. The study was conducted in the Kwa-Zulu Natal Durban area at four selected warehouses due to cost factors.

3.8.1 LIMITATIONS

The sample population for the study was limited to Durban-based warehouses. This was one limiting factor for the researcher as it became difficult to generalise whether warehouses from the outskirts of Durban and other provinces share similar sentiments and experiences regarding the matter under investigation. In addition, had the study included more participants such as in-and-outbound supervisors, last mile supervisors and inventory controllers, inferences could be made and a broader picture relating to the concerns of the warehouse would be unravelled. Nonetheless, the study hopes to reflect the experiences faced by some warehouses in the country and contribute to a holistic solution for effective and efficient warehouse management solutions.

3.9 PRE-TESTING/ PILOT TESTING

Devlin (2018: 95) describes a pilot test as using a small number of participants to test aspects of the research and receive feedback on measures and/or manipulations. A pilot study is always relevant when detecting weaknesses in design instrumentation and relevant in providing data which will assist in the selection of a sampling method (Myers 2017: 81). At this stage, testing or piloting elements such as the sampling frame, survey questions and data collection tools are involved. It is possible that several drafts of the research tool will have to be tested before a satisfactory version is reached (Gray 2014; 243). In assessing the effectiveness of the intervention in the study itself, the use of a manipulation check at the end of the study is advisable. Manipulation check relates to the questions posed in research, typically at the end, to assess whether the participants were aware of the level of the independent variable to which they were assigned (Devlin 2018: 95). In this case, the supervisor had evaluated the questions and approved them before submission to the FRC. The FRC gave approval, granting the researcher permission to proceed further with the research. In addition, three pilot interviews were conducted to test the validity and suitability of the interview questions.

3.10 DATA ANALYSIS

3.10.1 Thematic Analysis

According to Clarke and Braun (2017: 297), TA is a process used to identify, analyse, and interpret patterns of meaning, known as themes within qualitative data. Additionally, TA makes provision for an easily accessible and systematic process to generate codes and themes from qualitative data. Harding (2019: 105) citing Gibson and Brown (2009:128) proposes three sets of aims for thematic analysis, namely:

- **Examine commonalities** refers to the collection of all material through a set of data that has something in common. The commonalities discovered are further analysed, resulting in sub-divisions being revealed within them.
- **Examining differences:** the researcher ought to detect differences through the set of data and examine the importance of them to the concerns and themes that are being considered.
- **Examine relationships:** in this case, the researcher must observe how various parts of the analysis come together and contribute to an understanding of different concerns and themes.

Therefore, the researcher used thematic analysis to interpret, classify and articulate themes that emerged from the interview questions, with the intention of achieving valid and realistic findings using semi-structured interviews. As the first step was to collect all relevant data from participants through the process of interviews which constituted raw data, the information collected was cross-checked using both written notes and recorded audio. Then the coding process proceeded as information was now being transferred to Nvivo. In this way, the researcher was able to identify common patterns using the concept of inductive reasoning, where categories emerged from the data. Harding (2019: 104) confirms that on a known basis, TA is predominantly linked to inductive approaches and includes the identification of themes that emerge from the data.

The use of NVivo software assisted with the managing, visualizing and reporting of data. According to Thomas (2016: 207), NVivo allows for the researcher to code data

such as PDFs, audio, and video with the intention to sort the data into themes. Furthermore, the exploration of data can be done; with innovation on tentative ideas and coding of interesting bits; checking for similarities, marking, or grouping into nodes; and finally developing themes. Therefore, coding for NVivo was enabled using nodes (Bryman and Bell 2015: 609).

3.10.1.1 Inductive reasoning

Nowell *et al.* (2017: 8) wrote that inductive analysis is understood to be a procedure of coding the data without trying to fit it into a pre-existing coding frame or the researcher's analytic biases. Additionally, themes identified have an intense link to the data themselves and possibly have minimal relation to the exact questions that were asked of the participants. Harding (2019: 27) establishes that an inductive approach commences with the actual and moves to the general, meaning that the researcher will not begin with what is already known regarding a subject, but instead with the data collection and analysis.

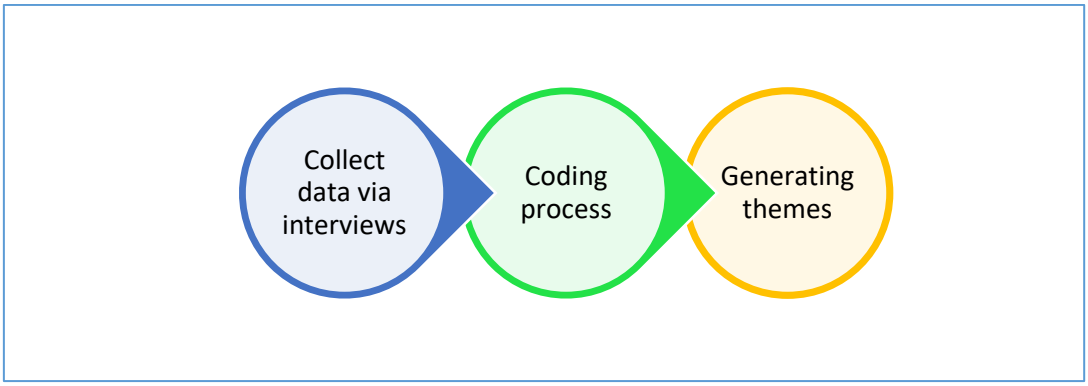
3.10.1.2 Coding analysis

In the view of Bazeley (2013: 5), qualitative analysis is primarily case orientated. Coding is an essential skill for analysing qualitative data as it provides a means of access to evidence- it is a tool for querying data, testing assumptions, and drawing conclusions (Bazeley 2013: 125). It is important to note that the coding of data is one essential phase in the entire qualitative data analysis process (Bryman and Bell 2015: 609). Coding involves evaluating interview transcripts, observational records, field notes and using symbols to mark similar things for easy grouping together (Spickard 2017: 140).

In this light, prior to the coding process, the researcher needed to sort and organise the transcripts, scrutinise the information gathered and double check it against the recorded audio. The process of transcribing is paramount, as everything recorded

needs to be written down, without exception. Every utterance or non-verbal sound from the participant or the interviewer needs to be recorded (Pajo 2018: 282).

Figure 3.1 The thematic analysis process



Source: Author's own

3.11 VALIDITY, RELIABILITY AND TRUSTWORTHINESS

3.11.1 Validity

Validity is one of the paramount concepts in research (Graziano 2013: 68). The extent to which information is gathered from surveying respondents accurately represents the concept being studied (Jensen 2016: 168). The key question surrounding validity is whether a measure of a concept actually measures that concept, i.e., does it measure what it claims to measure? The validity of research refers to the degree to which the research evaluates what it claims it does (Gray 2014: 151). The researcher did extensive reading on the transcripts prior to analysis. This simple technique of thorough reading contributes significantly to the process of validity, increasing the chances of the findings to correctly reflect the original data (Harding 2019: 120).

The researcher conducted a pilot study with the supervisor to ensure that questions are not biased or ambiguous. Validity was also ensured by conducting interviews in a safe environment, with no third-party individual present to listen to the interviews and recordings. For those participants who requested that the video screen be turned on to see the researcher's face and surroundings, the researcher complied.

3.11.2 Reliability

For a research instrument to be deemed reliable, it must measure what it set out to measure consistently (Gray 2014: 389). This refers to the extent to which the measurement used by the researcher and the data collected provides consistent results (Jensen 2016: 167). The interview questions were approved by both FRC and the supervisor. This was adequate for pre-testing as the sample size was small.

The following measurements were used to advance both the validity and reliability of the interview questions:

- ❖ All questions were directly linked to the aim and objectives of the study.
- ❖ Each question was formulated using the objective as guidance, fundamentally feeding back to the objectives.

3.11.3 Trustworthiness

Trustworthiness is an important concept in qualitative research. It gauges whether the findings reflect the participant's experiences from their actual perspective. The study cannot be beneficial if there is a fabrication of information, inaccuracy, and misinterpretation of findings. To ensure trustworthiness in the study, Trochim (2016: 72) and Kumar (2014: 219) identify four aspects of trustworthiness as credibility, transferability, dependability, and confirmability. These are explained as follows:

- ➢ **Credibility-** means that the participant involved in the research agrees that the results are true and believable. Respondents judge the findings and provide confirmation, congruence, validation, and approval of the study. Therefore, the higher the agreement from the respondents regarding the findings, the higher the validity of the study.

  The participants were selected using the purposive sampling technique. During the online interviews, the researcher requested permission to record participants. This helped the researcher in comparing what is said by

participants to the written notes of the researcher. This served as proof of truth to both the researcher and participant. The researcher used the same interview guide for all participants in the study, which was also sent to them in advance to prepare themselves. The researcher, alongside the supervisor, had an ongoing review of emerging themes, the coding process, and the interpretation of results until both parties were satisfied with the outcome of the emerged themes and findings. Another action performed by the researcher to ensure credibility was that of thoroughly checking the transcripts against the recordings on numerous occasions. After compilation of the findings in agreement with the supervisor, the researcher e-mailed all participants involved, requesting that they read through the findings and confirm whether they relay the truth. Responses were all positive and information was deemed truthful.

- **Transferability-** looks at the degree to which the results can be transmitted or generalized to other contexts or settings (Trochim 2016: 72; Kumar 2014: 219). Even though it might be difficult to establish transferability due to the qualitative approach, to some extent this can be attained if the researcher is able to thoroughly and extensively describe the process adopted for others to follow and replicate. This means that the researcher can transfer what was discovered to other contexts.

  In this study, transferability was achieved by mentioning the number of warehouses involved in the study, which were selected using the purposive sampling technique. These warehouses were based in KwaZulu-Natal, in the Durban area. Direct quotations from the participants were included to support the results and findings of the study. Although the study was limited to the Durban area, the study can still be applied to other cities where warehouses are situated.

- **Dependability**- requires the researcher being liable for the ever-changing context within which research happens (Trochim 2016: 72; Kumar 2014: 219). In this case, the researcher is accountable for communicating and describing

any changes that transpire in the setting and how these changes can affect the conclusions that are reached.

This represents the reliability of information to the extent that the researcher needs to account for any changes in the phenomena being studied. Ethical standards were key guiders, considering that participants need to be respected throughout the process.

In this study, the researcher ensured that the information represented in Chapter Three was followed accordingly. Information pertaining to data collection, analysis, and interpretation was adhered to and results were attained accordingly. All data collected was kept in its original form (recordings) as the researcher typed it out in the exact way information was said on the recordings, being the exact replica of the authentic data.

- **Confirmability-** looks at the degree to which results can be confirmed or verified by others (Trochim 2016: 72; Kumar 2014: 219). In completion of the study, the researcher can undertake a data audit that inspects the data collection and data analysis procedures and makes judgements about the potential for bias or distortion. This is possible if the researcher follows the process in an equal manner for the results to be compared.

The researcher in this case conducted in-depth interviews comprising open-ended questions, which resulted in the constant writing of notes. This was an important activity as a backup to the recordings and served as a mechanism of verification of the recordings as well, a guarantee that the findings agree with the data. The supervisor, along with the researcher, participated in the process of coding the transcribed interviews.

The researcher ensured trustworthiness principally by allowing participants to check the final compilation of the work.

3.12 ETHICS

The researcher followed the DUT ethical processes towards completing the study. Jensen (2016: 48) refers to ethics as principles or values that are important for the project, aligned to the research objectives and defining the researcher's responsibilities to participants, institutions, and individuals. Hence, to adhere to the ethical standards of DUT institution and ensure the "do no harm" principle of research(Spickard 2017: 88), the researcher engaged the following steps.

Prior to the commencement of the study, the researcher had to:

- Submit a proposal, which was tabled and accepted by the Faculty Research Committee (FRC);
- Submit a gatekeeper's letter as requested by the Ethical Research Committee; and
- After bullets 1 and 2 were completed, a letter of information was issued to participants, highlighting voluntary participation; the assurance of confidentiality; and anytime withdrawal whenever and for whatever reason participants may wish.

- Permission obtained to conduct the research.

The researcher ensured that participants are protected by:

- Informed consent;
- Anonymity and confidentiality;
- Right to withdraw at any stage of the study; and
- Exhibiting the utmost respect and consideration.

There are three ethical principles that the researcher followed. These are informed consent, confidentiality, and anonymity.

3.12.1 Informed Consent

This is a document issued to the selected participants outlining the nature of research. Participants need to acknowledge and sign or otherwise provide evidence of consent

to partake in the research (Devlin 2018: 105). Participants' right to privacy should not be infringed upon, as well as their lives and ownership of their ideas (Venter 2017: 55). Agreed consent from participants may be received either orally or written. In this case, the researcher, and the participant agreed on written consent. These were received via electronic mail before conducting the interviews. According to Jensen (2016: 57), this will provide the researcher and the institution protection from legal action. This will also ensure that no deception occurs (Silverman 2017: 59). Overall, such principles aim to ensure that the researcher's procedures are transparent, with the avoidance or elimination of any harm or deception to participants and that they take care of data protection (Flick 2015: 33).

3.12.2 Anonymity and Confidentiality

Anonymity and confidentiality are crucial aspects in research as they impact participants' wellbeing, experiences, and feelings. Thomas (2016: 81) emphasizes that keeping the anonymity of the participants is an integral factor, whether it be in one's everyday dealings and conversations with others, in the storage of data or reporting, the sacredness needs to be maintained. Confidentiality addresses the protection of information provided by research participants from other parties, whereas anonymity entails protecting the identity of an individual or organization by hiding their names or other identity information. Assurance and protection were carried out by the researcher throughout the study. The participants were informed of their right to withdraw from the study at any time without any consequences. Each interviewee was assured of their confidentiality and consented to the recording of the interviews. The names of the participants were not recorded and any information that might have revealed their identities was note transcribed and used in any way in this study. Thus, the personal information of participants was protected, and each participant was identified with a code. Participants were identified as P1, and P2 (participant 1 and 2) from the selected companies identified as C1-C4 (company 1-4).

Due to the nature of the interviews being online, no cameras on Microsoft Teams were turned on, unless requested by the participant. Participants were informed about the

recordings to ensure that responses were well captured. Data was only available to the supervisor after the researcher confirmed that the information provided by participants was correct. The researcher, in awareness of all ethical issues involved in conducting interviews, ensured that whatever recordings transpired remained confidential. No video recording was used or allowed. This was done to protect the identity of participants.

3.13 CHAPTER SUMMARY

This chapter outlined the research methodology that was used to carry out data collection. Aspects such as the research design, population, sampling size, and ethics were addressed. Participant recruitment, data collection and analysis were discussed, and coding and thematic analysis were addressed. The following chapter will report on the findings of the study by analysing the data that was collected during the interview process, interpret the results, and finally present the results.

CHAPTER FOUR
DATA ANALYSIS - PRESENTATION AND DISCUSSION OF RESULTS

"If you do not know how to ask the right question, you discover nothing"- Edward Deming

---

4.1 INTRODUCTION

This chapter presents the discussions on the data in the form of results and findings using both primary and secondary tools. Interviews were the primary tool used to collect data. The interview guides were distributed electronically due to the pandemic that ensued. This was done upon agreement with participants, as well as in terms of abiding by government regulations. Data collected from participants was analysed using Nvivo software. The data collected is in relation to the study's aim and objectives. The objectives of the study are supported by the research questions, which aimed to tackle the study's objectives and provide substance to them. The chapter concludes with a summary of the discussed data. Interviews were conducted with participants according to their respective roles, namely:

- Warehouse manager
- Floor supervisor
- Warehouse clerk
- Shipping and receiving associate.

4.2 PARTICIPANTS

The study used a purposive sampling technique to select participants. Participants were either directly involved in the warehouse or part of the supply chain field, with knowledge of e-commerce processes and trends within the warehouse. The study set out to interview 16 participants in different roles. However, it was found that one participant oversaw two roles. For example, the warehouse manager undertook the role of both manager and floor supervisor. This reduced the number of participants for

the study. However, this did not interfere with the results as rich and insightful information was shared by these managers.

4.3 QUALITATIVE DATA ANALYSIS AND INTERPRETATION

This section of the research presents the qualitative data collected using interviews.

4.3.1 Section A

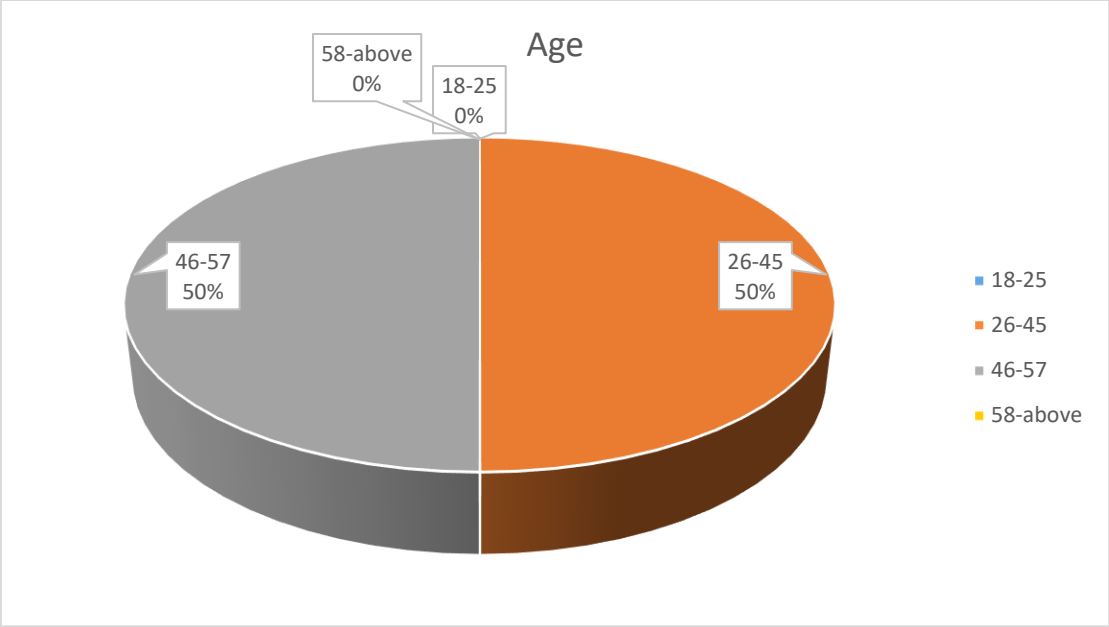
This section of the research allows for the researcher to explain briefly what the data for this section means. Information such as age, direct involvement in the warehouse and years of service and opening questions were addressed. This was depicted in the form of a pie chart. The information gathered impacted on the study outcomes.

4.3.1.1 Age Group of Participants

The purpose of this point was to define the age group of participants to determine whether age will impact on their experience of working in the warehouse. Four categories were given, allowing for participants to indicate their age group. The categories were as follows: 18-25; 26-45; 46-57 and 58-above. The following results emerged:

- **Results**

Figure 4.1 Age group of participants



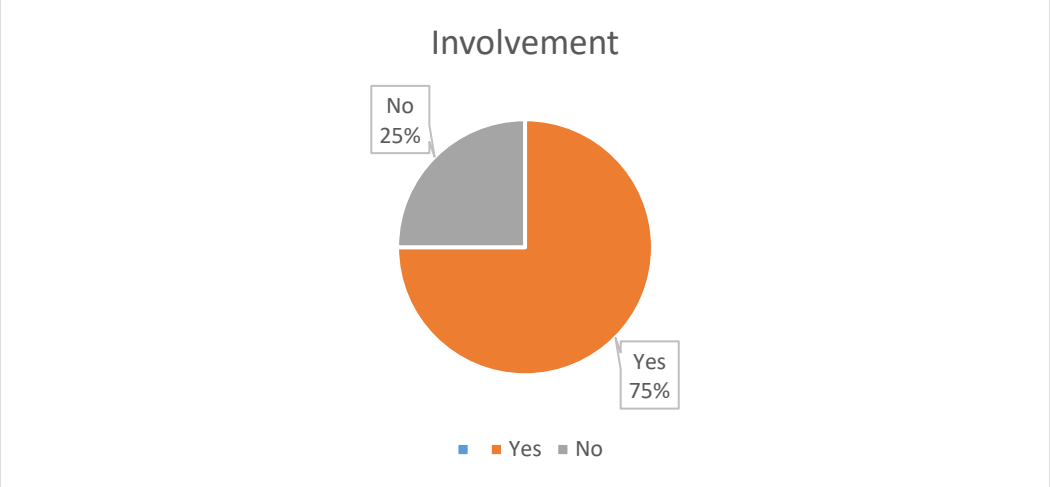
The researcher found that most of the participants emerged from the age range of 46-57 years, comprising 50%. This was followed by participants in the age range of 26-45 years which comprised 50%. The ages of 18-25 years and 58-above comprised 0%. This showed equal representation from participants in the range of 46-57 and 26-45 years of age.

4.3.1.2 Direct Involvement in the Warehouse

The researcher added this point to find out how much knowledge participants have regarding to the warehouse. Is their understanding and experience deeply rooted in this sector? The following results emerged:

- **Results**

Figure 4.2 Direct involvement of participants in the warehouse



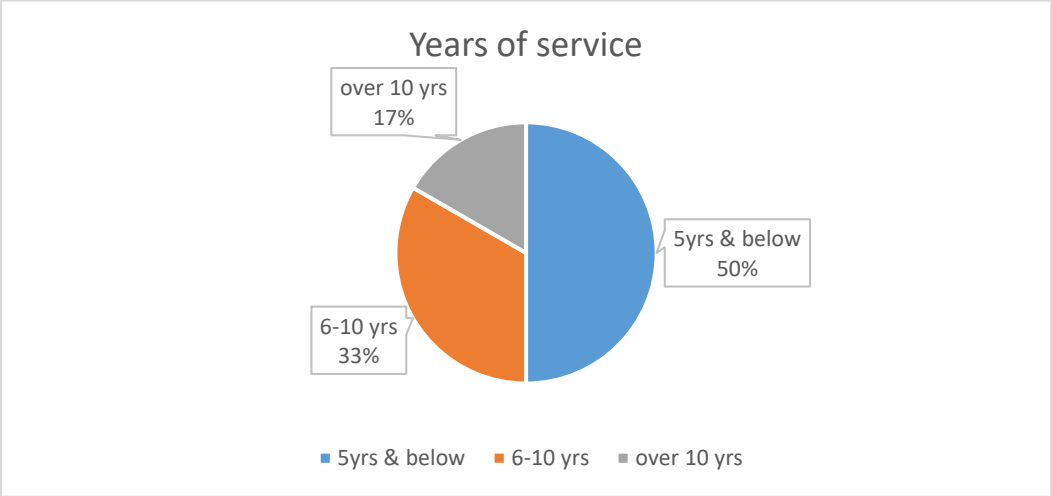
The researcher discovered that 75% of the participants were directly involved in the relations of the warehouse and 25% were not involved. Even though 25% of the respondents were not directly involved in the warehouse, they formed part of the supply chain/logistics field. For example, Participant 2 from Company 1 was the head of shipping, which has a link to the warehouse. When goods are imported from overseas, they are then transported to the warehouse for storage and distribution. Most of these goods are influenced by the demand of participants. The participants portrayed extensive knowledge on the subject matter.

4.3.1.3 Years of Service

The researcher included this information with the intent to find out the years of service of participants.

- **Results**

Figure 4.3 Years of service of participants



The researcher found that 50% of the participants' years of service was in the category of 5 years and below. These results relate to the current company of employment. Some participants indicated that they had offered their services to other companies before joining the current one. For example, one participant indicated that she worked for a beverage company in the warehouse for 5 years before venturing into her own logistics business.

The following three questions formed part of Section A. These were opening questions, with the intention to open the platform for participants to engage freely, as well for the researcher to have an idea of the company.

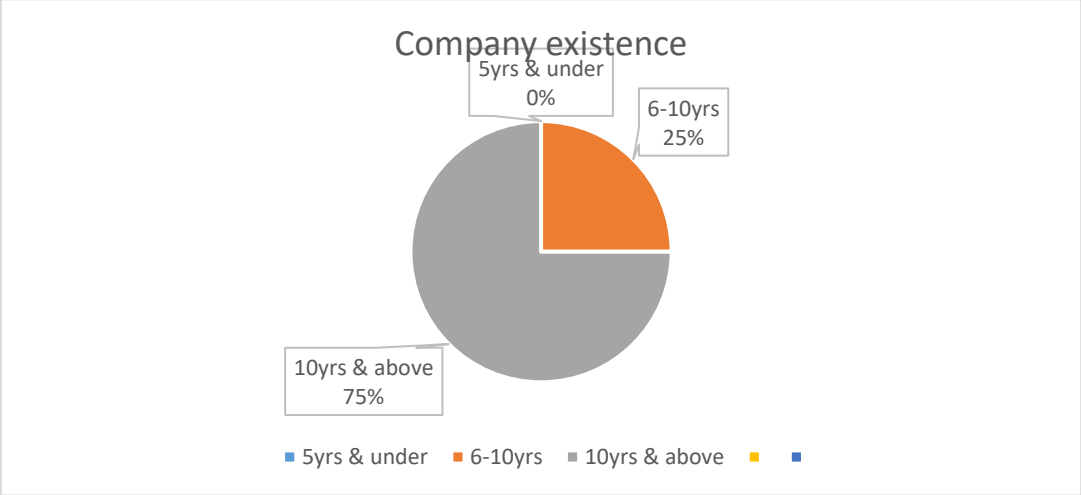
4.3.1.4 Existence of Company

The purpose of this point was to determine the existence of the company. For how long has the company been in operation? This will likely have an impact on how the

warehouse had been functioning in the traditional way, before advancing to technological systems and tools.

- **Results**

Figure 4.4 Existence of company



In this analysis, the researcher found that these companies have been established in various years and that 75% of the companies were in existence for more than 10 years. For example, a well-known giant retailer has been around for three decades and ranked as the best-value retailer.

4.3.1.5 Staff Members

The purpose of this point was to discover the number of employees working in the warehouse. Due to the nature of some warehouses and the company entirely, some figures where high as some were giant companies. For example, one company employed 24 full-time staff and 8 part-time and another employed roughly 35-38 employees within the shipping department, without the warehouse/DC being included. The dynamics varied from company to company. Hence, no figure has been inserted to represent the number of staff members.

4.3.1.6 Experience Working in the Warehouse

This question was posed by the researcher with the aim of understanding various experiences relating to the warehouse. What sort of challenges or difficulties have they encountered if any exist? Furthermore, this question intended to set the tone or mood for the interview, allowing participants to express themselves fully. This helped the researcher to understand more about the warehouse, as well as analyse the way participants responded (behaviour-wise). With participants being interviewed online, this became challenging, having to assess body language and facial expression. However, the responses from participants were interesting to know, especially within their field of work. The following was said:

- ***P1 from C1-*** *It's been an extreme learning curve, because of the high automation.*
- ***P2 from C1-*** *speaking from the point of shipping: it's quiet a loveable experience in a sense that, you are sitting at a junction of a very key service to the entire business. If we at shipping do not move anything, nothing will move for the company and nothing will be sold at the shops. On daily basis you learn to realise how crucial the decisions, timing, and flexibility on things that you do and decisions that you make to the entire business. You always have to be connected or planted into what is happening on the other side, and what is happening in here in terms of our internal divisions or internal customers we serve that end up pushing our retail prepositioning to the public, so it's very crucial.*
- ***P1 from C3-*** *it's challenging in terms of being in the black market, as stock does not always move on time, stock expires especially with the impact of COVID People are no longer buying as much as they used to. When we started on average we would cover between 25-30 stores, now we lucky if we get 10-15.*

- ***P2 from C2-*** *It has been great, because as a business owner I'm very passionate. I can go into this business in any level and know what's happening. I need to know what's happening. I can go into the packing space or go to the*

computer and download an order or I can go to the receiving or despatch. You got to be hands on at all times.

- ***P1 from C4-*** *At first, wow and then it became a part of my experience and knowledge. So now a single word "amazing".*

4.4 CODING AND THEMATIC ANALYSIS

This section presents the themes and sub-themes that emerged during the process of coding. These themes and sub-themes were derived from the questions and answers posed to the participants. Below are the results:

Q: What is your opinion/view on e-commerce?

4.4.1 Consumer behaviour

This theme emerged relating to the above question posed by the researcher and the sub-theme was the result of the form of behaviour by consumers.
Radu (2019) states that consumer behaviour analyses consumers and the processes used to select, consume, and dispose of products and services, including consumers' emotional, mental and behavioural responses.

The researcher found that consumer behaviour is one element that contributed to the evolution of e-commerce. Consumers' buying decision(s) continues to fluctuate as various options to shop become available.

4.4.1.1 Convenience

Consumers in today's market are searching for simpler and faster ways of doing shopping, at their luxury. In simpler terms, convenience also means "easy" (Hanson, Kress, and Romano 2019: 52). This is the result of consumers' changing needs and desires over time. Hanson, Kress, and Romano (2019: 52) defined convenience as an

experience that in the end will save time and effort for shoppers. Furthermore, it is quick, easy, near and allows the shopper to get what they need, whenever it is needed.

In conversing with participants, the researcher noticed that the word convenience was often mentioned. As part of the future, participants are strategizing on ways to make shopping experiences more seamless and efficient, whilst maintaining their competitive position. Some participants responded by stating that:

> *'In our business, that's the way of the future for more convenience to our retailers or traders.' (**C4-P1)***

Another two participants shared that:

> *'Most people in the consumer base do not have time to go to the shops, they hate queues, they try to avoid parking fees, avoiding public transport fees, there's issues like Covid and all those things.' **(C1-P2)***

> *'People are sceptical about leaving their homes to purchase essentials such as groceries, medications and much more, so having it delivered has brought convenience.' **(C3-P1)***

The last participant added that:

> *'People are getting use to stuff getting delivered to them, they just going to want it faster and faster-service delivery wise.' **(C2-P2)***

4.4.2 Growth

The most common result identified by participants was that of growth. Understanding the fact that e-commerce in South Africa has expanded rapidly, impacting on business models, is important. The decision to adopt an omni-channel approach was fuelled by consumers' buying patterns, competitor advantage and new trends. Moreover, this

dynamic growth means that management tools are properly adapted to e-commerce (Kawa 2017: 429).

> *'In my environment, it is a platform that will grow quickly in SA once the vast majority of the citizens have the ability to fully utilise e-commerce as a business platform.'* ***(C1-P1)***

Another participant inputed that:

> *'So, I have a very positive view of the industry and I look forward to a very high growth margin in 2021 because of how Covid impacted the industry in total.'* ***(C2-P1)***

In a closing remark, one participant confirmed that:

> *'It's just going to get bigger as time goes by.'* ***(C2-P2)***

4.4.2.1 Future

The results reveal that participants shared the same sentiment about e-commerce being the future. Hence one participant stated that, 'it's here to stay'. These responses were confirmed by the conclusion of Clark (2018), assuring that e-commerce is the future and it isnot going away anytime soon.

> *'In our business, that's the way of the future.'* ***(C4-P1)***

The above response was supported by one other participant:

> *'E-commerce is the way of the future. I would say e-commerce is not going anywhere, it's here to stay. It's the future.'* ***(C2-P2)***

Inevitable situations such as the current pandemic, affecting the world in various 'unimaginable' way(s), compel businesses to consider platforms such as e-commerce to survive in the future. Such pandemics will result in a high adoption of grocery e-commerce (Hamstra 2020: 32).

One valuable input mentioned by a participant is that:

> *'E-commerce is a crucial growing or developing vein of any business. So if you have to survive into the future, these are the things you need to start building now and adding it to your diverse levels of your income stream.'* ***(C1-P2)***

4.4.3 Online activity

The researcher found that the internet was the domain enabler for e-commerce. All activities relating to e-commerce are conducted online. This finding relates back to the question posed by the researcher about the view/opinion on e-commerce. One participant stated that:

> *'Transactions conducted via the internet. Every time individuals and companies are buying or selling products and services online, they are engaging in e-commerce.'* ***(C4-P2)***

Online activity might have brought about convenience to the daily lives of consumers, but the issue surrounding online security remains a concern for some consumers who have not fully transitioned to online purchasing. Cybersecurity is a concern for both consumers and companies with online platforms. One participant made mention of the threat of cybersecurity as a hindrance to adopting e-commerce successfully, which is also an important point to this theme.

> '*I think off hand is cybersecurity (being secure when shopping-not getting hacked).'* ***(C4-P1)***

Q: How has the company been able to keep up with the new trend?

4.4.4 Innovation

In a report issued by the Council of Supply Chain Management Professionals, Sparkman (2017: 17) announced that the upcoming years will bring a challenge to warehouse operators to steer these trends whilst building holistic, flexible networks

that are proficient in providing faster order fulfilment to accommodate consumers' expectations.

One participant made mention that:

> *'It's an evolution of the way we live our lives that pushes the reshaping of consumer behaviour, that drives innovations such as e-commerce.* ***(C1-P2)***

4.4.4.1 Decision-making

It was evident that in one of the responses, decision-making plays a crucial role in the success of e-commerce. The decisions made need to address the "how" factor. How do we sustain this innovation? How do we keep up with the innovation without incurring too many costs? How will the adoption of this innovation impact our competitive advantage?

> *'It needs to be accepted and known part of the income stream.'* ***(C1-P2)***

Part of the decision-making process for some participants was to outsource some of the activities of the warehouse to a 3PL company. In various cases, the option to outsource helps the business to focus on its core competency.

> *'The company at this stage has been able to outsource the e-commerce execution, as business aggressively promotes the use of e-commerce, enabling the person who can use it to have the benefit and try and widen the scope of customer base.'* ***(C1-P1)***

4.4.4.2 Technological innovations

Being technologically advanced is a competitive advantage.

'The silent pressures that technological innovations put upon you is perpetual enhancements that they need. You can't just create something and rest. It has to improve all the time.' ***(C1-P2)***

'In an environment that requires technology, the only way to stay current is to read absolutely everything that is regarding latest technology, trends, being part of seminars, going to exhibitions, its quiet demanding in that environment especially when you supply technology. ***(C2-P1)***

Q: What would you say is the biggest challenge(s) the company is facing with e-commerce adoption?

4.4.5 Miscellaneous

The researcher found that various types of sub-themes emerged under this question. The sub-themes were derived from the data that was captured in some of the extracts of the participant responses. In total, seven sub-themes surfaced.

4.4.5.1 Consumer education

The researcher found that in today's world, information on any subject matter is easily available, driven by innovations such as the internet. Consumers of this century are well-informed. Hence, before the decision to purchase, they gather all relevant information. When a consumer is well-informed, they are able to make a reasonable choice for themselves.

'You need to have a sustainable consumer education towards new innovation. ***(C1-P2)***

4.4.5.2 Physical experience

It was stated by the participants that some consumers still prefer the physical experience when shopping. Some consumers still prefer the touch and feel experience.

One evident reason was linked to cybersecurity. Some consumers have trust issues when it comes to access of personal information.

This was stated by one participant:

> *'Consumers believe in shopping themselves to ensure that it is the right product.'* ***(C4-P2)***

4.4.5.3 Technological infrastructure

> *'What I would say is there are challenges born with technology. There are questions we need ask as a country, like- do we have technological infrastructure like networks that are versatile, enough to handle, because now traffic will continuously and increasingly divert to e-commerce and we should have a technological infrastructure as a country as number of cities to absorb that traffic.'* ***(C1-P2)***

> *'It's creating an infrastructure that is cost effective to ensure that you remain the most value for money provider, because of the level of trade that we trade at.'* ***(C1-P1)***

Q: What technological challenges hinder the success of e-commerce in the warehouse?

4.4.6 Technological challenges

Technological challenges related to the following:

4.4.6.1 Change management

Change in business operations influenced by an innovation is likely to experience resistance. It is evident from the contribution of the participants that e-commerce has changed the "game", especially in the warehouse. From what used to be picking, packing, labelling, staging and sent to the dock, these are now narrowed down to a single process of picking, packing, and shipping.

Confirmation was made by one participant:

> *'Difficulty in changing the existing working procedures and organisational resistance to change.'* ***(C4-P2)***

4.4.6.2 Connectivity

> *'It could be connectivity issues, if you look at the way people use technology there to fulfilment of e-commerce orders-they are trained in that and the warehouse is quiet a favourable environment to work in.* ***(C1-P2)***

> *'So, I will say, one area that will remain a risk is connectivity- someone tries to get to the warehouse via e-commerce cannot because, the broadband is almost exhausted so it's low.'****(C1-P2)***

4.4.6.3 Costs

Cost factors/issues surfaced frequently from participants, stating that new technologies are expensive and depending on the size of your company, if you are not profitable enough, you cannot afford them. Cost factors filter through to other segments of the business, like transportation, geographical location and much more.

> *'Whatever solution we have or come up with eventually, needs to take into consideration cost of transport- the further put you go the more expensive delivery gets. So where is the ideal geographical place to have a fulfilment hub and that's something we looking at. Where's e-commerce really taking of? CPT, JHB, DBN. So, the biggest challenge we have is not human capital, it's trying to get the cost serve model in line with people's willingness to spend money.'* ***(C1-P1)***

Q: How has e-commerce affected traditional warehousing operations?

4.4.7 Traditional warehousing

The increase in online shopping gave rise to fulfilment centres. These centres serve as a relief to traditional warehouses. This implies that systems, operations, and equipment differ to accommodate high volumes of orders from consumers.

4.4.7.1 Delivery system

It was evident that delivery systems have changed tremendously. Delivery is no longer confined to another warehouse. Instead, it now encompasses “at your door” service delivery. The increase in online activities has compelled the warehouse to deliver smaller orders in a short period. This resulted in outsourcing parts of the warehouse to a 3PL company to handle the couriering element.

> *‘In the old traditional method, warehouse operation was never delivering to an end customer, ever. It was always delivering to another hyper local warehouse or another DC. Stock was travelling on pallets, boxes and large stock was making transfers. So in the old days, your vehicle fleet was enormous, whereas today the warehouse operation; the only time we see a truck is on collection.’* ***(C2-P1)***

Additionally, the participant stated that:

> *‘So, when we go into our warehouse to do warehousing functions, we are now packing individual orders going to consumers.’* ***(C2-P1)***

4.4.7.2 Human interaction

One participant stated that:

> *‘It changes the way you operate by transferring everything that requires higher levels of human interaction, and it transfers it to the keyboard.’* ***(C1-P2)***

4.4.7.3 Old vs new system

Participants expressed their views on how the old working ways of the warehouse differ to the current ones. With the introduction of technology, numerous processes had been impacted, meaning that there was a change in systems and operations. Some of the views expressed were:

> *'The documentation is done online, as opposed to people sitting with loads of paper, walking around seeking authorisation to another desk for implementation.'* ***(C1-P2)***

> *'An old designed traditional warehouse is in reality not the most proficient to fulfil e-commerce orders, because the old warehouses were not designed for such. They were pallets, full cartons in-and-out, while e-commerce is about one's and twos of different items. E-commerce itself calls for a much-specialised packing of product. How do your box it? How do you best protect the product? Presentation to door-to-door. It's now part of customer experience. Traditional warehouses aren't ideally suited for e-commerce.'* ***(C1-P1)***

> *'In the old days you would have documentations, forklift driver, manuscript. In an e-commerce facility you have scanners, point-of-sale machines because we can't pack e-commerce orders with forklift; we can pack them with technology, but then it's expensive with robots and things like that, so eventually the industry will get there and be able to grow into that kind of offering when we have vertical warehouse machines and robotics.'* ***(C2-P1)***

> *'Previously what would happen is, you would get paper orders, which you would go to the shelf and pick them up. Whereas now, we use electronic scanner barcodes with hand-held devices, which makes it more active. So, the technology, the advancement in technology keeps people all focused on e-commerce and all of it's good.'* ***(C2-P2)***

In this case, the researcher found that gravitating to a more paperless environment seemed ideal for the warehouse, taking into consideration the high level of growth with e-commerce. Going paperless means reduced errors, improvements in productivity and reductions in costs.

Q: What is your take/view of the warehouse in the next two years?

4.4.8 The future warehouse

The researcher found the responses from the participants intriguing. Analysing their views on what the warehouse could potentially be or look like in the coming years, as well as what can be expected, the responses were interesting, with some hoping to see business improve and grow, whilst some expressed their views about the warehouse being automated.

> *'Greater chance towards technology use, currently the company has shifted from using finger to face recognition when entering the warehouse, as well as sharing information from notice board to TV screen (improving communication).'* ***(C4-P2)***

This participant spoke from the view of the shipping department:

> *'I see those operations getting smaller in terms of shipping and warehousing but enhancing in terms of technology and cost control.'* ***(C1-P2)***

This view was in relation to automation:

> *'I see my warehouse becoming more automated and moving towards robotics and autonomous operations. It will remove some and complete some. Robotics takes away the manual element, but enables you to enhance those people that have the ability in your work environment to look after and care for your equipment.'* ***(C1-P1)***

One participant shared a similar view, stating that:

> *'Robotics. The next 2 years will be a lot of robotic warehouses also a long time need warehouse.'* ***(C2-P2)***

The last participant expressed their view, saying that:

> *'So the new warehousing efficiency opportunities are vertical picking machines.'* ***(C2-P1)***

The above data were themes and sub-themes discovered by the researcher with the assistance of the Nvivo system. Nodes, also referred to as themes, emerged as the researcher thoroughly analysed the transcripts, made notes, and coded the information. This all-formed part of the thematic analysis.

The following questions did not form part of the thematic analysis but were however very relevant to the study. These questions formed part of the interview guide/questions asked by the researcher.

Q: Can you perhaps give a breakdown on the different components of the warehouse?

In this question, the researcher was trying to obtain a clearer picture of the various department(s) that exist and form part of the warehouse. From the results, it is evident that these companies or warehouses have similar departments, with inbound and outbound being common alongside administration. It is with no doubt that some will have more and others fewer departments, looking at the size of the company and their speciality.

C4- P1: The operation is broken down into departments.

- Inbound- managing the incoming volumes to the DC (returns, assets, receiving and inventory).
- Outbound- managing the outbound volumes of the DC (picking, dispatch, and delivery).
- Maintenance (maintaining the fleet and DC).

C4-P2: Marketing, receiving, inventory, assembly, dispatch, transport.

C1-P1: This warehouse is made up of three fundamental departments: in-bound, performance and out-bound.

This participant went as far as outlining the process of the warehouse, stating that:

'We have several suppliers and local and products purchased overseas arrive in containers. Have automatic shipping night, enter purchase order at our door, then scan the box, looks at allocation on box (they come pre-labelled) then looks at the WMS and destination. It's got two choices-either into the warehouse or straight out as cross-dock. Travels through conveyors to a print and apply machine, that stamps and put label on top, depicting location/destination. Fulfilment gets orders and they can either pick a pallet, case depending where it's living. If it's a case, the picker a picking instruction by an RFID scanner and he will go and execute by series of scan, loads on conveyor and it's taken away.'

C2-P1: inbound and receiving

- Distribution and dispatch
- Activity based team (picking and packing), which falls under the General Operations department
- Administration and marketing
- Next year, they will be introducing the Technology department (2021).

C1-P2: Shipping department- comprises different streams of leaders, called stream leads.

- Finance- processes payments to suppliers
- Compliance- documents for compliance, such as SARS and customs
- Administration- processes documents and sends to clearance or compliance
- Delivering management- responsible for ensuring and securing the movement of products from the port to the DC, which is the last leg
- Duty drawback- innovation department.

C3-P2: The Company comprises the Administration department, as well as the warehouse. Marketing is done by the company they service.

Q: Do you think staff members are adequately equipped with soft and technical skills for such change?

These were the responses from the participants:

'Yes and no. Our workforce is moving to technological trends and for our older staff, these are new challengers they will have to adapt to. Our younger workforce is easily adaptable to these trends.' ***(C4-P1)***

Another participant from the same company expressed that:

Our staff comprises of older employees (30-40 years of service) which is a bit of a challenge to be equipped, however company ensures that they provide in-house training to assist employees into gaining knowledge and exposure to new systems. Company is also employing young staff and providing training for development and experience for future technology.' ***(C4- P2)***

Other participants went on to say:

'Yes, they are.' ***(C3-P2)***

'They will have to grasp very few concepts- the timelines and need for speed in presentation. All they have to do is treat the order in the fashion, speed and accuracy that the particular order needs. The trainings would be more internal around understanding accuracy, presentation and speed.' ***(C1-P1)***

'We just introduced our own warehouse inventory management system, so we bought an odd the shelf product, which was very dissatisfying, so we had a software as a service that we paid for every month and now we've built our own inventory management system and since we've done that-though the warehouse staff understands the general functionality of the warehouse in an e-commerce system, the current change to the IMS is requiring that we do a little bit of training.' ***(C2-P1)***

The following question was asked with the hope of drawing inferences from the participants' experience of working in the warehouse. The business advice they can share with other individuals in the same stream or companies focused on e-commerce warehousing operations, not forgetting those contemplating a start-up of this type of business. These were the honest opinions from participants.

Q: What advice can you provide about such channels of conducting business?

'One of the main things I would try and get them to understand, to me they will have to build their internal system, need to build it themselves because we see a lot of people coming into the environment where we've years of opportunities to creating efficiencies and efficiencies are only created in an environment where there is a lot of understanding so, the exiting warehouse infrastructure has been done in a certain way and we in the past 12-13 years learnt how to create our own efficiencies. Anyone thinking of coming into the supply-competitive product, to me they would think twice and if they get big enough, generally they would want to talk to one of us anyways. If you wanted to get into e-commerce-manufacturing-going into retail, you can start in your garage and as soon as it gets to a point where you doing 300-400 orders a month, then you need to hand it over to an expert.' ***(C2-P1)***

'The best way to cement your footing or create a solid foundation for whatever business stream you want to partake in shipping and retail sector, is for you by all means have a niche. Pick up a niche and run away with it. Enhance it in a way that apart from it being a niche, you can create a situation where no one can live without it.' ***(C1-P2)***

'It's going to be about getting the right people, the right tech and systems. If you don't have the right people who want to grow the business and passionate about it, it will hurt. People are very important. You need to look after your people and give them the technology they need to advance in this industry. So they going to need certain tools. They will need an ergonomic packing area where it's comfortable and works every day. Look after your people, supply them with the right tools and technology. ***(C2-P2)***

'It's not as easy as it looks. When I left the previous company of employment, some people's perspective of my decision was not pleasant, the fact that I rejected some offers to relocate to Kenya or East London. The plan in the first place was not to spend more than 5 years in that company, so I spent in my 4th year. The plan was not to employ was not to be employed for long instead be in a position to employ people. I can safely say, I'm living that dream. It's not as easy as it looks, because there are times were we are unable to pay for salaries and maintenance of vehicles, but the reward of doing your own thing and being your own boss is refreshing, knowing that I am creating employment. We looking to expand in going big. Also there are times

where we don't make a sale/profit, but the joys of knowing that I am creating employment not only for other families, but for my younger siblings.' ***(C3-P1)***

'Make sure you have a good relationship with the company you offering your service to. Know your stuff. Know what you are doing, so that you won't lose your stock nor your money. Equip yourself with warehousing. Don't just sign a contract for the sake of it. And lastly, don't be a boss, be a worker.' ***(C3-P2)***

*If business wants to be a dynamic it has to focus on all client platforms which is including e-commerce and there are simple ways of getting ahead of e-commerce, by getting a really good product and using someone who's good at it. You don't have to be good at e-commerce if you've got a good product. Let people who are good at e-commerce do it and you focus on your product. It's not a cheap environment to get into. If you want to do it on volume, anyone can set up a web base and agreement with courier. It's when you become successful that you have to find a structure that can do it quickly**.' (C1-P1)***

'That we communicate with members that will be affected by the change, be transparent regarding the importance of transitioning onto e-commerce and how this will better the business, increase revenue and in turn give job security.' ***(C4-P2)***

*'Being professional in your field and partnering with people you can trust and grow***.'** ***(C4-P1)***

Figure 4.5 Word cloud

Sources Authors own (2020)

4.5 CHAPTER SUMMARY

This chapter focused on analysing the primary data in the form of interviews. These interviews were conducted online due to restrictions and regulations stemming from the pandemic. It expresses the participants' views and opinions, perceptions and feelings regarding the research undertaken, whilst also sharing advice about undertaking such channels or stream (e-commerce related) of business. The researcher added a word cloud above, depicting the most frequently used words from the written text. According to Jin (2017: 788), a word cloud is more of a weighted list to envision language or text data. The attention to the text increases and offers a greater application of opportunities as the big data time approaches.

In summary, the more frequent a word appears in the text (whether paragraph or line), the larger it becomes in the image created.

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

"No research without action, no action without research"- Kurt Lewin

---

5.1 INTRODUCTION

The overall purpose of this study was to investigate the various challenges relating to technology encountered by warehouses in an era where e-commerce is rapidly growing. The previous chapter (Chapter Four) presented the results emerging from the primary data that was collected through interviews. It presented the seven themes and fifteen sub-themes that emerged in respect of the interviews. The overall objective of this chapter is to present conclusions and viable recommendations based on both primary and secondary data. The data revealed that similar challenges do exist when comparing both primary and secondary data. This chapter closes with brief summaries on the recommendations, limitations, and conclusions.

5.2 AIM AND OBJECTIVES OF THE STUDY

At this juncture, the researcher takes the opportunity to remind the reader of the aim and objectives of the study. The aim plays a significant role in defining the direction of the research strategically and how the purpose will be achieved.

5.2.1 Aim of study

The aim of the study was to investigate the technological challenges facing selected Durban warehouses in the era of e-commerce.

5.2.2 Objectives

- To determine the impact of e-commerce on warehouses;
- To investigate the technological challenges affecting warehouses in relation to e-commerce adoption;

- To identify the role of the internet as a domain factor for successful e-commerce; and
- To make recommendations on how to effectively implement warehouse management systems for improved business operations.

5.3 EMERGING THEMES AND SUB-THEMES FROM THE STUDY

The seven themes that emerged from the study were:

- Consumer behaviour
- Growth
- Innovation
- Miscellaneous
- Technological challenges
- Traditional warehousing
- The future warehouse

The fifteen sub-themes that emerged from the themes were:

- Convenience
- Future
- Decision-making
- Technological innovation
- Consumer education
- Job loss
- Online activity
- Physical experience
- Costs
- Delivery system
- Old vs new system
- Technological infrastructure
- Change management
- Connectivity
- Human interaction

5.4 METHODOLOGY OF RESEARCH

This study undertook an exploratory approach whereby data was extracted using interviews. The researcher decided on the qualitative approach to acquire specific information, viewpoints and experiences relating to the study. The researcher used the concept of thematic analysis, with the assistance of the Nvivo system to generate themes and sub-themes.

5.5 RESEARCH FINDINGS AND DISCUSSIONS

Findings from the objectives are linked to both primary (interviews) and secondary (literature) information. These are as follows:

5.5.1 First objective

- To determine the impact of e-commerce on warehouses.

5.5.1.1 Analysis of findings

The findings from the literature revealed that the increase in e-commerce has led to massive technological and operational changes, compelling a majority of the businesses to re-strategize their entire business model in order to remain relevant and competitive (Clark 2018: 1). This has created high expectations for the consumer- to be able to receive their package the same day of ordering. The researcher found that traditional warehouses are now resorting to fulfilment centres and DCs for last mile delivery. These fulfilment centres and DCs are now situated closer to the consumer for more convenience with delivery and cost factors.

The literature revealed how pivotal the role of robotics is becoming for the warehouse. This resonates with the findings from the primary data, where participants did express their interest and need for robotics in future. However, cost factors always pose a challenge to adopting and acquiring these technologies. As South Africa is a developing country, a few issues do exist that impact on businesses holistically, economically and trade wise. However, concerns did arise, such as a reduction in human capital. In a country where unemployment rates keep escalating, a high risk

persists with the introduction of robotics. The results found that in as much as robotics will help supplement humans, they do to some extent pose a threat to jobs.

The findings from the primary data revealed that in the next two years, some companies project to have a fully automated warehouse and robotic environment. Robotics is said to take away the manual element. An e-commerce warehouse was found to be more efficient as opposed to the old traditional warehouse, where deliveries were always directed to another warehouse or DCs. Now deliveries are directed straight to the end consumer. Documentation is now done online; scanners and point-of-sale machines replaced the manuscript and scanning of barcodes is done with hand-held devices.

5.5.2 Second objective

- To investigate the technological challenges affecting warehouses in relation to e-commerce adoption.

5.5.2.1 Analysis of findings

The findings from the interviews and literature revealed that various challenges (not only confined to technology) influenced the success of e-commerce adoption in the warehouse. Some challenges identified from the primary data, which constituted becoming sub-themes, were change management, connectivity, cost factors, technological infrastructure and many more. The data also revealed that changes with technology are expensive. Companies now find themselves having to either outsource activities involving technology or employ internal developers, with both linking to cost factors.

This is one reason it became a challenging to adopt e-commerce successfully unless one is a profitable and well-established company. An excerpt from Kembro, Danielsson, and Smajli (2017: 624) found that implementing ERP and WMS systems creates possibilities of storing and tracking information to handle and coordinate operations quicker, with fewer resources, has become a relief. The data revealed that one company, a giant retailer existing for over 30 years, had their e-commerce and

WMS built into its base from an international country. Aspects such as infrastructure and software were seen as a challenge. Connectivity, which is linked to speed as e-commerce is all about speed, also presented a challenge.

Information from the literature revealed that technology is steering the future of warehousing, ensuring that customers receive products in the quickest time possible (Allias 2018: 20). As stated before, e-commerce is all about speed. Being able to process orders and delivering in the quickest time will contribute to a company's competitive advantage.

Lastly, technologies such as RFID were revealed to be costly for the warehouses interviewed. This was confirmed by Feng *et al.* (2014: 2174), who stated that RFID technology is expensive. It is for this reason that one warehouse still relies on humans to do the documentation of orders, as opposed to having scanners linked to a computer when searching or transitioning an order. The researcher understood that this company is quite a small company and new in the market.

5.5.3 Third objective

- To identify the role of the internet as a domain factor for successful e-commerce.

5.5.3.1 Analysis on findings

The study revealed that to engage in an e-commerce activity, one would need access to the internet and a device supporting the internet. Findings from secondary data support the statement, saying that the success of e-commerce is the internet (Kamil 2015: 14). This means that without the internet, it would be impossible to process a transaction online. Additionally, an excerpt from secondary data reveals that the existence of the internet made it easier, simpler, cheaper, and more accessible for business and consumers to interact and conduct commercial transactions electronically (Clemes, Gan, and Zhang 2014: 364). This impacted on consumers' buying decisions and shopping behaviour.

The findings from primary data emerged from a question posed by the researcher addressing the opinion or view on e-commerce. The findings revealed that participants are knowledgeable about the concept, hence the decision of the researcher to use purposive sampling. There was an understanding that e-commerce activities are transactions conducted via the internet and whenever individuals or companies decide to buy or sell products or services online, they are engaging in e-commerce.

The researcher found that a theme that emerged from the primary data was supported by a statement found in the secondary data. The theme- online activity- was supported by an excerpt from Zhang *et al.* (2017:24) confirming that the prevalent use of social networks presented a popular and economically online activity: e-commerce. There appears to be no doubt that numerous advantages of the internet had an impact on the success of online stores (Amrouche and Yan 2016: 258). This was also met by negative aspects of e-commerce, such as the inability to access data at a reasonable price; cost of delivery to individuals; and high level of poverty, as expressed by one participant from a giant retail store.

Lastly, primary data revealed that the contribution to the success of e-commerce is also impacted by the concept of consumer education. Innovations such as the internet create channels for consumers to access information before deciding to purchase.

5.5.4 Fourth objective

- To make recommendations on how to effectively implement warehouse management systems for improved business operations.

5.5.4.1 Analysis of findings

A well-defined meaning presented by Coyle *et al*. (2017: 397) clarifies that the warehouse management system is the core software used for managing fulfilment processes, supporting all types of distribution operations, with its primary function being a software control system used for improving product movement and storage operations through the efficient management of information and completion of

distribution tasks. After dissecting this meaning, the researcher came to an understanding that it is important for the warehouse to have a software control system to track inventory, especially with e-commerce orders, as some orders come in small quantities requiring same-day delivery. This means having to track each individual order, as opposed to large quantity orders that have a set day/date for delivery.

Evidence from secondary data on a study conducted by Atieh *et al. (*2016: 568) revealed that WMS is essential for every warehouse. Furthermore, introducing technology in the warehouse has the potential to improve productivity, increase utilization, reduce costs, and increase customer satisfaction. Additionally, Kembro, Danielsson, and Smajli (2017: 625) assert that having a WMS will enable the warehouse to register incoming and outgoing goods. Furthermore, the importance of using a system to monitor goods throughout the warehouse makes it possible to achieve a better overview of completed and upcoming tasks, reducing the time required to look for activities in the warehouse; minimizing inventory deviations; reducing inventories; improving space utilization; and increasing service levels.

One control system suggested by Liu *et al. (*2019) related to RFID and sensor technology. However, the researcher understands that technology comes at a price, as mentioned by the participants. Primary data revealed that some warehouses have control systems in place, however not the RFID and sensor technology. One warehouse for instance is at its infant stage and therefore cannot afford such technologies at this stage. However, in the long-run, once established and profitable, the decision to transition to these technologies will occur. Primary data also revealed that one warehouse has already adopted a specialized system. However, it is RFID related, and another well-established warehouse in operation for 13 years has no WMS at all.

Recommendations on the objective will be highlighted in **section 5.7.**

5.6 SUMMARY OF CONCLUSIONS

- The study looked at the impact of the internet as a domain contributor to e-commerce.

- The study revealed that e-commerce is essential for business. It is a business platform that needs to be utilised effectively, especially with the continuous change and development in technology.

- Convenience is the new norm. Consumers are constantly seeking easier, simpler, and affordable ways to shop, not forgetting diversity and range of products and services. The more interactive the e-commerce platform is, the more consumers are willing to spend.

- As a developing country, aspects such as infrastructure still pose a challenge to successfully operating an e-commerce platform. With high costs of data, an unstable economy, political issues and many more, these affect the output in businesses.

- It cannot be ignored that the pandemic saw an immense downfall for some businesses, impacting on the lifestyles of people. However, it presented the opportunity for businesses to conduct their activities online using an e-commerce platform.

- Where technology exists, trust issues are bound to emerge. With cybersecurity a main concern for some consumers, e-commerce in SA has not reached its peak when compared to other developing countries such as Nigeria. It is vital that the country benchmarks itself to other developing countries in order to remain competitive and relevant.

- With the warehouses predicting a fully automated environment in the next two years, concerns were expressed about the possibility of job loss. In as much as

automation removes the manual element, the warehouse will not entirely remove human capital. These automations will need human assistance; hence their existence is to supplement humans.

- Roger's framework is an important framework to consider when deciding to adopt a novel innovation. Aspects around the knowledge about the innovation is a crucial aspect to get as much relevant information as possible and strategize how the company will incorporate the framework into the business model.

5.7 RECOMMENDATIONS

The researcher, after analysing the findings, recommends that:

- These warehouses, by any possible means must adopt a control system, not specific to RFID, to help manage their inventory and to avoid any loss of stock or errors with orders.

- To those that are fully equipped with control systems, they need to consider their bandwidth which impacts on the connectivity. As mentioned before, e-commerce is all about speed, so have a connection line and network that is efficient and will assist in the fast-paced movement of goods and orders.

- To consult an expert on control systems is paramount. The researcher understands it can be costly, but it is beneficial for the business. If possible, adopt a control system that has all features needed and that is preferably an international one.

- The warehouse management system might not be an entirely suitable system to work with or have when it comes to automation because of its inability to encompass a real-time view of all operations within the warehouse. However, it is still useful until warehouses are able to afford the next level of software.

- To consider the implementation of warehouse execution systems in the future that combines both warehouse management systems and warehouse control systems. The warehouse management system manages inventory, whereas warehouse control system controls the inventory. Having a system that consolidates all the activities of WMS and WCS is a great advantage for business.

- To keep up with the fast-paced technological world, consumer behaviour studies must be a focal point for the supply chain/ logistics field. With the demands escalating and sufficient supply being unavailable, consumer trends must continuously be monitored, and future projections need to be revised.

- To implement e-commerce successfully, it is important to understand the adoption process. It is also important to have knowledge about the innovation that feeds into the decision-making process up to the final stage of implementation.

5.8 FUTURE RESEARCH

This study explored the various challenges that emerged in the warehouse regarding e-commerce. These challenges were mainly linked to technology. However, there is a need to explore other challenges emerging from e-commerce, other than the ones relating to technology. There is a need to explore factors that hinder the success of e-commerce in the warehouse, its effect on business now and in the future. Additionally, there exists the need to explore avenues that the researcher was not able to access.

5.9 CONCLUSION

In summary, this study has investigated the technological challenges facing warehouses in the era of e-commerce. These warehouses were all situated in Durban. It looked at the current literature, making inferences on the responses of participants who are knowledgeable about the logistics field. The objectives of the study were explained in-depth, resulting in the aim of the study being achieved.

REFERENCES

Abushaikha, I., Salhieh, L. and Towers, N. 2018. Improving distribution and business performance through lean warehousing. *International Journal of Retail and Distribution Management*, 46 (8): 780-800.

Accorsi, R., Manzini, R. and Maranesi, F. 2014. A decision support system for the design and management of warehousing systems. *Computers in Industry*, 65: 175-186.

Adegbehingbe, O. D. 2015. Factors affecting computing students' awareness of the latest ICTS. M.Tech., Durban University of Technology.

Adivar, B., Huseyinoglu, I. Y. and Christopher, M. 2019a. A quantitative performance management framework for assessing omni-channel retail supply chains. *Journal of Retailing and Consumer Services* 48: 257-269

Adivar, B., Huseyinoglu, I. Y. and Christopher, M. 2019b. A quantitative performance management framework for assessing omni-channel retail supply chains. *Journal of Retailing and Consumer Services*, 48: 257-269.

Agarwal, J., and Wu, T. 2015. Factors influencing growth potential of E-commerce in emerging economies: an institution-based N-OLI framework and research propositions. *Thunderbird International Business Review*, 57(3): 197-215.

Agarwal, H. and Dixit, S. 2017. The encumbered growth of e-commerce in India: can we help? *Aweshkar Research Journal*, 23(2): 114-132.

Alawneh, F. and Zhang, G. 2018. Dual channel warehouse and inventory management with stochastic demand. *Transport Research Part E*, 112: 84-106.

Allias, E. 2018. A new day brings a new way of warehousing: technology is driving the future of warehousing, helping customers receive products in the shortest time possible. *Material Handling and Logistics*, 73 (6): 20-22.

Anand, A., Agarwal, M., Deepti, A. and Singh, O. 2016. Unified approach for modeling innovation adoption and optimal model selection for the diffusion process. *Journal of Advances in Management Research*, 13 (2): 154-178.

Al-Yahya, S. 2017. Integration and optimisation of an RFID-enabled inventory management system of a future generation warehousing system. PhD., University of Portsmouth.

Al-Zoubi, M. I. 2013. Predicting e-business adoption through integrating the constructs of Roger's diffusion of innovation theory combined with technology-organizational-environment model. *International Journal of Advanced Computer Research*, 3 (4): 63-73.

Amrouche, N. and Yan, R. 2016. A manufacturer distribution issue: how to manage an online and a traditional retailer. *Annals of Operations Research*, 244 (2): 257-294.

Ang, A. and Tan, A. 2018. Designing reverse logistics in an omnichannel environment in Asia. *LogForum*, 14 (4): 519-533.

Anon. 2017. *Global e-commerce trends taking off locally*. Available: www.bizcommunity.com/article/196/394/156914.html. (Accessed 20 September 2018)

Antonescu, M. 2018. Are business leaders prepared to handle the upcoming revolution in business artificial intelligence? *Quality Access to Success*, 19: 15-19.

Antwi, A. O. and Agyeman, A. 2020. The impact of e-commerce adoption on logistics companies. *European Journal of Business, Economics and Accountancy*, 8 (1): 1-19.

Ardjmand, E., Shakeri, H., Singh, M. and Bajgiran, O. S. 2018. Minimizing order picking makespan with multiple pickers in a wave picking warehouse. *International Journal of Production Economics*, 206: 169-183.

Aribawa, D. 2016. E-commerce strategic business environment analysis in Indonesia. *International Journal of Economics and Financial Issues*, 6 (6): 130-134.

Atieh, A. M., Kaylani, H., Al-Abdallat, Y., Qaderi, A., Ghoul, L., Jaradat, L. and Hdairis, I. 2016. Performance improvement of inventory management system processes by an automated warehouse management system. *Procedia CIRP*, 41: 568-572.

Aulkemeier, F., Schramn, M., Iacob, M. and Van Hillegersberg, J. 2016. A service-orientated e-commerce reference architecture. *Journal of Theoretical and Applied Electronic Commerce Research*, 11 (1): 26-45.

Awa, H. O., Ukoha, O. and Emecheta, B. C. 2012. Integrating TAM and TOE frameworks and expanding their characteristic constructs for e-commerce adoption

by SME'S *Proeedings of Informing Science and IT Education Conference* 12: 571-588.

Aydin, E. and Savrul, B.K. 2014. The relationship between globalization and e-commerce: Turkish case. *Social and Behavioral Sciences*, 150: 1267-1276.

Babbie, E. 2016. *The practice of social research*. 4th ed. Boston: Cengage Learning.

Banker, S. 2016. *Robots in the warehouse: it's not just Amazon*. Available: https://www.forbes.com/sites/stevebanker/2016/01/11/robots-in-the-warehouse-its-not-just-amazon#737c793940b8 (Accessed 14 November 2018).

Bazeley, P. 2013. *Qualitative data analysis: practical strategies*. Los Angeles: SAGE.

Bertram, C. 2014. *Understanding research: an introduction to reading research*. Pretoria: Van Schaik.

Bhattacharya, M. 2015. A conceptual framework of RFID adoption in retail using Rogers' stage model. *Business Process Management Journal*, 21 (3): 517-540.

Biederman, D. 2013. E-commerce explosion. *Journal of Commerce (1542-3867)*, 14 (22): 33-39.

Blazquez, M. 2014. Fashion shopping in multichannel retail: the role of technology in enhancing the customer experience. *International Journal of Electronic Commerce*, 18 (4): 97-116.

Bogue, R. 2015. Growth in e-commerce boosts innovation in the warehouse robot market. *The Industrial Robot*, 43 (6): 583-587.

Bond, J. 2015. What is in store for e-commerce operations. *Modern Material Handling*, 70 (1): 24-28.

Booth, A. 2016. *Systematic approaches to a successful literature review*. 2nd ed. California: SAGE.

Boysen, N., De Koster, R. and Weidinger, F. 2018. Warehousing in the e-commerce era: a survey. *European Journal of Operational Research*: 1-16.

Bryman, A. and Bell, E. 2015. *Business research methods*. 4th ed. Cambridge: Oxford University Press.

Burnson, P. 2012. *E-commerce impact measured on warehousing*. Available: http://www.logisticsmgmt.com/article/e-commerce-impact-measured-on-warehousing (Accessed 11 November 2018).

Callarman, S. 2020. What is e-fulfillment? automating and accelerating your ecommerce growth. Available: Shipbob.com/blog/e-fulfillment (Accessed 31 May 2020).

Cao, H., Scudder, C. and Dickson, M. A. 2017. Sustainability of apparel supply chain in South Africa: application of the triple top line model. *Clothing and Textile Research Journal*, 35 (2): 81-97.

Cascio, W.F and Montealegre, R. 2016. How technology is changing work and organizations. *The Annual Review of Organizational Psychology and Organizational Behavior*, 3: 349-375.

Chaffey, D. 2015. *Digital business and e-commerce management: strategy, implementation and practice.* 6th ed. Pearson Education Limited Harlow.

Chen, M. and Teng, C. 2013. A comprehensive model of the effects of online store image on purchase intention in an e-commerce environment. *Electronic Commerce Research*, 13 (1): 1-23.

Cheung, R. and Vogel, D. 2013. Predicting user acceptance of collaborative technologies: an extension of the technology acceptance model for e-learning. *Computers and Education*, 63: 160-175.

Chiejina, C. and Olamid, S.E. 2014. Investigating the significance of the 'Pay on Delivery' option in the emerging prosperity of the Nigerian e-commerce sector. *Journal of Marketing and Marketing*, 5(1): 120-135.

Clark, S. 2018. *How e-commerce is changing the future of warehouses*. Available: https://www.inddist.com/blog/2018/03/howe-commerce-changing-future-warehouses (Accessed 12 November 2018).

Clarke, V. and Braun, V. 2017. Thematic analysis. *The Journal of Positive Psychology*, 12 (3): 297-298.

Clemes, M D., Gan, C. and Zhang, J. 2014. An empirical analysis of online shopping adoption in Beijing, China. J*ournal of Retailing and Consumer Services*, 21(3): 364-375.

Collins, H. 2017. *Creative research: theory and practice of research for the creative industries*. 2nd ed. New York: Fairchild books.

Companik, E., Gravier, M. and Farris II, M. 2018. Feasibility of warehouse drone adoption and implementation. *Journal of Transportation Management*, 28 (2): 33-50.

Cook, R. 2018. *#Mobile commerce: the rise of mobile shopping and its impact on business*. Available: http://www.bizcommunity.com/article/196/822/178956.html. (Accessed 20 October 2018)

Cooke, R. 2018. *#Mobile Commerce: The rise of mobile shopping and its impact on business*. Available: http://www.bizcommunity.com/article/196/822/178956.html (Accessed 16 July 2018).

Coyle, J. J., Langley Jr, C. J., Novack, R. A. and Gibson, B. J. 2017. *Supply Chain Management: a logistics perspective*. 10th ed. Boston: Cengage Learning.

Creswell, J. W. 2014. *Research design: qualitative, quantitative and mixed methods approaches*. 4th ed. Thousand Oaks: SAGE.

Danderpan, K., Gupta, S. K. and Lassar, W. M. 2013. Price determination in brick and mortar and online. *The International Journal of Finance*, 25 (2): 7739-7755.

Davarzani, H. and Norrman, A. 2015. Towards a relevant agenda for warehousing research: literature review and practitioners' input. *Logistics Research*, 8 (1): 1-18.

De Koster, R. B. M., Johnson, A. L. and Roy, D. 2017. Warehouse design and management. *International Journal of Production Research*, 55 (21): 6327-6330.

De Villiers, G. 2017. *Strategic logistics management: a supply chain management approach*. 2nd ed. Pretoria: Van Schaik.

Devlin, A. 2018. *The research experience: planning, conducting and reporting research*. Thousand Oaks: SAGE.

Dey, R., D'Souza, R. and D'Souza, J. 2015. Relationships between brick and mortar stores and m-commerce facilitates customers towards shopping online. *International Journal of Education and Applied Social Sciences*, 6 (3): 189-196.

Dey, A., Vijayaraman, B. S. and Choi, H. 2016. RFID in US hospitals: an exploratory investigation of technology adoption. *Management Research Review,* 39 (4).

Diamantidis, A. C., Koukoumialos, S. I. and Vidalis, M. I. 2016. Performance evaluation of a push-pull merge system with multiple suppliers, an intermediate buffer and a distribution centre with parallel machines/channels. *International Journal of Production Research*, 54 (9): 2628-2652.

Dinu, G. and Dinu, L. 2014. Using internet as a commercial tool: a case study of e-commerce in Resita. *Procedia Engineering*, 69: 469-476.

Doyle, G. J. and Currie, L. M. 2014. Integrating mobile devices into nursing curricula: opportunities for implementation using Rogers' Diffusion of Innovation model. Nurse Education Today, 34(5): 775-782.

Dresch, A., Larceda, D. P. and Miguel, P. A. C. 2015. A distinctive analysis of case study, action research and design science research. *Review of Business Management*, 17 (56): 1116-1133.

Dromgoole, D. A., Pritz, R., Dewald, S., Gottwald, K. and Payne, M. 2018. *The adoption-diffusion process- Texas A&M AgriLife*. Available: https://agrilifecdn.tamu.edu/od/files/2018/08/pdf (Accessed 22 October 2018).

Du Plessis, G. 2018. *#Mobile-commerce: the growth of mobile shopping in South Africa*. Available: http://www.bizcommunity.com/article/196/822/179452.html. (Accessed 15 November 2019)

Dudelick, J., Goldschmidst, B., Hofbauer, R. and Martin, K. 2018. Waking up to a new reality: as Amazonization proceeds, grocery retailers step up efforts to be their own disruptors. *Progressive Grocer*, 97 (7): 33-50.

Duric, J. S., Jovanovic, S. Z. and Sibalija, T. 2018. Improving the efficiency of the warehouse storage process with the use of drones. *International Journal of Advanced Quality*, 46 (3-4): 46-51.

El-Gohary, H. 2012. Factors affecting e-marketing adoption and implementation in tourism firms: an empirical investigation of Egyptian small tourism organisations. *Tourism Management*, 33: 1256-1269.

Erceg, A. and Sekuloska, J. D. 2019. E-logistics and E-scm: how to increase competitiveness. *LogForum*, 15 (1): 155-169.

Evangelista, P., McKinnon, A. and Sweeney, E. 2013. Technology adoption in small and meduim sized logistics providers. *Industrial Management and Data Systems*, 113 (7): 967-989.

Fan, J., Tang, L., Zhu, W. and Zou, B. 2018. The Alibaba effect: spatial consumption inequality and welfare gains from e-commerce. *Journal of International Economics*, 114: 203-220.

Fayad, R. and Paper, D. 2015. The technology acceptance model e-commerce extension: a conceptual framework. *Procedia Economics and Finance*, 26: 1000-1006.

Feng, B., Yao, T., Jiang, B. and Talluri, S. 2014. How to motivate vendor's RFID adoption beyond mandate? a retailers perspective. *International Journal of Production Research*, 52 (7): 2173-2193.

Fernandez, P. 2016. Through the looking glass: envisioning new library technologies drones. *Library Hi Tech News*, 33 (7): 1-5

Flick, U. 2015. *Introducing research methodology*. 2nd ed. Thousand Oaks: SAGE.

Flick, U. 2018. *Doing qualitative data collection-charting the routes, in the sage handbook of qualitative data collection*. London: SAGE.

Foster, P. 2017. *E-commerce challenges impacting businesses*. Available: http://www.inddist.com/article/2017/02/7 (14 August 2017).

Frey, B. 2018. *The Sage encyclopedia of educational research, measurement and evaluation*. Thousand Oaks: SAGE.

Futch, M. 2018. The dawn of the automated warehouse: the retail and e-commerce industries are driving the adoption of robotics in warehousing applications. *Materials Handling and Logistics*, 73 (2): 18-20.

Gattuso, D., Cassone, G. C. and Pellicano, D. S. 2014. A micro-simulation model for an intelligent logistics platform: specification and caliberation results. *Supply Chain Forum: International Journal*, 15 (4): 52-69.

Giannikas, V., Lu, W., Robertson, B. and McFarlane, D. 2017. An interventionist strategy for warehouse order picking: evidence from two case studies. *International Journal of Production Economics*, 189: 63-79.

Gibbs, G. 2018. *Analyzing qualitative data*. 2nd ed. Los Angeles: SAGE.

Goga, S., Paelo, A. and Nyamwena, J. 2019. Online retailing in South Africa: an overview. *CCRED Working Paper*, 2: 1-45.

Govindarajan, A., Sinha, A. and Uichanco, J. 2017. *Inventory optimization for fulfillment integration in omnichannel retailing*. Available: DOI:10.2139/ssrn.2924850 (Accessed 20 March 2020).

Gray, D. E. 2014. *Doing research in the real world*. 3rd ed. London: SAGE.

Graziano, A. M. 2013. *Research methods: a process of inquiry*. 8th ed. Boston, Mass: Pearson.

Hammant, J. 2017. The future warehouse: are you ready? *Logistics and Transport Focus*, 19 (11): 44-45.

Hameed, M. A., Counsell, S. and Swift, S. 2012. A conceptual model for the process of IT innovation adoption in organizations. *Journal of Engineering and Technology Management*, 29: 358-390.

Hamstra, M. 2020. Pandemic leads to channel surfing for grocery shoppers: pricing, e-commerce position mass merchants and discounters for future gains. *SN: Supermarket News*, 68 (10): 30-33.

Hanson, A., Kress, M. and Romano, D. 2019. Defining convenience: just as shoppers' behaviors are changing, so are their definitions of convenience. *Convenience Store News*, 55 (4): 52-56.

Haque, M., Azhar, S. M. and Rehman, M. 2014. Incorporating emotions as antecedents and mediators in theory of reasoned action (TRA) model. *IBA Business Review*, 9 (2): 40-47.

Harding, J. 2019. *Qualitative data analysis: from start to finish*. 2nd ed. London: SAGE.

Harding, W. 2015. *The state of e-commerce in South Africa* Available: http://www.bizcommunity.com/article/196/394/126894.html (Accessed 17 September 2018).

Hart, C. 2018. *Doing literature review: releasing the research imagination*. 2nd ed. Thousand Oaks: SAGE.

Hassan, M., Ali, M., Aktas, E. and Alkayid, K. 2015. Factors affecting selection decision of auto-identification technology in warehouse management: an international Delphi study. *Production Planning and Control*, 26 (12): 1025-1049.

Hennink, M., Hutter, I. and Bailey, A. 2011. *Qualitative research methods*. California: Sage.

Hogg, R. 2015. System upgrades available. *Automotive Logistics*, 18 (4): 42-45.

Horn, G., Badenhorst-Weiss, H., Cook, G., Heckroodt, S., Howell, J., Phume, T. B. and Strydon, J. 2014. *Supply chain management: a logistics approach*. Cape Town: Oxford University Press.

Huang, G. Q., Chen, M. Z. Q. and Pan, J. 2015. Robotics in e-commerce logistics. *HKIE Transactions*, 22 (2): 68-77.

Huang, Z. and Benyoucef, M. 2013. From e-commerce to social commerce: a close look at design features. *Electronic Commerce Research and Applications*, 12: 246-259.

Hubner, A., Kuhn, H. and Wollenburg. 2016. Last mile fulfillment and distribution in omni-channel grocery retailing: a strategic planning framework. *International Journal of Retail & Distribution Management*, 44 (3): 228-247.

Internet World Stats. 2018. *Internet Growth Statistics 1995 to 2018- the Global Village Online*. Available: http://www.internetworldstats.com/emarketing.html (Accessed 12 September 2018).

Ishfaq, R., Defee, C. C., Gibson, B. J. and Raja, U. 2016. Realignment of the physical distribution process in omni-channel fulfillment. *International Journal of Physical Distribution and Logistics Management*, 46 (6): 543-561.

Jensen, E. A. 2016. *Doing real research a practical guide to social research*. Los Angeles: SAGE.

Jin, M., Li, G. and Cheng, T. C. E. 2018. Buy online and pick up in-store: design of the service area. *European Journal of Operational Research*, 268: 613-623.

Jin, Y. 2017. Development of word cloud generator software based on python. *Procedia of Engineering*, 174: 788-792.

Kamil, I. 2015. E-commerce in international trade : impact on supply chain and warehouse management. Bachelor's Degree, Jam K University of Applied Sciences.

Karimova, G. Z. and Shirkhanbeik, A. 2015. Society of things: an alternative vision of Internet of things. *Cogent Social Sciences*: 1-8.

Kawa, A. 2017. Fulfillment service in e-commerce logistics. *LogForum*, 13 (4): 429-438.

Kembro, J. H., Danielsson, V. and Smajli, G. 2017. Network video technology: exploring an innovative approach to improving warehouse operations. *International Journal of Physical Distribution and Logistics Management*, 47 (7): 623-645.

Kembro, J. K., Norrman, A. and Eriksson, E. 2018. Adapting warehouse operations and design to omni-channel logistics: a literature review and research agenda. *International Journal of Physical Distribution and Logistics Management*, 48 (9): 890-912.

Kembro, J. H., Danielsson, V. and Senajli, G. 2017. Network video technology: exploring an innovative approach to improving warehouse operations. *International Journal of Physical Distribution and Logistics Management*, 47 (7): 623-645.

Kentrus, R. 2017. Who is your champion? Attributes of organizational champions who transform organizations through innovation *Journal of Interantional Business Disciplines*, 12 (1): 31-47.

Khan, S., Liang, Y. and Shahzad, S. 2014. Adoption of electronic supply chain management and e-commerce by small and medium enterprises and their performance: a survey of SME's in Pakistan. *Journal of Industrial and Business Management*, 4: 433-441.

Kim, T.Y., Dekker, R. and Heij, C. 2018. Improving warehouse labour efficiency by intentional forecast bias. *International Journal of Physical Distribution and Logistics Management*, 48(1): 93-110.

Kinuthia, J. N. K. and Akinnusi, D. M. 2014. The magnitude of barriers facing e-commerce businesse in Kenya. *Journal of Internet and Information Systems*, 4 (1): 12-27.

Kivunja, C. 2018. Distinguishing between theory, theoretical framework and conceptual framework: a systematic review of lessons from the field. *International Journal of Higher Education*, 7 (6): 44-53.

Krebs, D. 2015. Supply chain agility: new levels of visibility through mobile and wireless investments. *Supply Chain Management Review*, 19 (3): 40-46.

Kumar, R. 2014. *Research methodology: a step-by-step guide for beginners*. 4th ed. Los Angeles: SAGE.

Kurnia, S., Karnali, R. J. and Rahim, M. 2015. A qualitative study of business-to-business electronic commerce adoption within Indonesian grocery industry: a multi-theory perspective. *Information and Management*, 52 (518-536)

Kwak, J., Zhang, Y. and Yu, J. 2019. Legitimacy building and e-commerce platform development in China: the experience of Alibaba. *Technological Forecasting and Social Change*, 139: 115-124.

Lee, C. K. M., Lv, Y., Ng, K. K. H., Ho, W. and Choy, K. L. 2018. Design and application of internet of things-based warehouse management system for smart logistics. *International Journal of Production Research*, 56 (8): 2753-2768.

Leung, K.H., Choy, K.L., Siu, P.K.Y., Ho, G.T.S., Lam, H.Y. and Lee, K.M. 2018. A B2C e-commerce intelligent system for re-engineering the e-order fulfilment process. *Expect Systems with Applications*, 91: 386-401.

Li, F., Fredrick, S. and Gereffi, G. 2019. E-ommerce and industrial upgrading in the Chinese apparel value chain. *Journal of Contemporary Asia*, 49 (1): 24-53.

Li, J., Huang, R. and Dai, J. B. 2017. Joint optimisation of order batching and picker routing in the online retailer's warehouse in China. *International Journal of Production Research*, 55 (2): 447-461.

Lim, M. K., Bahr, W. and Leng, S. C. H. 2013. RFID in the warehouse: a literature analysis (1995-2010) of its applications, benefits, challenges and future trends. *International Journal of Production Economics*, 145: 409-430.

Lim, S. F. and M, W. 2019. Configuring the last-mile in business-to-consumer e-retailing. *California Management Review*, 61 (2): 132-154.

Liu, H., Yao, Z., Zeng, L. and Luan, J. 2019. An RFID and sensor technology-based warehouse center: assessment of new model on a superstore in China. *Assembly Automation*, 39 (1): 86-100.

Liukkonen, M. 2015. RFID technology in manufacturing and supply chain. *International Journal of Computer Intergrated Manafucturing*, 28 (8): 861-880.

Lopienski, K. 2018. What is a fulfillment center and why it's important [breakdown of warehousing]. *ShipBob Blog* (Blog). Available: https://wwwshipbob.com/differences-warehouse-fulfillment-center (Accessed 16 June 2019).

Loseke, D. R. 2017. *Methodological thinking: basic principles of social research design*. 2nd ed. Los Angeles: SAGE.

Lu, W., McFarlane, D., Giannikas, V. and Zhang, Q. 2016. An algorithm for dynamic order-picking in warehouse operations. *European Journal of Operational Research*, 248: 107-122.

Lune, H. and Berg, B. L. 2017. *Qualitative research methods for the social sciences*. 9th ed. Harlow: Pearson.

Mahroof, K. 2019. A human centric perspective exploring the readiness towards smart warehousing: the case of a large retail distribution warehouse. *International Journal of Information Management* 45: 176-190.

Maras, E. 2016. Robotics and automation: evolution not revolution. *Food Logistics*, 179: 54-57.

Marchet, G., Melacini, M. and Perotti, S. 2015. Investigating order picking system adoption: a case-study-based approach. *International Journal of Logistics Research and Applications*, 18 (1): 82-98.

Mardikyan, S. and Ozel, B. 2017. Factors affecting e-commerce adoption: a case of Turkey. *The International Journal of Management Science and Information Technology (IJMSIT)*, 23: 1-11.

Maree, K. 2020. *First steps in research*. 3rd ed. Pretoria: Van Schaik Publishers.

Marmol, M. and Fernandez, V. 2019. Trigger factors in brick and click shopping. *Intangible Capital*, 15 (1): 57-71.

Matthews, W. and Dawson, S. 2014. *The shed of the future: e-commerce- its impact on warehouses*. Available: https://www.2deloitte.com/content/dam/deloitte/ch/consumer-business/ch-deloitte-the-shed-of-the-future (Accessed 12 November 2018).

McCrea, B. 2017. '5 game-changing voice trends'. *Logistics Management*, 56 (7): 50-55.

McCrea, B. 2020. Retail under pressure. *Supply Chain Management*, 24 (1): 50-54.

Melacini, M., Perotti, S., Rasini, M. and Tappia, E. 2018. E-fulfilment and distribution in omni-channel retailing: a systematic literature review. *International Journal of Physical Distribution and Logistics Management*, 48 (4): 391-414.

Michel, R. 2017. 2017 warehouse/DC operations survey: in the thick of e-commerce adjustments. *Supply Chain Management Review*, 21 (6): 52-58.

Michel, R. 2019. The state of IoT in the warehouse. *Modern Materials Handling*, 74 (4): 26-31.

Micklesson, G., Thai, V. V. and Halim, Z. 2019. The influence of responsibility shift on warehousing performance: the case of Australia. *The Asian Journal of Shipping and Logistics*, 35 (1): 3-12.

Miebach, J. and P, S. 2018. Supply chains to come. *Logistics and Transport Focus*, 20 (8): 30-32.

Mijac, M., Androcec, D. and Picek, R. 2017. Smart city services driven by IoT: a systematic review. *Journal of Economic and Social Development*, 4 (2): 40-50.

Mills, J. 2014. *Qualitative methodology: a practical guide*. London. SAGE.

Minculete, G. and Olar, P. 2014. New approaches to supply chain management concept: logistics integration of “hub and spoke” model. *Valahian Journal of Economic Studies*, 5(2): 21-33.

Mirzaei, M., De Koster, R. B. M. and Zaerpour, N. 2017. Modelling load retrievals in puzzle-based storage systems. *International Journal of Production Research*, 55 (21): 6423-6435.

Motlhale, K. J. 2018. An investigation of the integration challenges of informal contractors in the formal economy: a South African perspective. M.Tech., Durban University of Technology.

Moyer, E. and Curtis, S. 2018. *Moving the modern warehouse*. Available: www.plantengineering.com/information (Accessed 27 January 2019).

Mruma, F. V., Ngussa, M. G. and Parveen, S. 2020. The impact of e-commerce on supply chain costs. *Journal of Business and Management*, 22 (4): 9-21.

Myers, G. 2017. *Research methodology*. Hillcrest: Acacia Private Publishing.

Neuman, W. L. 2014. *Social research methods: qualitative and quantitative approaches*. 7th ed. Harlow, Essex: Pearson.

Ngah, A. H., Zainuddin, Y. and Thurasamy, R. 2017. Applying the TOE framework in the Halal warehouse adoption study. *Journal of Islamic Accounting and Business Research*, 8 (2): 161-181.

Ngalonkulu, M. 2019. *E-commerce sales in SA grow 20-35% annually*. Available: http://30-Dec-2019-moneyweb.co.za/news/south-africa/e-commerce-sales-in-sa-grow-20-35-annually (Accessed 21 October 2020).

Nguyen, T. H. and Waring, T. S. 2013. The adoption of customer relationship management (CRM) technology in SMEs: an empirical study. *Journal of Small Business and Enterprise Development*, 20 (4): 824-848.

Nisar, T.M. and Prabhakar, G. 2017. What factors determine e-satisfaction and consumer spending in e-commerce retailing. *Journal of Retailing and Consumer Services*, 39: 135-144.

Nkemkiafu, A. G., Asah, N. P., Felix, N. and Sylvie, F. 2019. Strategic process inovation practices on customer satisfaction and market share. *Journal of Marketing Development and Competitiveness*, 13 (2): 49-61.

Nowell, L. S., Norris, J. M., White, D. E. and Moules, N. J. 2017. Thematic analysis: striving to meet the trustworthiness criteria. *International Journal of Qualitative Methods*, 16: 1-13.

Nxumalo, G. P. 2015. Public relations practices within selected public hospitals in KwaZulu- Natal. MTech, Durban University of Technology. Available: http://hdl.handle.net/10321/1427 (Accessed 11 December 2018).

Obar, J. A. and Wildman, S. 2015. Social media definition and the governance challenge: an introduction to the special issue. *Telecommunication Policy*, 39 (9): 745-750.

Okoli, C. 2015. A guide to conducting a standalone systematic literature review. *Communications of the Association for Information Systems*, 37 (43): 879-910.

Onal, S., Zhang, J. and Das, S. 2017. Modelling and performance evaluation of explosive storage policies in internet fulfilment warehouses. *International Journal of Production Research*, 55 (20): 5902-5915.

Oturakci, M. and H, Y. O. 2018. New approach to Rogers' innovation characteristics and comparative implementation study. *Journal of Engineering and Technology Management*, 47: 53-67.

Pajo, B.2018. *Introduction to research methods: a hands-on approach*. Thousand Oaks. SAGE.

Patel, T. and Soni, P. 2013. E-commerce in developing countries. *Oriental Journal of Computer Science and Technology*, 6 (3): 357-361.

Philbeck, T. and Davis, N. 2018. The fourth industrial revolution: shaping a new era. *Journal of International Affairs*, 72 (1): 17-22.

Pillay, P. and Mafini, C. 2017. Supply chain bottlenecks in South African construction industry: qualitative insights. *Journal of Transport and Supply Chain Management*, 11: 1-12.

Piotrowicz, W. and Cuthbertson, R. 2014. Introduction to the special issue information technology in retail: towards omnichannel retailing. *International Journal of Electronic Commerce*, 18 (4): 5-16.

Porter, M. E. and Heppelmann, J. E. 2017. Why every organization needs an augumeneted reality strategy. *Harvard Business Review*, 95 (6): 45-57.

Prinsloo, D. A. 2018. *Online shopping steady increase but still far behind*. Available: https://urbanstudies.co.za/wp-content/uploads/2018/11/sasc-research-report-online-shopping-20181.pdf (Accessed 22 October 2020).

Radu, V. 2019. *Consumer behavior in marketing-patterns types, segmentation*. Available: http://www.omniconvert.com/blog/consumer-behavior-in-marketing-patterns-types-segmentation (Accessed 03 February 2020).

Rafique, M. Z., Rahman, M., Saibani, N., Arsad, N. and Saadat, W. 2016. RFID impacts on barriers affecting lean manufacturing. *Industrial Management and Data Systems* 116 (8): 1585-1616.

Rahayu, R. and Day, J. 2015. Determinant factors of e-commerce adoption by SMEs in developing country: evidence from Indonesia. *Procedia: Social and Behavioral Sciences*, 195: 142-150.

Rao, S. a. A., G K. 2017. Analytical models for a new turnover-based hybrid storage policy in unit-load warehouses. *International Journal of Production Research*, 55 (2): 327-346.

Reaidy, P. J., Gunasekaram, A. and Spalanzani, A. 2015. Bottom-up approach based on internet of things for order fulfillment in a collaborative warehousing environment. *International Journal of Production Economics*, 159: 29-40.

Reddy, N.A. and Divekar, B.R. 2014. A study of challenges faced by e-commerce companies in India and methods employed to overcome them. *Procedia Economics and Finance*, 11: 553-560.

Reyes, P. M., Li, S. and Visich, J. K. 2016. Determinants of RFID adoption stage and perceived benefits. *European Journal of Operational Research*, 254 (3): 801-812.

Richards, G. 2018. *Warehouse management: a complete guide to improving efficiency and minimizing costs in the modern warehouse.* 3rd ed. New York: Kogan Page Ltd.

Rogers', E. M. 2003. *Diffusion of innovations*. 5th ed. New York: Free Press.

Sainathuni, B., Parikh, P.J., Zhang, X. and Kong, N. 2014. The warehouse-inventory-transportation problem for supply chains. *European Journal of Operational Research*, 237: 690-700.

Sambo, N. P. 2018. Investigating post flight food waste management policies and procedure within the airline catering industry- a study of airchefs South Africa. M.Tech., Durban University of Technology.

Saghri, S. S., Bernon, M., Bourlakis, M. and Wilding, R. 2018. Omni-channel logisitics special issue. *International Journal of Physical Distribution and Logistics Management*, 48 (4): 362-364.

Saskia, S., Marei, N. and Blanquart, C. 2016. Innovations in e-grocery and logistics solutions for cities. *Transportation Research Procedia* 12: 825-835.

Sawmy, T. and Damar-Ladkoo, A. 2015. Wholesale and Retail e-commerce in Maurituis: views of customers and employees. *Studies in Business and Economics* 10 (2): 170-186.

Sekaran, U. and Bougie, R. 2016. *Research methods for business: a skill- building approach*. 7th ed. Chichester, West Sussex: Wiley.

Sethi, U. J. and Sethi, R. S. 2016. Impact of internet usage riskiness, attitude towards websites safely, online shopping convenience on online purchase intention. *CLEAR International Journal of Research in Commerce and Management*, 7 (10): 11-14.

Sharma, G. and Lijuan, W. 2015. The effects of online service quality of e-commerce websites on user satisfaction. *The Electronic Library*, 33 (3): 468-485.win

Silverman, D. 2017. *Doing qualitative research*. 5th ed. Los Angeles: SAGE.

Singh, S. and Singh, N. 2015. Internet of Things (IOT): security challenges, business opportunities and reference architecture for e-commerce. *In 2015 International Conference on Green Computing and Internet of Things (ICGCIOT)*: 1577- 1581.

Smith, C. 2017. *SA e-commerce growing by leaps and bounds*. Available: www.news24.com (Accessed 21 September 2018).

Socha, G. 2017. *What will AI mean for you? Judicature*. Available: https://search.proquest.com/docview/2102830485?accountid=10612 (Accessed 28 January 2019).

Son, D., Chang, Y. and Kim, W. 2015. Design of warehouse control system for real time management. *IFAC Papers Online*, 48 (3): 1435-1439.

Sooksaksen, N. and Sudsertsin, S. 2014. The application of RFID in warehouse process: case study of consumer product manufacturer in Thailand. *Log Forum*, 10(4): 423-431.

Sparkman, D. 2017. Logistics in the time of e-commerce: warehouse operators and parcel delivery companies are the big winners in an internet-driven economy. *Material Handling and Logistics* 72 (6): 14-18.

Spickard, J. V. 2017. *Research basics: design to data analysis in six steps*. Los Angeles: SAGE.

Stoltz, M., Giannikas, V., McFarlane, D., Strachan, J., Um, J. and Srinivasan, R. 2017a. Augmented reality in warehouse operations: opportunities and barriers. *IFAC Papers Online*, 50 (1): 12979-12984.

Stoltz, M. H., Giannikas, V., McFarlane, D., Strachan, J., Um, J. and Srinivasan, R. 2017b. Augmented reality in warehouse operations: opportunities and barriers. *IFAC Papers Online*, 50 (1): 12979-12984.

Stoyan, S. 2017. Just a click away? Jurisdiction and virtually carrying on business in China. *Journal of Private International Law*, 13(3): 602-632.

Stuadt, F. H., Alpan, G., Di Mascolo, M. and Rodriguez, C. M. T. 2015. Warehouse performance measurement: a literature review. *International Journal of Production Research*, 53 (18): 5524-5544.

Sujatha, R. and Sekkizhar, J. 2019. Determinants of m-commerce adoption in India using technology acceptance model infused with innovation diffusion theory. *Journal of Management Research* 19 (3): 193-204.

Sutton, J. and Zubin, A. 2015. Qualitative research: data collection, analysis and management. *The Canadian Journal of Hospital Pharmacy*, 68 (3): 226-231.

Tejesh, B. S. and Neeraja, S. 2018. Warehouse inventory management system using IOT and open source framework. *Alexandria Engineering Journal*, 57: 3817: 3823.

Thai, Y. K., Dekker, R. and Heij, C. 2018. Improving warehouse labour efficiency by international forecast bias. *International Journal of Physical Distribution and Logistics Management*, 48 (1): 93-110.

Thomas, G. 2016. *How to do your case study*. 2nd ed. Los Angeles: SAGE.

Tian, F. 2016. An agri-food supply chain traceability system for China based on RFID and blockchain technology. PhD, Vienna University of Economics and Business. Available: epub.wu.ac.at/6090/1/Dissertation-of-Fen-Tian (Accessed 6 January 2019).

Tran, A. H. 2017. The internet of things and potential remedies in privacy tort law. *Columbia Journal of Law and Social Problems*, 50 (2): 263-298.

Triantafilo, J. 2017. *Playing catch-up with the warehouse tomorrow? fast track with low code integration*. Available: https://boomi.com/blog/warehouse-tomorrow-fast-track-low-code-integration (Accessed 18 December 2018).

Trochim, W. K. 2016. *Research methods: the essential knowledge base*. Boston, Mass: Cengage Learning.

United States. Department of Commerce. 2018. *Quartely Retail e-commerce sales 4th quarter 2017*. Washington: U.S Census Bureau News.

van Gils, T., Ramaekers, K., Braekers, K., Depaire, B. and Caris, A. 2018. Increasing order picking efficiency by integrating storage, batching, zone picking and routing policy decisions. *International Journal of Productions Economics*, 197: 243-261.

Venter, P. 2017. *Economic and management research* Cape Town: Oxford University Press.

Vermaat, M. E., Sebok, S. L., Freud, S. M., Campbell, J. T. and Frydenberg, M. 2016. *Discovering Computers 2016: tools, apps, devices and the impact of technology*. Boston: Cengage Learning.

Vokhmyanina, A., Zhuravskaya, M. and Osmolski, W. 2018. The issue of bullwhip-effect evaluating in supply chain management. *LogForum*, 14 (2): 163-170.

Wang, H., Chan, S. and Xie, Y. 2010. An RFID digital warehouse management system in the tabacco industry: a case study. *International Journal of Production Research*, 48 (9): 2513-2548.

Wei, J., Lowry, P. B. and Seedorf, S. 2015. The assimilation of RFID technology by Chinese companies: A technology diffusion perspective. *Information and Management*, 52: 628-642.

Weidinger, F., Boysen, N. and Schneider, M. 2018. Picker routing in the mixed-shelves warehouses of e-commerce retailers. *European Journal of Operational Research*, 1-15

White, G. R., Afolayan, A. and Plant, E. 2014. Challenges to the adoption of e-commerce technology for supply chain management in a developing economy: a focus on Nigerian SME's. *In E-commerce Platform Acceptance* 23-39.

Wollenburg, J., Holzapfel, A., Hubner, A. and Kuhn, H. 2018. Configuring retail fulfillment processes for omni-channel customer steering. *International Journal of Electronic Commerce*, 22 (4): 540-575.

Woods, R. 2019. The silicon solution? How robots are reinventing the cargo warehouse. *Air Cargo World*, 109 (4): 12-15.

Wruck, S., Vis, I. F. A. and Boter, J. 2017. Risk control for sraff planning in e-commerce warehouses. *International Journal of Production Research*, 55 (21)

Wu, W., Cheung, C., Lo, S., Zhong, R. and Huang, G. 2020. An IOT- enabled real-time logistics system for a third party company: a case study. *Procedia Manufacturing*, 49: 16-23.

Wunderlin, A. 2017. Warehouse equipment innovations: the hows and whys of robotics in the warehouse. *Supply and Demand Chain Executive*, 18 (1): 40-42.

Yu, Y., Wang, X., Zhong, R. Y. and Huang, G. Q. 2016. E-commerce logistics in supply chain management: practice perspective. *Procedia CIRP*, 52: 179-185.

Zhang, H.-L., Zhang, H.-J. and Guo, X.-T. 2020. Research on the future development prospects of sports products industry under the mode of e-commerce and internet of things. *Information Systems and e-Business Management*, 18 (4): 511-525.

Zhang, Y., Trusov, M., Stephen, A. T. and Jamal, Z. 2017. Online shopping and social media: friends or foes? *Journal of Marketing*, 81: 24-41.

Zhong, R. Y., Dai, Q. Y., Qu, T., Hu, G. J. and Huang, G. Q. 2013. RFID-enabled real-time manufacturing execution system for mass customization production. *Robotics and Computer Integrated Manufacturing*, 29: 283-292.

Zhou, W., Piramuthu, S., Chu, F. and Chu, C. 2017. RFID-enabled flexible warehousing. *Decision Support Systems*, 98: 92-112.

Zuchowski, W. 2016. The impact of e-commerce on warehouse operations. *Scientific Journal of Logistics*, 12 (1): 95-101.

APPENDICES

APPENDIX A- LETTER OF INFORMATION

LETTER OF INFORMATION

Title of the Research Study: The technological challenges faced by selected Durban warehouses in the era of e-commerce.

Principal Investigator/researcher: (Master of Management Science: Business Administration)

Supervisor: Dr Saths Govender

Brief Introduction and Purpose of the Study: I am a Master's degree student (Business Administration) at the Durban University of Technology. The aim of this study is to investigate the technological challenges faced by selected Durban warehouses in the era of e-commerce.

Outline of the Procedures: The study will involve 16 participants in total from 4 selected warehouses in the Durban area. You are requested to answer a set of questions, not more than 30 minutes on the current state of the company with the new e-commerce trends occurring. Data will be collected through interviews, which are strictly voluntary in nature and very confidential.

Risks or Discomforts to the Participant: There will be no anticipated risk or discomfort to you. However, if it happens that some of the questions lead to discomfort or anxiousness you are free to withdraw from the process.

Benefits: The research findings will be published in academic journals and presentations of the research findings will be made at local and international conferences.

Reason/s why the Participant May Be Withdrawn from the Study: Participation is entirely voluntary, and you can withdraw at any time without any adverse consequences to you or the continuity of the study.

Remuneration: There will be no remuneration given to you for participating in this study.

Costs of the Study: Interviews will be conducted at the company's premises, hence there will be no need for your travel and other related expenses.

Confidentiality: All the relevant information received from the data collection tools will be treated with complete confidentiality and used only for the research purposes; no individual will be identified in the dissertation.

Research-related Injury: There will be no anticipated risk or inquiry to you.

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

General:

Potential participants must be assured that participation is voluntary and the approximate number of participants to be included should be disclosed. A copy of the information letter should be issued to participants. The information letter and consent form must be translated and provided in the primary spoken language of the research population e.g. isiZulu.

APPENDIX B- LETTER TO PARTICIPANTS

Faculty of Management Sciences

Entrepreneurial Studies and Management

15 October 2018

Dear Participant

I am a Master's Degree student (Business Administration) at the Durban University of Technology. The research being undertaken is based on the complexities surrounding warehouses in the modern world of e-commerce. To deliver insightful, reliable and credible information, I hereby request your participation in an interview, not longer than 30-minutes. Your participation is voluntary, with the understanding that you are at liberty to withdraw from the interview at any stage without prejudice.

Confidentiality on information gathered is assured, hence no names are required. Please be assured that no sensitive business information will be disclosed to anyone. Should you feel uncomfortable with any question, it is within your right not to respond or divulge any information that may be against company policy.

For any concerns regarding the research project, you can contact:

Ms Jeslyn Hoover (031 373 5374) - Post Graduate Research Officer
Dr Saths Govender (0823757722) - Supervisor

Thank you for your time and assistance, your participation will be greatly appreciated.

Kind Regards
Ms Yenziwe Shozi
078 706 2490
mayenziweshozi@gmail.com

APPENDIX C- COMPANY 1

mr pricegrouplimited

A: Upper Level, North Concourse, 65 Masabalala Yengwa Avenue, Durban, 4001
T: +27 31 310 8000 **F:** +27 31 304 3725 **P:** P.O. Box 912, Durban, 4000 **W:** mrpricegroup.com
Registration Number 1933/004418/06 • Incorporated in the Republic of South Africa

To: Whom it may concern
From: Werner Pelser
Date: 12.02.2020

I, **Werner Pelser** grant permission to **Yenziwe Shozi** (**student number: 21031465)** to conduct her research at Mr Price Distribution Centre, provided that all information gathered is kept highly confidential.

I trust that the above is in order and if you need any more information please do not hesitate to contact me on the details below.

031 310 8705
WPelser@mrpg.com

Sincerely

…… ……

Werner Pelser

APPENDIX D- COMPANY 2

eCommerce Fulfillment (SAAS) Warehousing and Distribution

Unit 4/5 Chestnut Grove Industrial Park

Waterfall South Africa 4000

Phone 0860727235

Email: info@ideliver.co.za

15 October 2018

To Whom it may Concern

Yenziwe Shozi has requested an interview with our MD Gareth Moulton as part of the degree. We have accepted the 30 minute Interview at our premises in Waterfall in the next week from Tuesday morning onwards.

Thanks and Regards

Gareth Moulton

APPENDIX E- COMPANY 3

LOPANO CONSULTANTS

We deliver anywhere & everywhere

863 Curnick Ndlovu Highway
Inanda Stop 8
Durban

Cell Phone:060 430 4164
Email: 25mazibuko25@gmail.com

To : Durban University of Technology
From : Lopano Consultants
Date : 04 September 2020
Subject : Company consent to a research project

Dear Sir/Madam,

I Londiwe Mazibuko the sole owner of Lopano Consultants hereby confirm permission for Yenziwe Shozi (student number: 21031465) to conduct her research project at my company on condition that all information gathered will be kept highly confidential.

I trust that the above is in order and should you require any further information, please do not hesitate to contact me on the details below.

Contact Person: Ms. Londiwe Mazibuko
Contact Number: 0604304164
Email Address: 25Mazibuko25@gmail.com

Yours Sincerely,

Londiwe Mazibuko
MANAGING DIRECTOR

APPENDIX F- COMPANY 4

SPAR KWAZULU-NATAL
A DIVISION OF THE SPAR GROUP LTD
CO. REG. NO. 1967 /001572 /06

Date: 04th June 2019

Re: CONSENT TO CONDUCT RESEARCH

Dear Sir/Madam

The management of SPAR KZN Distribution Centre hereby grants permission to Yenziwe Shozi, student number 21031465, to conduct research as part of her **Master's Degree: Business Administration** studies. This is subject to the following conditions:

- SPAR management being in a position to identify/select participants in order to ensure that selected participants are knowledgeable and can contribute effectively to the study.
- SPAR management being granted access to view the final results of the study.
- The contents of the study may be used strictly for academic purposes and may not be published without prior consent from SPAR management.

304 Aberdare Drive, Phoenix Industrial Park 4068 | Tel: 031 508 5000, Fax: 087 942 9363 P.O. Box 371. Mount Edgecombe 4300 | Website: www.spar.co.za

- The company will not be referred to by name, however, may be described as a Wholesale Distribution Centre, warehousing and distributing product to supermarkets in the KwaZulu Natal and Eastern Cape region.

The dates agreed upon are between the 24th June 2019 – 05th July 2019. Kindly note that we will require Yenziwe to confirm beforehand the exact dates that she will be conducting her research on our premises so that we can prepare accordingly.

Yours faithfully

Siyanda Mdletshe
HR Manager
Tel: +27 (0) 31 508 5076 | Email: siyanda.mdletshe@spar.co.za I Fax: 086 699 5021

APPENDIX G- CONSENT LETTERS

DUT DURBAN UNIVERSITY OF TECHNOLOGY

INSTITUTIONAL RESEARCH ETHICS COMMITTEE

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, **(Yenziwe)**, about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: **__FREC REF: 1a/19FREC_,**
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

Graham Hood		14:49	
Full Name of Participant	**Date**	**Time**	**Signature / Right Thumbprint**

I, **Yenziwe Shozi** herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Yenziwe Shozi	07/10/2020	G.Y.SHOZI
Full Name of Researcher	**Date**	**Signature**
Full Name of Witness (If applicable)	**Date**	**Signature**
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

DUT DURBAN UNIVERSITY OF TECHNOLOGY

INSTITUTIONAL RESEARCH ETHICS COMMITTEE

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, **(Yenziwe)**, about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: **__FREC REF: 1a/19FREC_,**
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

LAWRENCE NDIMANDE	12/10/20	0900HRS	
Full Name of Participant	**Date**	**Time**	**Signature / Right Thumbprint**

I, **Yenziwe Shozi** herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Yenziwe Shozi	07/10/2020	G.Y.SHOZI
Full Name of Researcher	**Date**	**Signature**
Full Name of Witness (If applicable)	**Date**	**Signature**
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

DUT DURBAN UNIVERSITY OF TECHNOLOGY — INSTITUTIONAL RESEARCH ETHICS COMMITTEE

CONSENT

Statement of Agreement to Participate in the Research Study:

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

Full Name of Participant	Date	Time	Signature / Right Thumbprint
[illegible]	18/12/2020		

I, **Yenziwe Shozi** herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Yenziwe Shozi	30/11/2020	G.Y.SHOZI
Full Name of Researcher	**Date**	**Signature**
Full Name of Witness (If applicable)	**Date**	**Signature**
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

CONSENT

Statement of Agreement to Participate in the Research Study:

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

Londiwe Nazibuko	27/11/2020	10:03	
Full Name of Participant Thumbprint	**Date**	**Time**	**Signature / Righ**

I, **Yenziwe Shozi** herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Yenziwe Shozi	30/11/2020	G.Y.SHOZI
Full Name of Researcher	**Date**	**Signature**
Full Name of Witness (If applicable)	**Date**	**Signature**
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, (**Yenziwe**), about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: (**FREC REF: 1a/19FREC**).
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a stucy report
- In view of the requirements of research, I agree that the data collected during this stucy can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

Mpho Brown	7/10/2020		
Full Name of Participant	**Date**	**Time**	**Signature / Right Thumbprint**

I, **Yenziwe Shozi** herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Yenziwe Shozi	07/10/2020	G.Y.SHOZI
Full Name of Researcher	**Date**	**Signature**
Full Name of Witness (If applicable)	**Date**	**Signature**
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, **(Yenziwe)**, about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: **__FREC REF: 1a/19FREC_,**
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

__Sanesh Pillay__	___15/12/2020_	10:00 _	__SPillay____
Full Name of Participant	**Date**	**Time**	**Signature / Right Thumbprint**

I, **Yenziwe Shozi** herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Yenziwe Shozi	07/10/2020	G.Y.SHOZI
Full Name of Researcher	**Date**	**Signature**
Full Name of Witness (If applicable)	**Date**	**Signature**
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, (**Yenziwe**), about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: __FREC REF: 1a/19FREC_,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

LUNGI NGEMA	15/12/2020_	08:00	L. NGEMA
Full Name of Participant	**Date**	**Time**	**Signature / Right Thumbprint**

I, **Yenziwe Shozi** herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Yenziwe Shozi	07/10/2020	G.Y.SHOZI
Full Name of Researcher	**Date**	**Signature**
Full Name of Witness (If applicable)	**Date**	**Signature**
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

DUT DURBAN UNIVERSITY OF TECHNOLOGY

INSTITUTIONAL RESEARCH ETHICS COMMITTEE

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, **(Yenziwe)**, about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: **(FREC REF: 1a/19FREC)**.
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

GARETH MORGAN	10/3/21	15:37	
Full Name of Participant	**Date**	**Time**	**Sighature / Right Thumbprint**

I, **Yenziwe Shozi** herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Yenziwe Shozi	07/10/2020	G.Y.SHOZI
Full Name of Researcher	**Date**	**Signature**
Full Name of Witness (If applicable)	**Date**	**Signature**
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

APPENDIX H- INTERVIEW GUIDE

INTERVIEW GUIDE

The research undertaken, seeks to understand the technological challenges/difficulties facing warehouses in this e-commerce era. The research being conducted is towards obtaining a Master's degree qualification, at the Durban University of Technology. I would like to interview participants who are knowledgeable about the day-to-day operations of the warehouse, people such as the manager, supervisor, warehouse clerk and the shipping and receiving associate.

The questions posed pertains to the adoption of e-commerce, components of the warehouse and the warehouse management systems actively available. It is my duty to ensure that confidentiality is maintained during and after the interview. Your participation is voluntary, only upon agreed consent granted by participant will the interview continue. No names required, and no filming will take place.

Kindly supply the below for data analysis;

- Age:
- Are you directly involved in warehousing?
- Years of service:

Opening question(s)

1. How long has the company been in existence?
2. How many staff members does the company employ?
3. How can you best describe your experience working in the warehouse?

Key question(s)

1. What is your opinion/view on e-commerce?
2. How has the company been able to keep up with the new trend?
3. What would you say is the biggest challenge(s) the company is facing with e-commerce adoption?
4. What technological challenges hinder the success of e-commerce in the warehouse?
5. How has e-commerce affected the traditional warehousing operations?
6. How have you managed to integrate e-commerce with the company's current WMS?
7. Can you perhaps give a breakdown on the different components of the warehouse?
8. What's your take/view of the warehouse in next two years?
9. Do you think staff members are adequately equipped with soft and technical skills for such change?
10. What training programme(s) does the company employ to advance employee's skills and knowledge about e-commerce?

Closing questions

1. What are your hopes for the warehouse in the future?
2. What advice can you provide about such channels of conducting business?

Thank you for your time and availability to participate in the interview.

APPENDIX I- LETTER FROM THE EDITOR

EDITING LETTER

696 Clare Road

Clare Estate

Durban

4091

29 April 2021

To: Whom it may concern

Editing of Masters Thesis: YG Shozi

THE TECHNOLOGICAL CHALLENGES FACED BY SELECTED DURBAN WAREHOUSES IN THE ERA OF E-COMMERCE

This letter serves as confirmation that the aforementioned thesis has been language edited.

Any queries may be directed to the author of this letter.

Regards

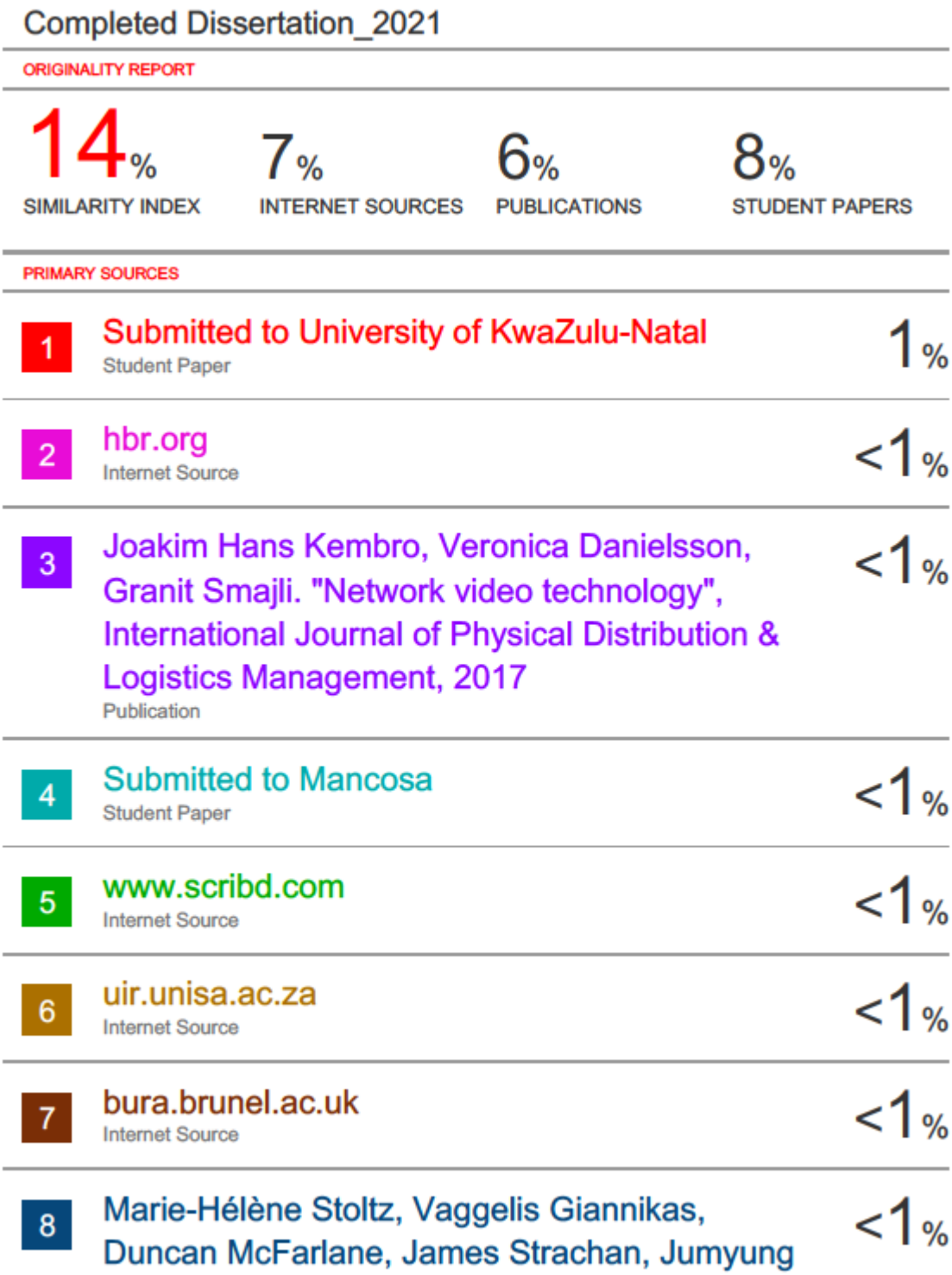
MP MATHEWS

Lecturer and Language Editor

Mercillenem@dut.ac.za

083 676 4778

APPENDIX J- TURNITIN REPORT



Completed Dissertation_2021

ORIGINALITY REPORT

14%	7%	6%	8%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to University of KwaZulu-Natal Student Paper	1%
2	hbr.org Internet Source	<1%
3	Joakim Hans Kembro, Veronica Danielsson, Granit Smajli. "Network video technology", International Journal of Physical Distribution & Logistics Management, 2017 Publication	<1%
4	Submitted to Mancosa Student Paper	<1%
5	www.scribd.com Internet Source	<1%
6	uir.unisa.ac.za Internet Source	<1%
7	bura.brunel.ac.uk Internet Source	<1%
8	Marie-Hélène Stoltz, Vaggelis Giannikas, Duncan McFarlane, James Strachan, Jumyung	<1%