Going green: green warehousing in selected food retail enterprises in Durban, South Africa

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Abstract

The processes utilised in food retail warehouses have various negative impacts on the environment such as air and land pollution arising from distribution and in-house activities. The search for new technologies that can mitigate these impacts is gaining traction in the business world. However, the implementation of green warehousing strategies has several implications. Research on the effects of such strategies will promote informed decision-making on sustainable practices and enable the identification of green technology's contribution to sustainable development. This study examined the technology, distribution and operations gaps in selected food retail industries. Its objectives were to identify the challenges confronting green retail warehousing operations in this industry and assess retail warehousing distribution practices and how retailers enhance eco-friendly environmental logistics as well as measure how innovative technology influences the adoption of green warehouse operations. This involved identification of the types of vehicles and modes of transport utilised. The warehouse management systems employed in the selected companies were also assessed in order to determine their contribution to the organisations' willingness to innovate. Energy-efficient measures were examined to highlight new processes to reduce emissions in the warehouse. An exploratory, descriptive research design was employed and a qualitative approach was adopted. Data was gathered by means of interviews with nine participants and thematic analysis was used to analyse the data. The results show that many food retail companies have not fully integrated green practices and that the manual processes in place pose a threat to the environment. Based on the findings, green implementation is recommended to sustain the environment as well as simplify in-house practices.

Key Concepts: Green Logistics, Distribution Practices, Green Technology, Innovative Technology, Eco-friendly, Sustainable

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List of Abbreviations

4IR	Fourth Industrial Revolution
AI	Artificial Intelligence
AWS	Automatic Warehouse Systems
CO_2	Carbon Dioxide
CO2e	Carbon Dioxide Equivalent
COVID-19	Corona Virus Disease 2019
GL	Green Logistics
HVAC	Heating, Ventilation, Air Conditioning
ICT	Information Communication Technology
loT	Internet of Things
IT	Information Technology
LIFO	Last In First Out
MHE	Material Handling Equipment
RFID	Radio Frequency Identification
TBL	Triple Bottom Line
TOE	Technological, Organisational, Environmental

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 Introduction

Current and future generations across the world confront the challenges of environmental degradation, depletion of natural resources and increased global warming. Green warehousing is a vital practice in the modern manufacturing sector because it promotes environmental sustainability. The term green refers to environmentally-friendly in-house processes. Warehousing activities typically include distribution management, which entails fleet management, route planning and warehousing operations such as materials handling and inventory management (Badenhorst-Weiss, van Biljon and Ambe, 2017). Sustainable Development Goal 13 holds that "Climate Action, green logistics constitute best practice in the food retail value chain" (Salviaa et al., 2019:10). Dekker, Bloemhof and Mallidis (2012: 671) define green logistics (GL) as "the study of practices that aim to reduce the environmental externalities, mainly related to greenhouse gas emissions, noise and accidents, of logistics operations and therefore develop a sustainable balance between economic, environmental and social objectives". This is also considered to be the definition of the triple bottom line (TBL) as it ensures that businesses remain profitable while preserving the environment and giving back to the community (social responsibility). A company that adopts the TBL is able to assess the full costs of running the business (Elkington, 2018). Against this background, this study investigated the green warehousing practices utilised in the small-scale food retail industry. Babies R Us produces food and formula, CC Food and Beverage produces confectionary and Sunnyfield produces staple foods such as rice, salt and spices, all of which are significant fast-moving consumer goods. Obtaining sufficient stock at the right time and place is thus of dire importance. The three logistical components considered were warehousing operations, distribution, and technology innovation.

Food retail logistics confront several challenges, including the perishability of food due to inefficient warehousing processes and pollution (land and air) resulting from inappropriate waste and fuel management. Several products also require controlled temperatures during transportation and storage (Helo and Ala-Harja, 2018). Effective implementation of green warehousing practices involves simplifying or restructuring tasks without affecting standards and profitability. Examples

include efficient space utilisation and improved understanding of temperature control for storage. Green procedures also include aspects such as efficient route planning to reduce fuel consumption and minimal materials usage for effective waste reduction.

1.2 Background of the study

All industries' day-to-day processes have an impact on the environment and GL assist in reducing such effects. Azhgaliyeva and Liddle (2020:83) state that there is no precise meaning of the term *green*, given that only certain activities can be considered green, including pollution prevention and control, sustainable waste management, and eco-efficient production technologies and processes. These activities form part of GL. Seroka-Stolka and Ociepa-Kubicka (2019: 473) define GL as the processes implemented in an industry to minimise the adverse impact of industrial processes on the natural environment. In a nutshell, Samadova et al., (2020) explains green to be sustainability practices and activities rather than focus being placed on the broader strategic view of sustainability. While greening is interpreted as something that creates value (Angelo, 2019), within the context of sustainability and environmental awareness, logistics is defined as the part of the supply chain process that deals with the storage, warehousing, packaging, and a product's life cycle and not simply transportation. The study focused on GL as this process minimises damage to the environment. The main focus was on green warehousing operations, distribution and technology. The green warehousing logistics components considered in this study were innovative warehousing practices and environmental awareness and initiatives.

Green warehousing practices include efficient route planning, waste management and efficient space utilisation. Some of South Africa's biggest food retail companies have adopted green values in their logistical practices. For example, Woolworths partnered with Imperial Logistics to develop advanced trucking systems such as FrigoBlock, a refrigerated truck powered by an alternator that runs from the truck's engine instead of using diesel (Woolworths, 2018). The Shoprite Group is using liquid nitrogen cooling systems to maintain a set temperature for perishable food during delivery. Liquid nitrogen does not damage the environment and does not contribute to global warming as it is released into the air, thus avoiding the emission of exhaust fumes (Shoprite Holdings, 2018). Research has shown that a temperature-controlled food distribution system produces significant carbon dioxide (CO_2) emissions. According to Helo and Ala-Harja (2018:11), analysing CO_2 emissions during distribution enables an understanding of the impact of different

activities and identifies the barriers to environmental improvements. Spar has produced a plastic bag that is 100% recyclable, reducing production emissions by 40% (The Spar Group, 2020).

Recent research (Baah, Jin and Tang, 2019) suggests that, while many companies have adopted green practices, challenges remain, including the increasing number of vehicles used, leading to traffic congestion and global warming. There is thus a need for more thorough scrutiny of transport operations. Furthermore, the notion that *green* initiatives are always better is not without its challenges. Liu, Wang and Sun (2019:1) observe that although considerable progress has been made in developing countries, there is still a large gap when it comes to technical efficiency, resource allocation and the green concept. It is common for more profitable organisations to embrace greening initiatives to protect the environment as such initiatives call for substantial financial investment that their less profitable counterparts lack access to. This study focused on identifying the effects of green warehousing on the food retail industry.

1.3 Research problem

The food industry is a major contributor to environmental degradation due to air and land pollution caused by in-house logistics operations. Recent research has shown that a country's growth is significantly impacted by the activities of its logistics sector such as transportation and warehousing, as these activities depend heavily on non-renewable natural resources (Karaman, Abdullah, Merve and Uyar, 2020). Krešimir et al. (2019) note that warehousing generates greenhouse gases due to poor energy efficiency, incorrect heating levels, excessive air conditioning, and lighting systems that utilise excessive amounts of energy. In the absence of proper management and innovation, these aspects of warehousing can be harmful to the environment. Incorrect storage methods can lead to inefficient space utilisation and product wastage. Inefficient or poor route planning may also have a negative impact on the environment locally and internationally. Unnecessarily lengthy trips increase the amount of fuel required, as well as fuel emissions. Clean fuel injectors are required to promote an eco-friendly environment.

Green technology comes at a price, preventing its adoption by many developing economies (Jayant and Tiwari, 2017). Furthermore, the implementation of innovative technology in green warehousing is time consuming. Skills development will be an added expense as staff require the necessary training to fully realise its benefits. Maintenance is also costly and may restrict the adoption of innovative technology. Against this background, the study assessed whether the

measures currently in place maintain efficient quality standards. It explored the adoption of green warehouse operational practices linked to the storage of goods, technological advancements in warehouses and the distribution of goods to retail warehouses. Recommended measures for green warehouses include efficient stock control, utilisation of fuel-efficient vehicles, and the adoption of innovative technology such as cooling systems for perishable goods. This will assist warehouses to recognise their challenges and overcome them to maximise benefits. Companies also need to adopt green processes in order to comply with global environmental standards.

1.4 Research questions

- What challenges confront the implementation of green retail warehousing operations in selected organisations in the food retail industry?
- How do retail warehouse distribution practices promote an eco-friendly environment?
- How does innovative technology influence the adoption of green warehousing operations?

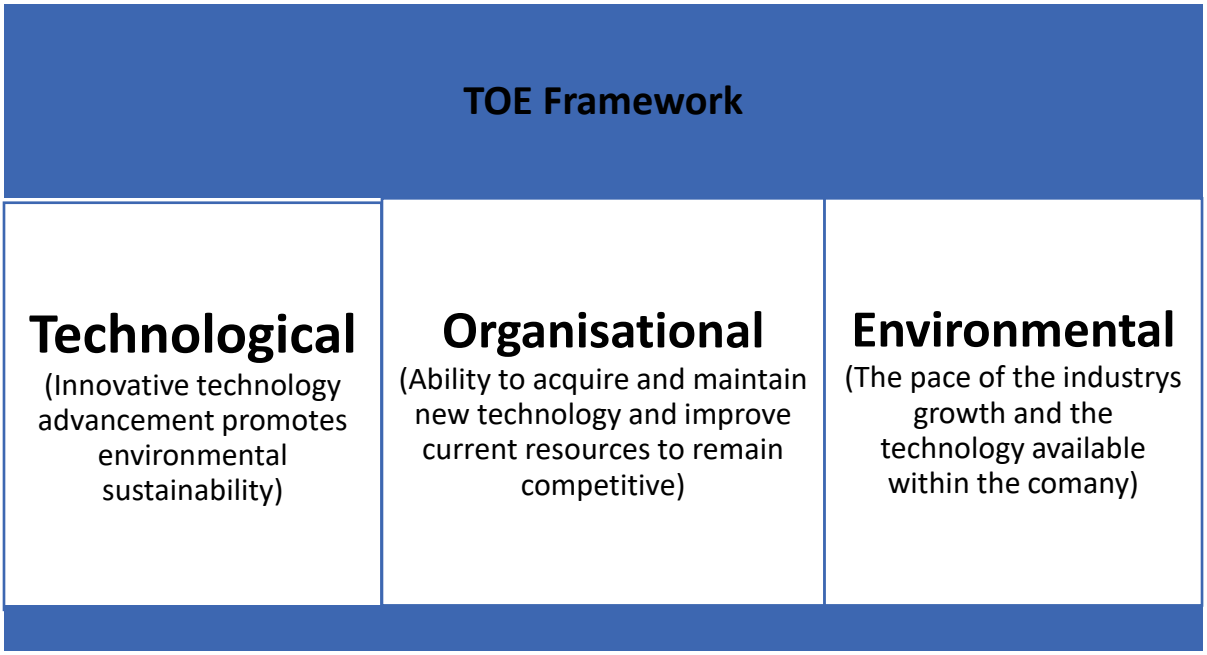
1.5 Research objectives

- To identify the challenges confronting green retail warehousing operations in selected organisations in the food retail industry.
- To assess the extent to which retail warehouse distribution practices promote an eco-friendly environment.
- To assess how innovative technology influences the adoption of green warehouse operations.

1.6 Theoretical framework

Kivunja (2018:46) notes that a theoretical framework is the foundation of every research study as it outlines the study's concepts and theories. These theories are drawn from knowledge that has been tested by experts in the field and provides the basis for analysis. This study employed the technological, organisational, and environmental (TOE) framework, which is concerned with the influence of decision-making processes when dealing with technological innovation. It posits that the factors that prompt an organisation to innovate include the company's willingness to do so, the speed of the industry's development and the technology available in relation to the company's specific processes.

Figure 1. 1: TOE Framework



Source: Designed by researcher

1.7 Literature review outline

1.7.1 Green warehousing

A fully performing warehouse inevitably contributes to environmental degradation; therefore, sustainability should be a priority. It is important to reduce the warehouse's negative effects on the environment as much as possible. Bartolini, Bottani and Grosse (2019:243) describe green warehousing as the implementation of environmentally friendly processes that reduce greenhouse gas emissions and energy consumption in the warehouse. According to Grunchman (2019:665), greenhouse gases are the most potent cause of global warming. It is therefore essential for industries to adopt green warehousing.

1.7.2 Eco-friendly transportation

South Africa is one of the highest producers of emissions. Emission reduction is imperative in GL as transportation accounts for the highest impact. Road transport has developed and become much more intricate over the past few years, making a major contribution to environmental pollution (Urbanek, 2021). Li et al. (2020) showed that fuel consumption and carbon emissions are reduced when multi modes of transportation are used. There is a paucity of research on the specific types of vehicles or the different modes of transport that could be utilised in the South African context.

Research on the effects of alternate transportation modes and vehicles contributes to the current body of knowledge on eco-friendly measures.

1.7.3 Warehouse operations

A number of studies have focused on green warehousing from the perspective of supply chain sustainability. For example, Agyabeng-Mensah et al. (2020:4) found that using biodegradable and recyclable material for packaging promotes sustainability. It was also found that green packaging, which involves reducing the number of materials used, optimises space efficiency in the warehouse. More items can be stored on shelves in the warehouse and vehicle loads can carry a higher capacity. Reducing space waste is said to be a good warehouse management system which enhances eco-friendly warehousing (Minashkina and Happonen, 2020). A warehouse's environmental impact is primarily due to energy consumption (Kamarulzaman, Hussin, Abdullah and AbdRahman, 2018). Verma, Malhotra and Rao (2017) established that 90% of energy can be saved by utilising energy efficient lights such as light-emitting diode (LED) and sensor lights

1.7.4 Innovative technology

The fourth industrial revolution (4IR) has opened up a new world for the current generation with its development of AI, robotics, drones and the internet of things (IoT), among others. Studies have shown that embracing IT promotes a company's growth in the market (Agyabeng-Mensah et al., 2019) as it enables customer requirements to be easily met, thus promoting brand loyalty.

1.8 Research methodology

The study adopted a qualitative approach, with data gathered by means of in-depth interviews. Permission was obtained from the participants to record the interviews.

1.8.1 Research design

The study adopted a qualitative exploratory, descriptive research design. This was appropriate as the participants possessed the knowledge required to provide data on the challenges confronting warehousing operations, how distribution practices incorporate sustainability and how innovative technology influences the adoption of green warehouse technology in the food retail industry.

1.8.2 Data analysis

NVivo software was employed to conduct thematic data analysis in order to answer the research questions and achieve the research objectives.

1.8.3 Target population

The target population consisted of employees of Babies R Us, CC Food & Beverage and Sunnyfield. The average warehouse spans more than 69 112 m^2 (Anon., 2017) with around ten managers. The target population was thus 30 possible participants in manager/supervisor positions in three warehouse facilities.

1.8.4 Sample size

The sample size was nine participants made up of three senior employees at each food retail warehouse. These participants were selected based on their knowledge of green implementation.

1.8.5 Sampling strategy

Non-probability sampling was used that selects a sample based on the researcher's judgment. Purposive sampling was employed where the researcher selects participants who possess the specific knowledge and information required to answer the research questions (Etikan and Bala, 2017).

1.8.6 Data collection methods

In-depth face-to-face interviews were conducted to gather data. COVID-19 protocols, including the use of face masks and sanitisers, were observed.

1.8.7 Data quality control

Data quality control measures the trustworthiness of the data collected. It is imperative to practice data quality control as a study's validity depends on accurate data. Sunderland et al. (2019:2) highlight that high quality data promotes reliable results and trustworthy conclusions. Quality data is free of errors, relevant for the study, interpretable and traceable to its source (Vancauwenbergh, 2021). Quality control in this study was achieved by verifying the data's credibility, confirmability, dependability and transferability.

1.8.8 Limitations

The study focussed on small- to medium-sized food retail companies in the Durban area of KwaZulu-Natal province. Given that it covered such a small segment of the national food retail industry, its findings cannot be generalised to the sector as a whole. There were a few limitations, such as a time restriction on conducting the interviews as it was done during working hours, as

well as employee resistance. Employees were unsure about the study's findings being confidential until reassured by the manager and upon signing the informed consent.

1.9 Ethical considerations

The researcher acquired gatekeepers letters from each respondent and thereafter obtained the ethical clearance from the University of KwaZulu-Natal Ethics Committee. The researcher had to respect the decision of the interviewee and their right to refuse to participate. Each interviewee was assured that their identity will be confidential before giving consent to participate. The researcher laid out the study's objectives prior to the consent forms being handed out. Information gathered will be used purely for research purposes and will be destroyed in accordance with the ethical clearance guidelines.

1.10 Dissertation structure

Chapter 1: Introduction to the study

This chapter introduced the background of the study and thereafter reflected on the research problem. The aim of the study was presented through the research questions and objectives which paved the way to the theoretical framework which was then highlighted. Lastly the research methodology was briefly discussed and the chapter concluded with the structure of the dissertation.

Chapter 2: Literature Review

In this chapter a literature review is conducted, which is based on the theories currently available. It reviews the literature relevant to green warehousing in the food retail industry. It discusses distribution practices, warehouse operations and technology innovation. The challenges of green warehousing are reviewed as well as the factors which promote an eco-friendly environment. The chapter also presents the theoretical and conceptual framework that underpinned the study.

Chapter 3: Research Methodology

Chapter 3 discusses the research methodology employed from a scientific point of view. It begins with discussing the research design and approach of the study, indicating the need for a qualitative research structure. The sampling strategy, data collection and analysis were discussed portraying the method in which objectives of the study would be achieved. It also discusses the ethical considerations taken into account and the study's limitations.

Chapter 4: Presentation and Analysis of Data

This chapter portrays the results that were acquired from the data collection method. It further presents and analyses this data gathered from the interviews in line with the study's research objectives and questions.

Chapter 5: Discussion of Results and Recommendations

Chapter 5 is the presentation of the findings of the study, which explains the overall situation of green warehousing in food industries in Durban. This section shows how each research objective was achieved and provides overall conclusions. Data quality control is emphasized along with data saturation. It touches on the contributions of the study and offers recommendations based on the findings as well as suggestions for further research.

Conclusion

This chapter introduced the study by discussing the ongoing green challenges facing the world, as well as presenting a brief background on the food retail industry. It presented the problem statement, the research questions and objectives and the research methodology employed, as well as the study's theoretical framework.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the literature on green warehousing in the food retail industry. It begins with a detailed background on food retailers' practices in the process of going green. This is followed by the presentation of the theoretical framework that underpinned the study. The concept of green warehousing is introduced along with its three logistical components, namely, warehousing operations, distribution, and technology innovation. Challenges related to these logistical components are presented as well as the gap in the literature. The purpose of the review is to highlight the organisational, and technological dynamics of green warehousing and how it impacts not only the company's target outcomes but environmental sustainability.

2.2 Literature review

"A literature review provides a comprehensive overview of literature related to a theme/theory/method and synthesizes prior studies to strengthen the foundation of knowledge" (Paul and Criado, 2020:1). Supply chain management covers the process involved in the lifespan of a good, from the gathering of raw material to manufacturing, distribution and return (Tortorella, Miorando and Marodin, 2017). The process consists of three components, logistics, operations, and procurement. This study on green warehousing focussed on two components of the supply chain, namely, logistics and operations. These can be further broken down into the three categories of distribution, technology, and warehouse operations. Technology focuses on the systems utilised by organisations since the advent of industry 4.0. Distribution involves the logistics side of the supply chain, which is the physical transportation of goods. Kain and Verma (2018:3812) define logistics as the planning involved in the coordination of goods and services from inception to the end customer. Martins et al. (2020:1724) state that operations refer to the activities and processes used in the warehouse which play a vital role in supply chain efficiency. While technology focuses on the current systems utilised, an effective distribution channel, such as a distribution warehouse, is designed to maximise economic and social benefits such as job creation, low vehicle usage, cost reductions and customer satisfaction (Vafaei et al., 2020). Faber, De Koster, and Smidts (2017:1) note that distribution warehouses are the last point in the process where items are stocked, picked, assembled, and distributed; they thus play an important role in the supply chain. The performance

of the warehouse itself is crucial for the success of the supply chain. This study employed a qualitative research method which Sellitto et al. (2019) used to analyse practices which promote eco-efficiency in green supply chain management.

2.3 Theoretical framework

Kivunja (2018:46) observes that every research study requires a theoretical framework that outlines the study's concepts and theories. These theories are drawn from knowledge that has been tested by experts in the field and is used to create a basis for current analysis. This study employed the TOE framework, which focuses on decision-making processes' influence on technological innovation. The framework enables the identification of innovative technology for a specific industry, analyses the structure of the industry, and reviews the organisation's resources and communication processes (Baker, 2011). Hao et al. (2020) used the TOE framework to show that firms that are interested in establishing automated warehouse systems are drawn to green technology as it has been found to increase efficiency. The theory posits that innovation is driven by a company's willingness to innovate, the fast pace of change in modern industry and the technology available in relation to the specific processes employed by the company.

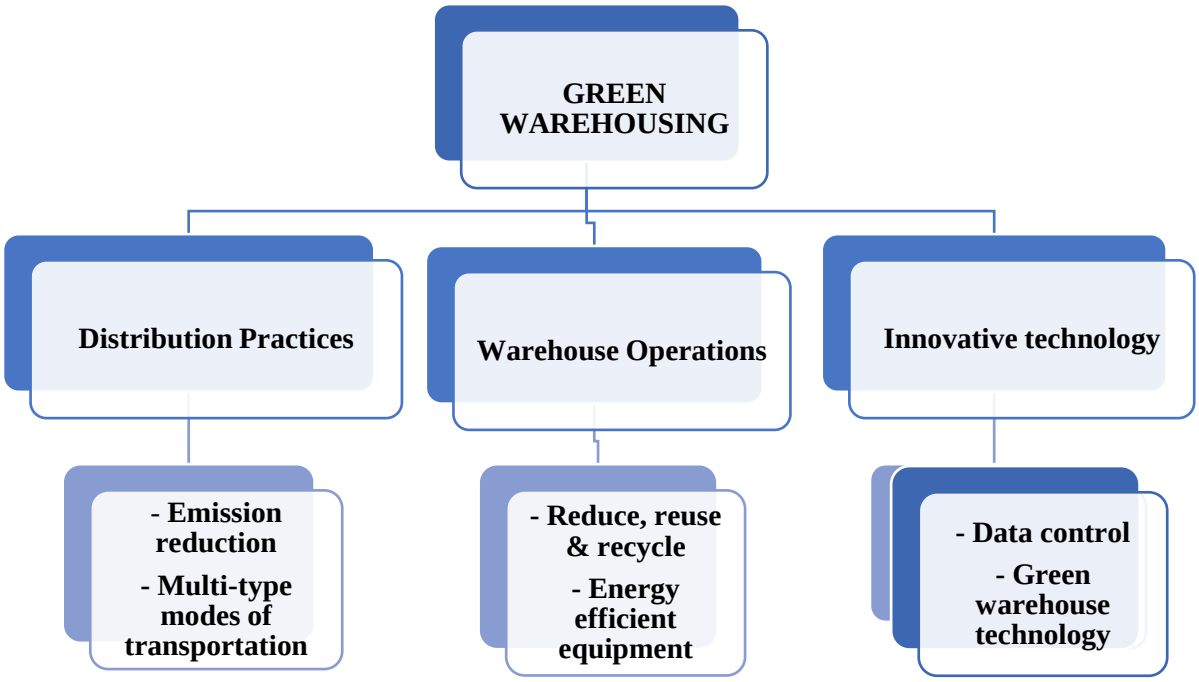
The key components of the theory, namely, technology, environment and organisational, were used to develop two of the study's research questions. Technological advancement in the food retail industry promotes efficient production and distribution, which contribute to environmental sustainability. Innovative technology such as drones, or artificial intelligence (AI) was assessed according to the level of greening that it achieved within the warehouse. Distribution practices were measured in terms of the extent to which they were eco-friendly. Distribution strategies such as the use of autonomous and electric vehicles impact an organisation's competitive edge as, in an ever-changing and growing market, innovation is key to survival. An organisation's ability to acquire and maintain new technologies as well as improve current resources enables it to remain competitive and efficient.

A noted flaw of the TOE theory is that size and innovation are identified as primary factors in the organisational context, yet there is no relationship between the two. Rather than assuming that larger firms are more inclined to innovate, the study sought to identify the resources possessed by the selected organisation that would promote willingness to innovate.

The theory is appropriate to investigate a food retail warehouse's ability to innovate as it enables the organisation to broaden its current process stream and advance technologically, which promotes efficient and effective procedures. These elements can influence the ways in which decisions in relation to innovation and the need for green technologies are made.

2.4 Conceptual framework

Figure 2. 1: Conceptual Framework



Source: Designed by researcher

The conceptual model shows the three components of green warehousing. Each component depicts the individual practices that need to be adopted in order to green the warehouse. The following sub-sections review the literature emanating from the above conceptual framework.

2.5 Green warehousing

A fully performing warehouse inevitably contributes to environmental degradation; therefore, sustainability should be a priority. It is important to reduce the warehouse's negative effects on the environment as much as possible. Bartolini, Bottani and Grosse (2019:243) describe green warehousing as the implementation of environmentally friendly processes that reduce greenhouse gas emissions and energy consumption in the warehouse. According to Grunchman (2019:665),

greenhouse gases are the most potent cause of global warming. The challenges associated with green warehousing include adoption and diffusion. Adoption confirms the decision to implement a new idea whilst diffusion is the process of communicating this new idea to the entire team or organisation (De Vries et al., 2018).

Woolworths, Checkers, Spar and Pick n Pay are among the large food retail companies in South Africa. Woolworths' main goal is providing superior quality and product innovation, although Checkers, Spar and Pick n Pay are increasingly moving in the same direction with upmarket lifestyle stores and food emporiums (Vilakazi et al., 2020). These retail giants are in a state of diffusion as they recognise an opportunity to grow and grab it. Bigger companies are more likely to innovate and follow through successfully, whilst smaller companies have much to lose when taking such a decision.

Innovation requires an organisational culture that inculcates the will to innovate and adopt new ideas (Mazzarol and Reboud, 2020). Adoption is a difficult step as companies need to be convinced that an initiative will succeed. Reluctance to do so is sometimes due to a lack of technological solutions that fit with the organisation's operations. Developed economies are home to many companies that are well-versed in technology and can offer efficient and effective solutions. Once implemented, an innovation will either become accepted general practice or fail to achieve its objectives. Adaptation to change is also a prerequisite for the adoption of green practices to combat environmental degradation.

Numerous methods can be adopted to initiate green warehousing. Although this is a time-consuming and costly process, it is beneficial in the long run. The benefits of green warehousing include reduced energy consumption, energy costs and greenhouse gas emissions (Bartolini et al., 2019).

Table 2. 1: Green warehousing practices

Rank	Green practices	Methods
1st	Eco-driving	Training drivers to drive in an environmentally friendly manner; assessing and monitoring drivers' fuel consumption; optimising vehicles' energy efficiency through regular maintenance
2nd	Alternative energy	Utilising alternative energy/fuel sources such as biofuel which causes less emissions; switching to modern or more energy-efficient vehicles; using hybrid electric vehicles
3rd	Modal shift	Changing transport mode from road to rail, sky or sea; implementing integrated delivery systems; intermodal and multimodal transport
4th	Vehicle routing	Optimising transport routes to reduce miles; optimising transport load distribution; full vehicle loading; using IT applications for vehicle routing and scheduling
5th	Green packaging	Reusing recyclable or reusable packaging and containers; substituting environmentally friendly materials for harmful ones; reducing packaging; recycling waste from warehousing activities
6th	Technology	Utilising automatic identification technology; controlling the efficient flow of data to all sectors; optimising warehouse management systems

Source: Designed by researcher (Adapted from Jazairy, 2020; Sureeyatanapas, Poophiukhok and Pathumnakul, 2018).

Table 2.1 shows the level of importance of the green practices adopted by organisations. These ranks were employed to examine the selected food retail organisations' operations. Jazairy (2020) found that behavioural practices such as eco-driving techniques proved to be the simplest strategy to achieve green success. The lowest priority is given to practices which involve more time and money.

2.6 Distribution practices in warehouses

In breaking down the negative effects of distribution on the environment, this section examines how emissions can be reduced as South Africa is one of the highest producers of emissions. Multimodal transportation is also highlighted as an alternate option to green the distribution process.

2.6.1 Emission reduction

Emission reduction is imperative in GL as transportation accounts for the highest impact. Sureeyatanapas et al. (2018:5) note that route planning is effective in reducing emissions by delivery vehicles. Delivery routes are designed with the aim of completing all the tasks assigned

in the least possible time and distance (Lu and Ya-Yang, 2018). Grunchmann (2019:670) states that minimising the distance travelled through efficient route planning and optimisation of loading space in the vehicle reduces pollution and energy consumption. While most studies highlight the role of route planning in efficient distribution, others (Trivellas, Malindretos and Reklitis, 2020) note that electric vehicles are more efficient in decreasing air pollution and greenhouse gas emissions. Electric vehicles are the cleanest option as they emit zero emissions (Moghdani et al., 2021). However, they cannot travel long distances and are typically slower than the average car (Habich-Sobiegalla, Kostka and Anzinger, 2018). Using electric vehicles to distribute fast-moving food items could prove to be a major inconvenience due to the longer delivery times. They thus cannot be considered a greening solution.

Moreover, Buresh, Apperle and Booysen (2020:132) found that electric vehicles in South Africa produce more emissions than vehicles that use petrol due to the country's dependence on coal to produce electricity. Charging an electric vehicle during the day using solar power reduces the carbon footprint; however, such vehicles are costly and constantly need to be charged. While some commentators nonetheless argue that this is a viable future option, Abraham et al. (2021) are of the view that, given that South Africa is a developing country with a low-capacity carbon grid and fragile electricity grids, electric vehicles' potential is questionable.

In the context of green warehousing, route planning is a more cost-effective alternative than the use of electric vehicles. Baah, Jin and Tang (2019) found that cleaner fuel injection contributed to sustainable transportation as did efficient route planning. Many studies highlight that distribution is the main source of high emissions, which led Grunchmann (2019) to recognise the need for route planning systems that simplify the prevention of environmental pollution and decrease energy consumption. The systems should also consider efficient utilisation of vehicles. Song et al. (2020) centred their research on issues such as loading pallets with only one customer's order to ensure quicker, more accurate delivery. The authors also highlighted the last in first out (LIFO) concept, which enables orders to be unloaded without reorganising or shifting other orders for later delivery. A similar study by Lu and Ya-Yang (2018) introduced a hybrid approach to route planning, which effectively improved the use of space in a vehicle. This is achieved by adding pick-up packages to the delivery schedule to avoid double trips. Another approach is to shorten trips or reduce the number, which decreases emissions and enhances eco-efficiency in the distribution chain. Mbhele

and Pillay (2015:48) also note that the adoption of green practices improves a business's image, while reduced routing schedules through central hubs minimise unnecessary transportation.

Research (Rose, Chew and Hamid, 2018) has shown that the adoption of a broader perspective of green transportation that embraces vehicle maintenance reduces the leakage of harmful fluids. This study focused on eco-efficient environmental logistics as the driver of a sustainable organisation.

2.6.2 Multimodal transportation

Road transport has developed and become much more intricate over the past few years, making a major contribution to environmental pollution (Urbanek, 2021). Li et al. (2020) showed that fuel consumption and carbon emissions are reduced when multi modes of transportation are used. There is a paucity of research on the specific types of vehicles or the different modes of transport that could be utilised in the South African context. Research on the effects of alternate transportation modes and vehicles contributes to the current body of knowledge on eco-friendly measures. Since the start of the COVID-19 pandemic, there has been serious pressure on supply chains, which has impacted their performance and efficiency. This has prompted further research on multimodal supply chains and their ability to cope with the pressure of change (Beresford et al., 2020). Multimodal transportation refers to the transportation of goods involving two or more modes of transportation. Pinchasik et al. (2020:1) state that long distance travel is more efficient when initiating modal shift, as water and rail are more energy efficient than road transportation. Salvucci, Gargiulo and Karlsson (2018) highlight that CO_2 emissions are reduced when shifting from road to rail or sea. These modes also contribute to a decrease in traffic congestion, accidents, and noise. While this may be the case in Europe, South Africa does not have an easily accessible rail network. Thus, each country will be faced with different modal shifts depending on the available transport infrastructure. Whilst modal shift may be a viable option for greening the distribution sector, Kaack et al. (2018:2) assert that there is still a need for transport at the origin and destination of a journey as distribution centres, warehouses and hubs are mainly located inland; thus, only certain parts of distribution can be shifted from road transportation.

In the context of road transportation, the use of vehicles that rely on cleaner fuel could result in more efficient distribution and thus decrease CO_2 emissions. Many industries are turning their attention to emission control. Given that South Africa is one of the top CO_2 emitters in the world, government has adopted measures such as a carbon tax, shifting to cleaner energy and setting a

carbon emission cap (Garidzirai, 2020). The carbon tax was introduced in 2019 and was initially set at R120 for one ton of CO_2 equivalent (CO2e). A tax free emission (60%–95%) is also applied that could reduce the carbon tax rate to R6. This is arguably too low to have any substantial impact on the country's emission levels (Nong, 2020).

Greenhouse gas and CO_2 emissions have been the focus of attention in the automotive industry (Iuga, Popa, and Popa, 2019). Storage methods also differ when using alternate vehicle types with better spacing and storage options. This was further investigated in the selected food retail distribution sector.

2.7 Warehouse operations

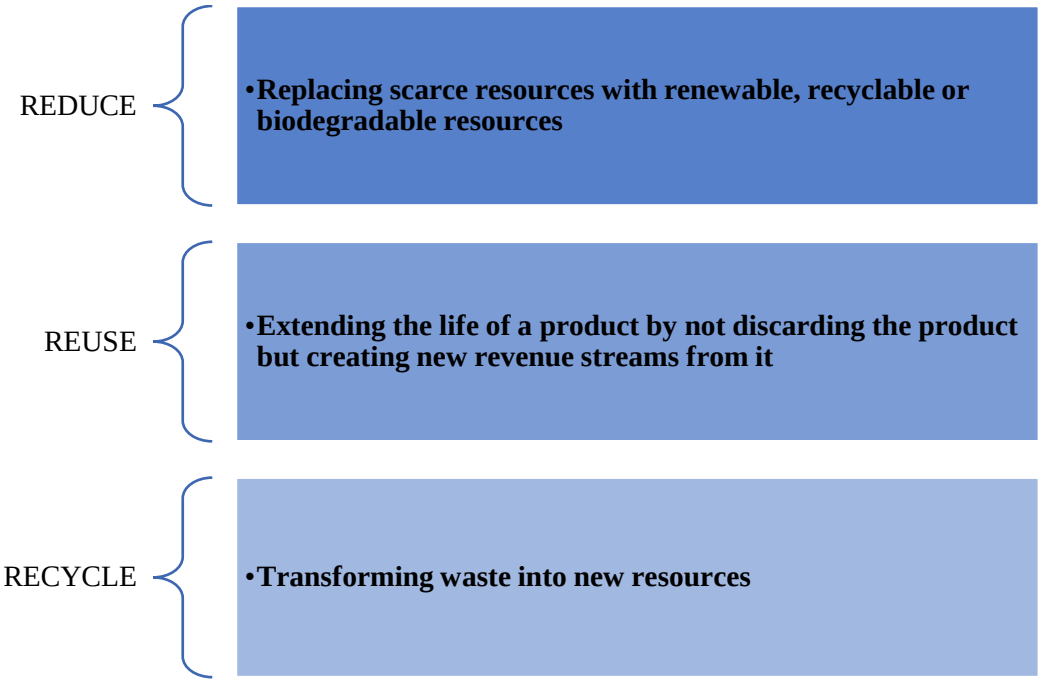
2.7.1 Reduce, Reuse, Recycle

A number of studies have focused on green warehousing from the perspective of supply chain sustainability. For example, Agyabeng-Mensah et al. (2020:4) found that using biodegradable and recyclable material for packaging promotes sustainability. It was also found that green packaging, which involves reducing the number of materials used, optimises space efficiency in the warehouse. More items can be stored on shelves in the warehouse and vehicle loads can carry a higher capacity. Kibler et al. (2018) focused on recycling targeting food waste. Lin (2013 cited in Kibler, 2018:59) found that molecules such as proteins and carbohydrates found in food waste could be used for chemical production in the feedstock, pharmaceuticals, and cosmetics sectors; however, pre-treatment is an expensive and necessary step to produce the required chemicals. This strategy is unlikely to gain widespread acceptance as it involves costly manufacturing processes that result in higher in-store prices. Hao et al. (2020) also mentioned that reducing space used, by 50% in the warehouse is the aim in order for more products to be packed. Reducing space waste is said to be a good warehouse management system which enhances eco-friendly warehousing (Minashkina and Happonen, 2020).

Figure 2.2 explains the main aspects of the three Rs (Reduce, Reuse, Recycle). Their adoption contributes to a more sustainable warehouse and supply chain. Sustainable practices need to be developed over time using information technology (IT) that has been used to develop many systems to manage logistic activities in order to reduce pollution and waste as well as develop eco-efficient products (Agyabeng-Mensah, Ahenkorah and Korsah, 2019). Indeed, IT is said to be the backbone of GL management. For example, a recent study found that replacing synthetic fibres

with natural fibres went a long way in addressing current warehouse challenges. “Natural fibre composites, in the form of panels, tubes, sandwich plates, have been used to replace wooden fittings, and fixtures, for furniture, and noise insulating panels in the last decade” (Sanjay et al., 2017:5).

Figure 2. 2: Reduce, Reuse and Recycle Framework



Source: Designed by researcher (Adapted from Goyal, Esposito and Kapoor, 2016)

In promoting environmentally-friendly practices, suppliers will also need to be selected according to their environmental standards, which will create a group of suppliers who are dedicated to green supply chain management (GSCM) practices (Teixeira et al., 2018). Ayabeng-Mensah et al. (2019) state that supplier quality integration also motivates a company to develop green policies such as recycling packaging, etc.

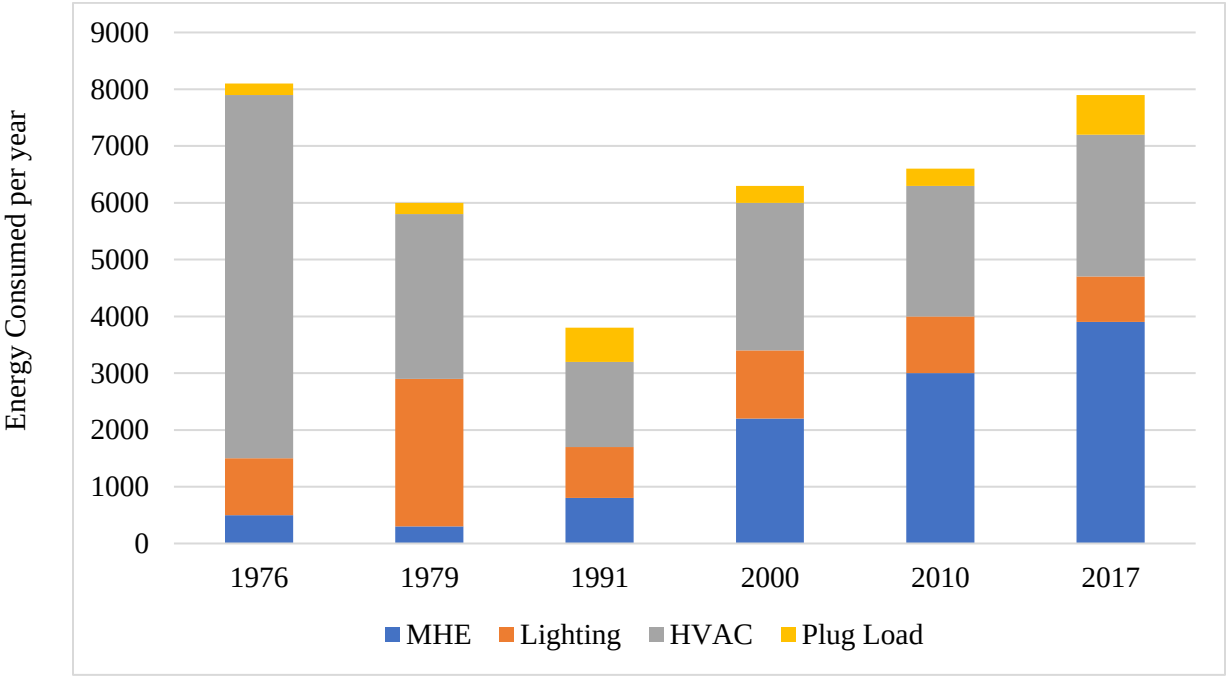
2.7.2 Energy efficient equipment

A warehouse’s environmental impact is primarily due to energy consumption (Kamarulzaman, Hussin, Abdullah and AbdRahman, 2018). Verma, Malhotra and Rao (2017) established that 90% of energy can be saved by utilising energy efficient lights such as light-emitting diode (LED) and sensor lights. Ries, Grosse and Fichtinger (2016) also indicate that emissions can be reduced by around 10% by improving the insulation and lighting of a warehouse although the former needs to

be upgraded more often than the latter. Temperature control is also a vital part of energy efficiency that spans every process in the warehouse from transportation, and storage to office operations. Over- or under-cooling increases the use of energy in the warehouse (Helo and Ala-Harja, 2018). Several technologies and methods are available that promote energy saving in a warehouse, the simplest being the use of fuel-cell battery-powered forklifts (Kamarulzaman et al., 2018).

Carlie et al. (2019) offer insight into how energy is consumed in a warehouse. Material handling equipment (MHE) such as forklifts and conveyor belts as well as heating, ventilation, air conditioning (HVAC), lighting, a computer power supply and catering appliances all consume energy.

Figure 2. 3: Energy consumed by warehouses



Source: Carli et al. (2019)

Figure 2.3 illustrates a steady increase in energy used in a warehouse as the years go by. It is taken from Carli et al. (2019) who researched eco-friendly equipment in a warehouse which could reduce energy consumption. The study shows that as time passes, more and more energy is utilised in the warehouse, with a concomitant increase in costs. The energy consumption of materials handling equipment like forklifts and conveyor systems increased by up to 77%, highlighting that energy efficiency should be a priority.

This study thus examined energy efficient measures in the warehouse, the challenges with regard to implementation, and measures that could further reduce emissions such as the use of energy efficient equipment. The aim was to identify key energy wasters in the warehouse as well as challenges that can be mitigated by energy efficient solutions.

2.8 Technological developments

2.8.1 Data control

The fourth industrial revolution (4IR) has opened up a new world for the current generation with its development of AI, robotics, drones and the internet of things (IoT), among others. Studies have shown that embracing IT promotes a company's growth in the market (Agyabeng-Mensah et al., 2019) as it enables customer requirements to be easily met, thus promoting brand loyalty.

Many warehouse activities rely on technology which is only reliable when data is accurate. Technologies such as the loT assist in collecting and processing data (Motlagh, Mohammadrezaei, Hunt and Zakeri, 2020) to provide accurate information on distribution, suppliers, and the volume of emissions. Mathu and Phetla (2018) found that technology enhanced supply chain operations in the food industry by facilitating information flow and process speed. Agyabeng-Mensah et al. (2020) concluded that the ability to respond efficiently to customer demand, which is made possible by technological developments, results in increased sales.

Information sharing reduces the order cycle and enables a high order fulfilment rate in the FMCG industry (Mbhele, 2015). Many organisations process large volumes of data that cannot be analysed manually. Big data analysis offers a wide range of applications that can be used to detect patterns, etc. When data cannot be updated in real time, it is difficult to share information with other supply chain members. Data leakage is also possible (Tan et al., 2020). Blockchain systems were developed to alleviate challenges with manual data interchange. This system allows data to be stored in a shared location. The data is constantly updated, promoting transparency, traceability and decentralisation (Dwivedi et al., 2020).

Technology innovation is a costly investment; however, it reaps eco-friendly rewards. Information communication technology applications enhance food supply performance by improving quality control and evaluating key factors that impact food distribution, thereby promoting sustainable

development (Singh et al., 2019). This study built on current knowledge of innovative technology and its benefits in the food retail warehouse.

2.8.2 Green warehouse technology

Jepherson et al. (2021:1) state that warehouse management systems have a major influence on the performance of the supply chain, including optimal stock control, fewer stock retrieval errors and increased productivity. This study examined the different green warehouse systems and technology used by the selected food retailers and their contribution to willingness to innovate and implementation of innovations. Hao et al. (2020) refer to automatic warehouse systems (AWS) as a form of green technology, which gives rise to energy and cost savings. It also improves warehouse efficiency. Miniashkina and Happonen (2020:2) investigated automation and digitalisation strategies to add value and efficiency to operations. An example is warehouses with solar panels installed on their roofs to reduce CO_2 emissions. Makro, a large food retail organisation, has installed solar panels in its parking lot.

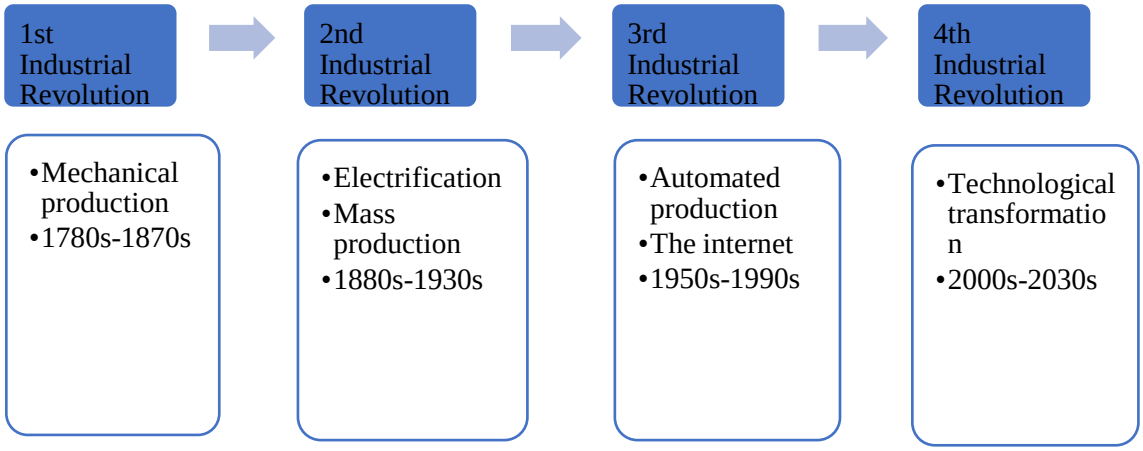
Kamali (2019) highlights the use of automatic identification technology such as barcodes and radio frequency identification (RFID), which track storage units and individual items in the warehouse. This system eliminates human error because it is accurate and reliable in storing, retrieving, and dispatching goods. Drones are also used to track units; these can be used to find goods at high altitudes which normal warehouse vehicles cannot reach (Marchuk et al., 2020). Behun et al. (2020) found that RFID chips placed directly into items provided useful information such as identification for storage, the manufacture timestamp, and the quantity and description of goods. The aim was to monitor the movement of items or containers from the onset of distribution. While this eliminated errors that occurred in manual data processing, the technology also decreased the need for employees. Stopka and Luptak (2018) applied the same method for optimised warehouse management. Further investigation found that barcodes are a cheaper alternative than RFID and are also the most widely used automated identification technology.

Many different activities fall under warehouse operations, including outbound and inbound deliveries, storing and packaging of goods, among others. Kamali (2019:10) asserts that automating these activities eliminates redundant operations, with innovative technology reducing operation costs by 30% over the following few years.

2.9 The role of the fourth industrial revolution

The 4IR has created the possibility of diversifying products by means of automation and increasing organisations' competitive advantage (Zunino et al., 2020:1).

Figure 2. 4: The four industrial revolutions



Source: Designed by researcher (Adapted from Kayembe and Nel, 2019)

Figure 2.4 shows that, during the first industrial revolution in the 1780s, when mechanical manufacturing took the world by storm. The second industrial revolution was marked by mass production, while the third of the 1970s saw the development of computers. The 4IR focuses on key technologies such as AI, the IoT, robotics and blockchain (Chung, 2021:6). The role of the 4IR in green warehousing is to promote enhanced productivity through innovative technologies, one such being an AI robot which transports goods (Nahrawy, 2020).

2.9.1 Autonomous vehicles

Autonomous vehicles drive on their own using smart technology which picks up the intentions of others on the road (Fanoro et al., 2021:6). These vehicles can ideally be utilised for simple trips at short distances. This type of technology is designed to reduce accidents and prevent injury, ultimately, they can be used to simplify distribution as well as decrease costs.

2.9.2 Blockchains

A blockchain can store and share data without the risk of it being lost, erased or changed; such data is accessible to everyone which facilitates data sharing (Motlagh et al., 2020). These aspects

are critical factors in greening a warehouse as all information needs to be clear and easily assessable in order for processes and procedures to run smoothly. Initiating block chains in business also promotes trustworthiness and transparency among the various chains.

2.9.3 Internet of things

The internet of things (IoT) is a form of technology which collects huge volumes of data and enables it to be interpreted for information that can be used for tracking, monitoring, and forecasting as well as to create an intelligent warehouse and transport management system (Hamdy et al., 2020:60). Various IoT technologies promote efficient, up-to-date processes that give organisations a competitive edge.

2.9.4 Artificial intelligence

The artificial intelligence (AI) process involves inputting human intelligence into a machine to enable it to perform complex tasks (Li, 2021:2). This computer enhanced system reduces errors, provides an unbiased method and is always available and ready. Technologies such as AI take green warehousing to the next level and enable fewer resources to be used to complete a task.

2.10 Conclusion

Based on the literature, warehouses need to focus more on green warehouse practices to remain sustainable. Given the many challenges in terms of its implementation, this is a lengthy and costly process. Against this background, the study sought to better understand the intricacies of distribution, technology innovation and warehouse operations in specific warehouses to promote sustainability and eco-friendly practices.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The research methods show how a researcher designs a study to ensure valid and reliable results which address the research objectives. The research methodology describes the procedures employed to solve the research problem (Mishra and Alok, 2017).

3.2 Research design

An exploratory, descriptive research design was employed to establish the green warehousing practices currently used in the food retail industry and to identify improvements. Descriptive research assesses the current state of a phenomenon while exploratory research seeks to discover new themes in order to improve the existing phenomenon (Rahi, 2017).

A research philosophy is the researcher's perception of what constitutes truth, reality, and knowledge (Ryan, 2018). The choice of a qualitative study was the result of three philosophical positions, namely, ontology, epistemology, and axiology. This study was located within the interpretivist paradigm. Interpretivism believes that knowledge is subjective and based on the experiences of participants and their understanding of the world. In this study, the philosophical beliefs and values of the researcher guided the research design, data collection, and analysis.

3.2.1 Exploratory design

An exploratory design is used when little is known about the phenomenon under investigation. It enables the respondents to proffer new ideas and knowledge (Hunter et al., 2019). An exploratory research design enables the researcher to identify aspects that call for further investigation. It is a learning process and a way to understand what is happening from a different point of view. One-on-one interviews were conducted as part of this design to enable the researcher to identify challenges and gaps in green implementation in food retail warehouses.

3.2.2 Descriptive design

A descriptive research design aims to identify and describe a phenomenon in a straightforward manner. It enables the researcher to establish who and what was involved as well as when, where

and how it took place (Hunter et al., 2019). This study thus aimed to identify current patterns in an existing phenomenon in order to better understand the issues surrounding it.

3.3 Research approach

Three approaches can be used to conduct social research, namely, qualitative, quantitative, and mixed methods. This study adopted a qualitative approach.

3.3.1 Qualitative approach

Qualitative research describes, and analyses data based on respondents' experiences that they express in their own words and assumes that these subjective descriptions are valid (Creswell et al., 2017). It enables the researcher to assess the participants' behaviour, personal motivation and attitudes and make deductions by identifying the themes in the data.

3.3.2 Quantitative approach

A quantitative approach transforms aspects of social behaviour into reliable quantifiable data that can be represented numerically and analysed by means of statistical techniques (Rahman, 2017). It requires the researcher to mathematically measure data to produce results. This approach was not employed as the study aimed to explain things that will occur under certain conditions.

3.3.3 Mixed methods approach

The third approach is mixed methods, which is a combination of the qualitative and quantitative approaches (Creswell and Creswell, 2018). A researcher utilising the mixed methods approach is able to present statistical findings while also presenting each respondent's personal experiences.

3.4 Sampling strategy

Probability and non-probability sampling are used to select a sample for a study. This study utilised non-probability sampling that is based on the researcher's judgment. Examples of non-probability sampling include purposive, snowball, and quota sampling (Sharma, 2017). This study employed purposive sampling, which selects participants with the specific knowledge and information required to answer the research questions and is able to freely share this information (Etikan and Bala, 2017). Purposive sampling ensures that the targeted group is able to provide relevant information to answer the key research questions. The sample comprised managers and supervisors with adequate knowledge of processes within the warehouse who could thus provide insight into the topic.

3.4.1 Non-probability sampling

Non-probability sampling measures a small portion of the population to estimate the characteristics of the population as a whole (Cornesse et al., 2020) This type of sampling was used as it enabled the researcher to obtain the most suitable results.

3.4.2 Probability sampling

In probability sampling, all of those in the study population (Wisniowski et al., 2020) are viable respondents. While it can facilitate unbiased outcomes, a larger sample is required to promote accuracy. It was thus not suitable for this study.

3.5 Target population

The target population consisted of employees of Babies R Us, CC Food & Beverage and Sunnyfield. The average warehouse spans more than 69 112 m^2 (Anon., 2017), each with an estimated ten managers. The target population was thus 30 participants in manager/supervisor positions in three warehouse facilities.

3.6 Sample size

A sample size is selected as it is usually impossible to cover the entire population (Andrade, 2020). While the sample size is determined by data saturation, it was expected that a sample of nine participants would be sufficient to reach saturation. Guest et al. (2020 cited in Morgan et al., 2002:2) found that data saturation is attained during the first five to six interviews and that very little new information is obtained as the 20^{th} interview is reached. Taking this into consideration, a total of nine participants were interviewed

3.7 Research instruments and data collection

The qualitative data was collected using two instruments: (i) the researcher as the key instrument and (ii) an interview schedule. The method used for data collection was in-depth interviews. Qualitative research offers unique opportunities to access intricate details regarding key decision-makers' perceptions and opinions (Nir, 2017). This methodology enabled the researcher to extract relevant data through direct engagement with managers in the selected food retail warehouses in Durban, South Africa. The in-depth interviews were designed to collect data on the factors affecting green retail warehousing operations and the challenges, how green distribution practices enhance sustainability as well as the use of innovative technology to create an eco-friendly environment. Interviews were conducted in person in accordance with COVID-19 protocols of

each company. The interview schedule consisted of four sections: Demographic characteristics; Section A – Warehouse; Section B – Distribution; and Section C – Technology. Permission was obtained to audio record the interviews.

3.8 Data analysis

Thematic analysis was used to analyse the qualitative data collected by means of in-depth interviews. Thematic analysis sifts through data, categorising it and identifying themes from the categories to present an overall storyline (Mojtaba and Sherrill, 2019). The themes were analysed in line with the research questions.

Thematic analysis was performed on the verbatim transcriptions of the in-depth interviews. NVivo® 12 computer software was employed to perform content analysis (NVivo, 2018). This software enables efficient data storage and coding operations (Creswell, 2009). The iterative approach used to code the interviews assisted in the development and modification of the coding system, as well as the determination of when data saturation was reached (Fush et al., 2015; Saunders, 2017). The categories identified aided the structuring of the material in line with the study's aims and objectives and the literature review (Guest et al., 2012).

The coding involved the following iterative steps: The complete transcript was read to obtain a general feel of the facts. The content was summarised using codes to describe, evaluate, and critically assess the data, resulting in a code report. The code report involved the development of themes from the transcripts. The interview material was coded and related concepts were grouped under a single heading called a 'node' to be used in later data analysis. After coding the material, NVivo highlights selected text and assigns a particular colour to the coding stripes. Initial themes were developed from the interviews and following the coding of large chunks of verbatim data, terms with comparable meanings and the context and reference (the participant's identifying code) were combined into categories by classifying and integrating coded units of data, as advised by Saldana (2021). The nodes were then merged into hierarchies, creating main themes and sub-themes. The researcher then re-examined the qualitative categories to identify any duplication or possible relationships or patterns in the data. These were grouped into broad categories. The findings of this study were reported in the final descriptive summary, which included themes and important points from the code report as well as quotes from the participants.

3.9 Limitations

The results from this study cannot be generalised to all food retail warehouses as it only covered three small to medium size warehouses in Durban. This limitation was addressed by adopting an exploratory rather than explanatory research design. There were other restrictions such as the time limit given for the interview process as well as a slight resistance from the employees. There was some uncertainty on the confidentiality of the research at first. All participants were assured with the signing of the informed consent form.

3.10 Ethical considerations

Ethical clearance was obtained from the University of KwaZulu-Natal as well as a gatekeeper's letter from each food retail warehouse. Informed consent was obtained from each participant while the researcher also ensured the participants understood the nature of the study. Professional integrity and honesty were upheld and the participants were assured that confidentiality and their privacy would be maintained.

3.11 Data quality control

The trustworthiness of a qualitative study is measured in terms of credibility, confirmability, dependability, and transferability. Credibility ensures that the research methodology aligns with the research questions, data collection methods, and findings. Confirmability refers to the relationship between the data and the results, which can be supported by other researchers' analyses. Dependability shows that the research is easy to read and follow (Stenfors, Kajamaa and Bennett, 2020).

3.12 Conclusion

This chapter discussed the various strategies adopted to achieve the study's objectives. It described the research design and philosophy, and the qualitative method adopted. The chapter also discussed the study population, sampling technique and data collection and analysis, as well as the study's limitations and the ethical considerations taken into account.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF DATA

4.1 Introduction

The previous chapter presented the research methodology employed to conduct the study. This chapter presents and analyses the data collected by means of in-depth interviews. Thematic analysis was employed and three key themes and several sub-themes were developed. Each theme addressed one of the core research objectives.

The study's objectives were:

- To identify the challenges confronting green retail warehousing operations in selected organisations in the food retail industry.
- To assess the extent to which retail warehouse distribution practices promote an eco-friendly environment.
- To assess how innovative technology influences the adoption of green warehouse operations.

The three key themes that were developed from the data are warehouse operations, warehouse distribution practice and warehouse adoption of technology.

4.2 Sociodemographic Characteristics

Nine participants employed in managerial positions in the three warehouses were interviewed. Table 4.1 below presents the participants' sociodemographic characteristics.

Table 4. 1: Sociodemographic Characteristics of Participants

Participant's ID	Age group (In years)	Educational Qualifications	Job Title	Years of Employment
Participant 1	30 – 40	Diploma in Business Administration	Distribution Supervisor	2
Participant 2	30 – 40	Matric	Warehouse Assistant	5
Participant 3	30 – 40	Matric	Admin/Warehouse Branch Manager	4
Participant 4	40 – 50	Matric	Distribution Manager	13
Participant 5	50 – 60	Mechanical Engineer	Factory Manager	11

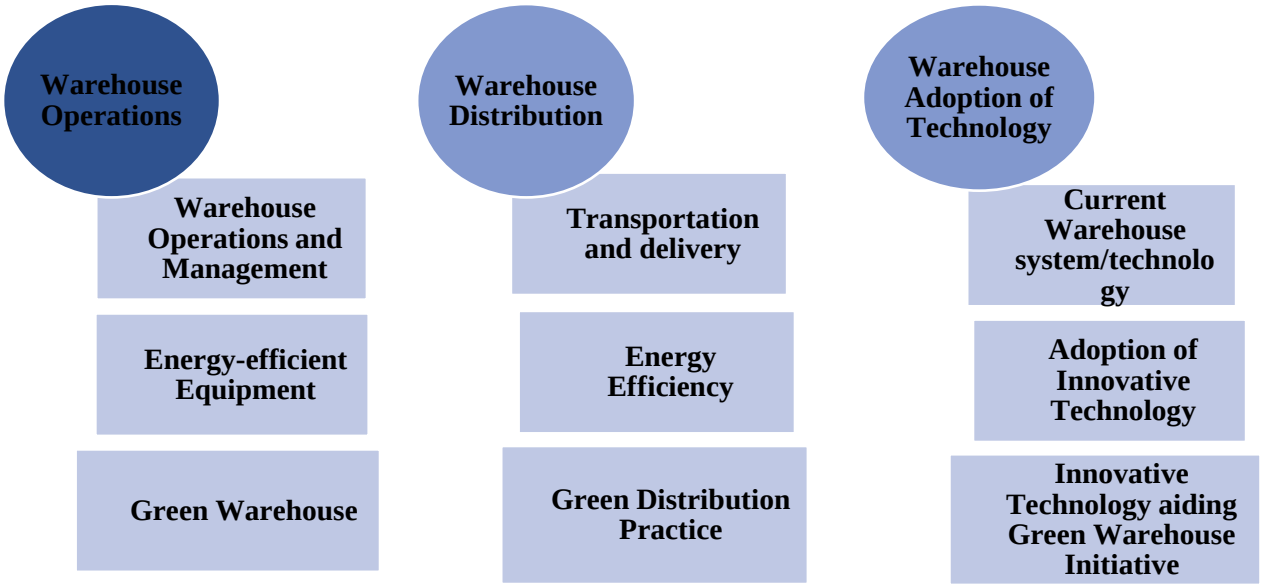
Participant 6	20 – 30	BCom in Supply Chain Management	Warehouse Co-ordinator	2
Participant 7	40 – 50	BSc	Logistics Co-ordinator	10
Participant 8	40 – 50	Matric	Operations	10
Participant 9	30 – 40	BCom degree	Designer	7

Source: Researcher, 2022

4.3 Data presentation

The analysis of the interview data generated key themes and sub-themes. The key themes included warehouse operations, warehouse distribution and warehouse adoption of technology. The participants were assigned numbers, e.g., P1. The themes and sub-themes are listed in the figure below.

Figure 4. 1: Main themes and Sub-themes

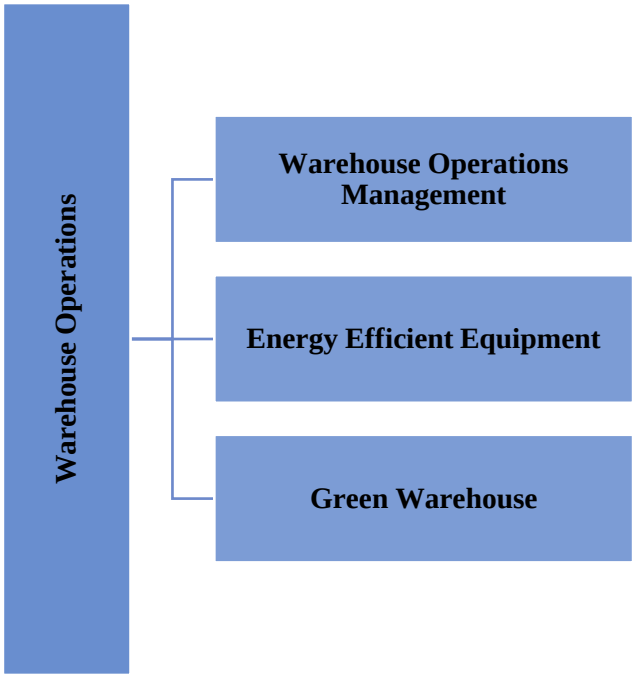


Source: Researcher, 2022

4.4 Theme 1: Warehouse Operations

This theme focused on warehouse operations and management, energy-efficient equipment in the warehouse and what has been done to achieve a green warehouse in the participants' companies. The diagram below presents a breakdown of this theme.

Figure 4. 2: Warehouse operations sub-themes



Source: Researcher, 2022

The key theme is on the left and the sub-themes are on the right. The sub-themes are presented in detail below.

4.4.1 Warehouse Operations and Management

This section evaluates stock keeping, space utilisation, recycling and packaging, environmental impact, efficient warehouse operations, and possible improvements.

4.4.4.1 Stock keeping and space utilisation:

Stock keeping decisions impact space utilisation in the warehouse and are accompanied by the risks of excessive stock holding, insurance costs and obsolescence. Proper planning and efficient stock and/or inventory management are essential for warehouse operations and management. P2 commented: *"Our stock is not seasonal; we keep bulk stock as it is more efficient for us. The planners decide when they want the stock to go to each store, it depends on how fast stock is selling out in store".* Stock ordering, receiving and distribution systems are adequately planned. P5 noted

that *"We are fully FMCG, so what comes in today goes out within the month. Due to expiry dates we cannot keep our products for long periods. We use the FIFO method"*.

P8 was of the view that *"keeping stock keeping depends on the product. How long it stays in the warehouse depends on the product, as some stock will be distributed while some still remain in the container it came with, and one container will be in the ship while another is being manufactured".* P8 noted that: *"We always keep one container of one item in the warehouse, one container is always on the ship in transit and one container being manufactured".*

These comments were made in relation to non-perishable goods. All the participants except for P2 reported that they do not store perishable goods. P2 reported that "*they keep perishable goods for a short time as they are stored at room temperature with no fridges needed".* The space in the warehouse seems to be insufficient for a refrigerator or cold room. Most of the participants reported that no strategy existed to ensure efficient space utilisation. P2 stated that *"We do not have a method of efficient space utilisation. There are errors made because of this, but we follow procedures. We just work by eye, but high value items are stored in a caged area".* P8 said: *"Each product has an allocated slot, there is no system to help maximise space. Everything is done by eye. Each item has its own space, but we also allocate more space to smaller items [when] … a large amount [of] stock is due to come in".*

P5 was the only participant who reported that a plan was in place in this regard: "*They have a system, there is a plan for how goods come in and how it goes out. Furthermore, a storeman communicates to the heister driver which passage needs to be open and which items need to be moved out and relocated so new items are correctly placed".* This participant added that *"there is a daily inspection",* and that they know in advance which items are coming in. Proper utilisation of space calls for adequate planning on the inbound and outbound operations systems. Efficient stock management and delivery reduces errors and enhances environmentally-friendly packaging and recycling processes in the warehouse.

4.4.4.2 Packaging and recycling

Packaging systems are shifting to more environmentally-friendly components and warehousing operations are moving towards recyclable and biodegradable materials. P2 commented: "*yes, we use recyclable and biodegradable materials in packaging".* However, in response to a question on the type of materials used in packaging and manufacturing items, P2 contradicted this statement:

"*No, I guess we cannot fully say we are thinking of the environment when we do not know what packaging we keep and dispose of".* In contrast, P5 and P8 claimed to *"know the type of materials that are used for packing and manufacturing.*" This is positive as knowledge of the packaging used will enable appropriate waste disposal, and reduce negative environmental impacts. However, it was found that some companies do not have effective waste disposal systems. They work with a lot of plastics and sell this waste without knowing what it will be used for. Participant 2 remarked: *"We are very backwards with waste disposal; we have a lot of plastic waste. Most of the time it is taken to the landfill, or a few Pakistani men come and buy the bubble wrap now and again".* Participant 5 noted that, *"Recycling companies come and buy the waste and rework it."*

In summary, while there appears to be some level of appropriate waste management and disposal in these warehouses, practices persist that negatively impact the environment.

4.4.4.3 Environmental Impact

The participants were of the view that they had negatively impacted the environment with their manual systems but stated they were taking steps to embrace green alternatives. P2 felt that, "*We are quite good when it comes to impacting the environment positively. We are in the process of installing energy efficient lighting, although we have a lot of paper waste as well since we are paper based when picking goods. This … negatively impacts the environment".*

P5 stated that, *"with accurate disposal of waste and installation of sensor lights, their negative impact on the environment is at a low level".* Lower energy consumption, and accurate and efficient waste disposal mitigate the negative impact on the environment. However, P8 noted: *"We do not have any energy-efficient lighting; [this] … impact[s] the environment negatively by means of energy wastage. I think there are positive impacts on the performance of the company when using energy-efficient equipment".*

Thus, more needs to be done in these warehouses to ensure efficient energy consumption and effective waste disposal to reduce the negative impact on the environment.

4.4.4.4 Efficient warehouse operations

The warehouses' efficiency and budgets for green outcomes were assessed to measure their impact on the environment.

All the participants stated that their warehouse operations are quite efficient. P5 said that they have a "*double-check system. two managers monitor the staff and their time efficiency"*. P8 reported, "*We do a check every month of packaging. If there was a spike in wastage, we try to find … the reason. We also have quality checks in place for correct order picking."* P2 also pointed to the need for proactive management: "*The managers group all staff and ask them how we can make a change to do things differently and better. They ask for everyone's input about communication as well."*

Effecting changes to ensure a smooth-running warehouse calls for financial resources. P8 and P2 stated that no budget had been allocated for warehouse improvements, although P2 added that, *"when we notice a need for change and improvements then yes, a budget is put together"*. Only P5 said that the company had a budget for warehouse improvements. Thus, financial resources need to be set aside to improve packaging, and waste recycling and to minimise errors.

4.4.2 Efficient Warehouse Equipment

The type of equipment in the warehouse, its ongoing maintenance, and the challenges of installing and implementing systems influence a warehouse's energy efficiency. All the participants stated that their warehouses have a ventilation system/equipment and that ongoing maintenance is required. P5 commented: "*Maintenance is done by our agents. We also do a walk around to check if the lights and extractors are working and if the curtains are doing the job of keeping the insects out."* However, P2 reported that "*Our equipment is low maintenance; not many improvements [have been] done."*

All the participants confirmed that their warehouses do not have insulated walls. P2 stated that "*We have normal walls, although we have fans which extract the hot air in the warehouse."* As alluded to above, these fans are low maintenance. P5 added that "*We have standard walls as our products do not [call] … for insulated walls."*

Asked about the challenges faced in installing energy-efficient equipment in the warehouse, all the participants pointed to financial resources. P5 remarked that, *"It would be tough to change our processes as we have been doing things the same way for years,"* while P8 said: "*There would be financial challenges, also the challenge to adapt to new equipment"* P2 concurred: "*It would be challenging financial wise, the company would only be willing to effect one energy-efficient*

equipment every few years, depending on the cost … such as skill development, maintenance, initial constructing costs, to name a few."

P5 indicated that, "*It will be a struggle to financially commit to new energy-efficient equipment without fully knowing what the actual progress is with environmental sustainability. In other words, it's difficult to measure its benefits."*

It can thus be argued that without evidence of tangible benefits to the business and awareness of the need for environmental sustainability, it is unlikely that a company will invest in energy-efficient equipment as it is expensive. This highlights the need to raise awareness of the need for environmental sustainability.

4.4.3 Green Warehouse

Green activities promote environmental sustainability. The type of practices employed in the warehouse such as an efficient lighting system promotes a greener warehouse. This section presents the participants' views and knowledge of the methods and techniques associated with green warehouses, the advantages of such warehouses and their willingness to invest in them.

The participants agreed that green warehousing offers definite advantages. P2 said: "*Yes, definitely, the environment faces less harmful impacts from companies' processes and the company as whole benefits by reducing costs in using energy efficient measures."* However, P8 noted that although there would be energy savings and a less negative impact on the environment, "*the cost of implementing in this country is too high."*

The participants were of the view that they are able to contribute to the green warehouse initiative in small ways like recycling, effective use of storage space and routine maintenance of the ventilation system. P8 stated: "*We do try to be efficient in every sense although it is difficult to monitor. We mainly focus on servicing our fans, checking our wastage as well as rechecking orders picked."* P2 noted: "*We are ensuring all our lights are LED, we are installing a conveyor belt system to ensure dispatching and receiving processes are shortened and workers can be more efficient in other areas of the warehouse. There is soon to be [a] scanning system to eliminate picking errors.*"

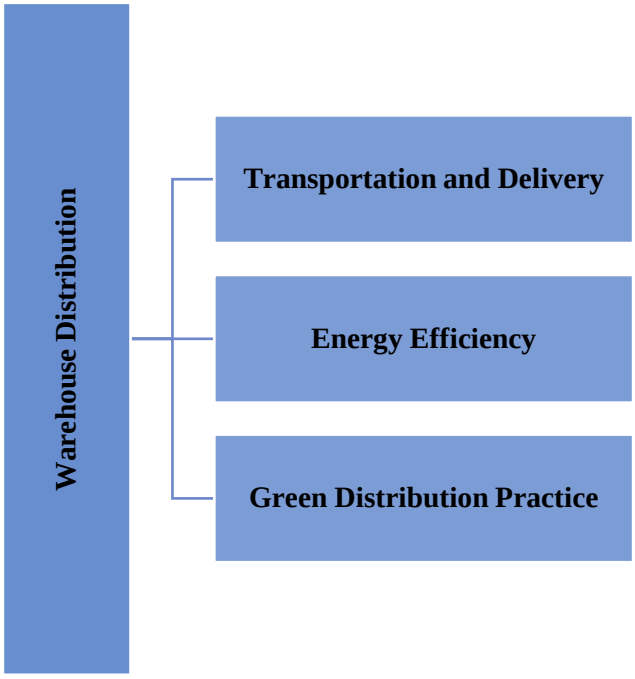
All the participants agreed that their companies are willing to invest in implementing green warehouse initiatives despite the cost. P8 stated: "*Any company interested in saving money and improving the efficiency for the environment would be a fool not to do it. We would be willing."* P2 concurred: *"They are very willing as each year they do something different to improve the warehouse"* P5 noted that, *"The company is in the process of going paperless. They are willing."*

It can be argued that many benefits accrue from investing in green warehouse initiatives, including efficient use of storage space, proper waste recycling and disposal and energy savings on lighting systems.

4.5 Theme 2: Warehouse Distribution

The second key theme has three sub-themes: transportation and delivery, energy efficiency, and green distribution practice. This theme aimed to assess the adoption of retail warehouse distribution practices that enhance eco-friendly environmental logistics.

Figure 4. 3: Warehouse distribution sub-themes



Source: Researcher, 2022

4.5.1 Delivery and Transportation

The best way to save on distribution costs in the food retail industry is to use road transportation. P1 stated that, "*using rail, for example, would be inconvenient as we would need additional modes of transport to pick up from rail stations, as rail stations are not accessible everywhere."* P4 concurred: "*Involving air or rail would mean more skills needed, more route planning, more vehicles, more costs and ultimately a messy distribution system. This mode of transport works and has been working for years, especially with FMCG as goods need to be fast moving and available when and where needed."* Based on this feedback, it is clear that road transportation is the most efficient and orderly delivery system. However, P7 presented a different perspective in relation to international transportation: "*If we were travelling [long] … distances to distribute, then sea would be more efficient as we currently use sea to get our stock from the manufacturers."* Many participants noted that most, if not all, their deliveries are local and within a short distance. P7 thus stated that road transportation "*is the most efficient option we have presently in South Africa. Any other mode … would not be cost effective. Also, we have short distances to deliver which is why road is the best option."*

Furthermore, P4 noted that the type of transportation depends on the weight of the goods being delivered. "*The weight of the commodities we deliver [is] … too high to be used on any other mode of transport. We use air freight very seldom, but it is not a feasible option cost wise."* Thus, utilising the most efficient mode of transport is just one part of an efficient and orderly distribution method. According to the participants, another important aspect is ensuring that all deliveries and routes are properly planned. Participants reported that all their routes were planned weeks/days before the trip. P1 stated that, "*We do a three- to four-week plan. It can change within the week in which I would swop the days around and notify the stores, but we have set days to do set deliveries."*

The participants also stated that they have to plan their route efficiently, taking into consideration a number of factors such as time, distance and load capacity. P4 said that "*trucks leave at 5h30 every morning to avoid peak traffic."* P7 indicated, *"We do not send trucks early in the morning when we know there will be traffic. Deliveries usually start after peak around 8h30-9h00. Our routes are always the same; there is no need for constant changes to the route schedule unless*

major roads are affected by strikes, accidents or [road] closures." P7 added that, "*They are loaded to capacity to accommodate multiple deliveries. For deliveries in the north, we try to combine them for example, Umhlanga, Ballito and Durban North deliveries are done together."* Participants noted that trucks are usually loaded at full capacity, although P1 stated: "*Whatever is needed for those two stores will be delivered whether the truck is full or not. Although if it is … one pallet and two boxes then we contact the store [and] ask if we can accumulate and deliver next week"* Thus, with proper planning, decisions are made depending on time, distance between stops and the extent of the load and with no onboard temperature in the vehicle, the only weight on the engine is the load.

It can thus be argued that the best mode of transportation in the FMCG industry is road freight, with other modes considered when stock specifications require this. The effectiveness of a company's distribution system influences costs.

4.5.2 Energy Efficiency

All the participants reported that they do not use clean fuel injection. All except P1 also stated that vehicle emissions are not recorded. P1 revealed that, "*There is a check done before every vehicle leaves where the amount of fuel in the tank is recorded. For example, if we started the day at full tank and the end of the day, we're only at ¼ tank, [this] does not [add up] 'cos we only did … 70 km for the day. Then in-depth checks are done. The KM done for the day is given to us every day by our tracking company; this also helps us check on fuel usage."* Thus, in this instance, emissions are recorded using fuel usage. These companies are not using systematic methods to record emissions like car emission tests.

Of the three participants who responded to this section of the study, one rated their energy efficiency as high but did not expand on the response. P1 stated "*The monthly report for drivers sits on an average of 99.9% efficiency."* P4 reported moderate energy efficiency, and P7 a low level: "*We do not use clean fuel and we do not have any electric cars as we do not have the finance …."* However, P1 added: "*We … take measures to save fuel intake."*

It can thus be argued that green distribution practices are not very impactful in KwaZulu-Natal as emissions are not recorded and vehicles are not loaded to capacity. This calls for improved distribution.

4.5.3 Green Distribution Practices

All the participants were of the view that their retail warehouse distribution practices incorporate eco-friendly practices. P7 stated: "*We … implement routing efficiency and packing efficiency in our company."* P1 noted: "*We have cameras in the back and front of the vehicle to check if drivers have their masks and seat belts. We can track if drivers are … braking [hard] or speeding. Vehicles are tracked. We route plan every three weeks, and we plan for one easy store and one difficult store per trip."* These measures were adopted to reduce fuel consumption and overall wear and tear of vehicles. P1 also reported that, "*We do not negatively impact the environment much; we more positively impact the environment than anything else."*

P4 revealed that, "*The vehicles are serviced by … agents who make sure the vehicle is up to environmental standards. No excessive emissions, etc."* The participants further stated that their company holds environmental sustainability in high regard, although P4 believed that they could do better: "*We are trying, but it is not highly regarded. We try to keep the fuel consumption of the vehicle low*." P4 indicated that "*the impact on the environment is mostly positive. With regards to the maximisation of the vehicle space, it leads to fewer trips, which is an advantage."*

P7 and P4 believed that green practices had benefited the company as tracking vehicles keeps it up to date with deliveries and maintains vehicles' roadworthiness. P4 noted: "*From the vehicles being tracked, we do benefit by knowing that our deliveries and vehicles are up to standard, and we do not face any losses like break downs or late/missed deliveries. With routing efficiency, we make sure our vehicles complete their deliveries timeously, decreasing … fuel emissions. We also minimise the amount of packaging material used when packaging our products which would decrease waste."*

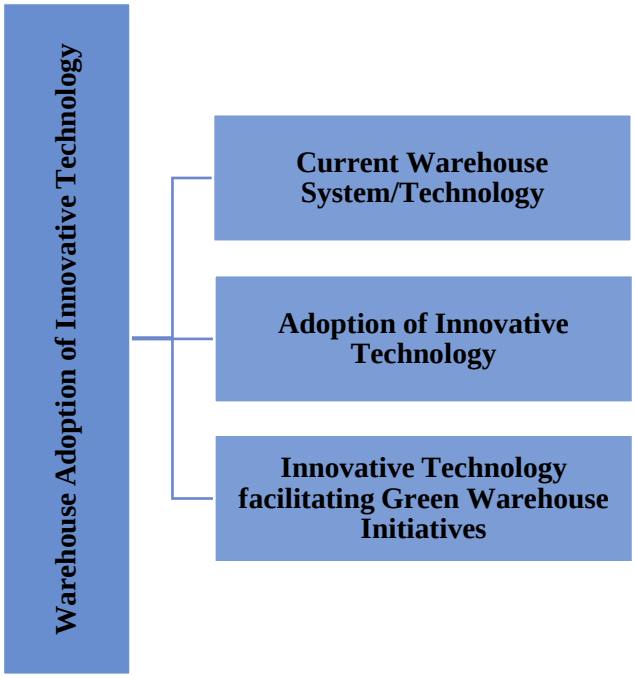
Proper implementation and adoption of green distribution practices reflects willingness to innovate. Green distribution initiatives reduce packaging waste, ensure timeous delivery and minimise breakdowns.

4.6 Theme 3: Warehouse Adoption of Innovative Technology

This section presents the participants' perspectives on existing warehouse systems and the need for innovative technology in warehouses. It also assesses the possibility of innovative technology promoting green warehouse initiatives. Thus, this section covers the following sub-themes; current

warehouse system/technology, adoption of innovative technology, and innovative technology facilitating green warehouse initiatives.

Figure 4. 4: Warehouse Adoption of Innovative Technology sub-themes



Source: Researcher, 2022

4.6.1 Current Warehouse System/Technology

Two out of the three participants who took part in this section of the research reported that they have automated systems in their warehouse. P3 uses Dolphin and P6 uses Microsoft Office Excel. However, P9 stated: "*We are fully manual, paper based. We have bought a new system which we will get on 1 March 2022, called Sync. This system will automise the warehousing process, incoming, outgoing, stock take and orders.*"

All the participants added that their warehouse system is easy to use and that low to medium levels of expertise are required to operate the system.

Tracking systems are key in warehouse operations. P3 stated: "*There is a tracking system. We [always] know where products are ….*" P4 also noted that, *"We have a system that we currently work with on Excel. It tells us how much stock is packed, how much is in bulk, what is a work in*

progress. We have a daily stock count to synchronise the stock on the floor to the stock on Excel." However, P9 stated that they make use of a manual tracking process, which is not fully effective as it is human-driven. Goods are pulled manually per location, and there is a 50% possibility of picking up incorrect items. P9 stated that this is usually due to *"human error or shipping discrepancies."* P3 and P6 believed that their system is more efficient, P3 noted: *"For example, head office creates an order for 100 items, we go and pick the 100, and there will be packing slips attached to the order which we separate and send off per store."* P6 reported: *"An invoice is generated from head office and sent to us. We print the picking slip and give it to our pickers. Once it has been picked, it comes to the front and gets double checked against the invoice and it is then scheduled for delivery."*

P9 believed that they reaped no rewards from the system they currently use as it is manually based, while P3 stated that the only advantage of the system is that "*It's easy to be trained to use."* All participants were of the view that some aspects of their system could be improved. P6 stated that, "*there's always room for improvement, although we are not sure how we can improve on an Excel document."*

P3 pointed to flaws in the system: "*If a new item has not been in a specific location in the warehouse, Dolphin will not accept it because there is no history of it being there. It makes stock take very difficult. It is a huge flaw in the system. I think the system should be able to take in new items as it does with old items."* P3 thus believes there is room for improvement, while P9 said that there is "*Nothing at the moment, as we are hoping the new Sync system will improve a lot of things for us."*

Thus, some warehouse systems are not environmentally friendly as they are still paper based. Low energy efficiency indicates a need to adopt innovative warehouse technology that offers smoother, less error driven processes.

4.6.2 Adoption of Innovative Technology

This section examines the possibility of adopting a new innovative warehouse system and its advantages and challenges.

All the participants stated that their companies are open to new and improved technology. P6 noted: "*It is important; our senior manager is always looking to improve."* Such improvements were said to have many benefits. P9 stated: "*We would use less paper, time-saving, more efficient delivery timing, less errors."* P3 added: *"It would shorten our processes while making difficult processes simple. It will also push us to [become] … more efficient, less mistakes and more cost savings."* However, the participants pointed to challenges in adopting innovative technology, including the need for new skills, financial resources, and readiness to adopt new ways of doing things. P6 stated: "*If we are looking into adopting a scanner system, the challenge would be the finances of acquiring this system and knowing how to distinguish between our different products on the floor. For example, we have 10 different types of rice. How will that be handled? In a nutshell we will need the proper skills. With any new system there will be mistakes, but it will make [the] process better in the future"* P3 highlighted the need for "*skills development … when implementing the scanners, but nothing else. We will mostly benefit from this new technology."*

P3 commented that the company is willing and able to adopt new technology, adding that, "*we have had a budget for the last three years to initiate these scanners"* P9 highlighted that the company is more than willing to innovate as *"this new technology would lessen the negative impact on the environment from our current processes."*

While the adoption of innovative technology requires funding and willingness to initiate it, the benefits of new improved technologies outweigh the challenges.

4.6.3 Innovative Technology Facilitating Green Warehouse Initiatives

This section explores the participants' perspectives on innovative technology facilitating green warehouse initiatives. All the participants believe that innovative technology can facilitate such initiatives. P6 stated: "*Yes, with new technology we will be able to simplify our processes and make them more efficient. We could decrease errors and shorten deadlines, all contributing to greening the warehouse."*

Based on the data, it can be argued that innovative technology reaps green benefits as it reduces paper usage and errors and provides for efficient delivery systems.

4.7 Conclusion

This chapter presented the study's findings emanating from the thematic analysis of the data using NVivo 12 pro software. Three key themes emerged: warehouse operations, warehouse distribution, and warehouse adoption of technology. The findings show that warehouse operations have some negative effects on the environment. This is because little energy-efficient equipment is used. Most operations are still paper-based, clean fuel vehicles are not used, and car emissions are not recorded. The results point to the need to adopt green warehouse initiatives that will not only contribute to a cleaner environment, but benefit companies in a number of ways. The following chapter presents an in-depth discussion of the findings and offers recommendations based on the study's results.

CHAPTER FIVE

DISCUSSION OF RESULTS AND RECOMMENDATIONS

5.1 Introduction

This study aimed to identify how food retail industries incorporate green warehousing in their operations and distribution practices. The previous chapter analysed the data collected by means of in-depth interviews. The research findings revealed a lack of green implementation, the researcher intends to show how green implementation assists in the improvement of environmental sustainability. This chapter discusses the findings in line with the study's objectives and the literature review and presents conclusions and recommendations.

5.2 Overview of Research Objectives

5.2.1 Objective One

To identify the challenges confronting green retail warehousing operations in selected organisations in the food retail industry.

The study's first objective was to identify the challenges confronting green warehousing operations in the selected food retail industries. By identifying these challenges companies can develop solutions, thus promoting their growth and competitiveness. Green warehousing operations are the foundation of efficient and effective business practice. Without measures in place to sustain the environment, businesses will become less successful.

There are many ways in which a warehouse can be green minded. Agyabeng-Mensah et al. (2020:4) highlights the use of biodegradable and recyclable materials for packaging. Participants noted that recycled materials are used in packaging although they aren't aware of its disposal process. A lack of knowledge in this area contradicts the benefits of biodegradable material implementation. Furthermore, costs increase while profitability remains low. P1 stated: *"We are very backwards with waste disposal; we have a lot of plastic waste. Most of the time it is taken to the landfill, or a few Pakistani men come and buy the bubble wrap now and again".* This poses a threat to the environment as it is not being disposed in an environmentally friendly manner. Companies need to control this process with efficiency as correct waste disposal contributes to sustainability and streamlining efficiency.

Temperature control is also a vital part of energy efficiency that spans every process in the warehouse from transportation, and storage to office operations. Over- or under-cooling increases the use of energy in the warehouse (Helo and Ala-Harja, 2018). Participants highlighted the lack of insulation within the warehouse, but also noted that this is due to the products not requiring heat protection but more ventilation. Extractor fans and air conditioners are installed in each company and serviced regularly while refrigeration storage equipment for perishable goods are non-existent. It has been noted that products come in and go out constantly which is why there is no need for refrigeration. This is a risk the company is willing to take.

A notable challenge mentioned by the participants was that there are no methods implemented for effective space utilisation in the warehouse and this results in errors being made. Reducing space waste is said to be a good warehouse management system which enhances eco-friendly warehousing (Minashkina and Happonen, 2020). One participant stated *"Each product has an allocated slot, there is no system to help maximise space. Everything is done by eye. Each item has its own space, but we also allocate more space to smaller items [when] … a large amount [of] stock is due to come in".* There are systems in place for when goods come into the warehouse but no efficient method for storing.

In an effort to stay efficient, it was noted that many companies have only just started the changeover to energy efficient lights. Verma, Malhotra and Rao (2017) established that an energy saving of 90% can be achieved by utilising lights that are energy efficient such as light-emitting diode (LED) and sensor lights. Although changes are being implemented, participants noted that company processes continue to harm the environment. This is due to manual-based systems currently being utilised, systems which will soon be phased out, due to the ongoing need to improve and move to more advanced technology. Studies have shown that embracing IT promotes a company's growth in the market (Agyabeng-Mensah et al., 2019). Participants further mentioned that the financial costs of implementing green operations are high in South Africa. One participant stated: "*It will be a struggle to financially commit to new energy-efficient equipment without fully knowing what the actual progress is with environmental sustainability. In other words, it's difficult to measure its benefits".* Greening is a slow process with many long-stretched failures along the way. Companies are aware of these growing pains yet still push onwards in anticipation of success

5.2.2 Objective Two

To assess the extent to which retail warehouse distribution practices promote an eco-friendly environment.

The second objective assessed the extent to which retail warehouse distribution practices promote an eco-friendly environment. It is important to understand how the company aims to incorporate green practices while meeting deadlines and following company protocol, as it is necessary to be able to identify risks resulting from the implementation.

All the participants stated that route planning is undertaken, with taking into consideration time, distance, congestion and the vehicle's load capacity. Grunchmann (2019:670) found that minimising the distance travelled through efficient route planning and optimisation of loading space in the vehicle reduced pollution and energy consumption. Vehicles are dispatch before or after peak periods to avoid traffic, hence shortening travel time for deliveries in the day. Less time spent driving equals less fuel intake and ultimately less emission spread. It was noted that routes do not change often unless there are strikes and other unforeseeable circumstances which then negatively impacts the vehicles travel time. According to all participants, the loading of vehicles are maximised in line with route planning as it helps ensure less frequent trips are made.

Electric vehicles were not used by the participant's companies as it is a costly investment. Electric vehicles are generally known to be the cleanest vehicle option as they emit zero emissions (Moghdani et al., 2021). However, they cannot travel long distances and are typically slower than the average car (Habich-Sobiegalla, Kostka and Anzinger, 2018). Although electric vehicles aren't utilised, companies are putting more effort into monitoring fuel intake. Which is implemented in place of clean fuel. Baah, Jin and Tang (2019) concluded that a cleaner fuel injection made a significant contribution to sustainable transportation as did efficient route planning. All the participants noted that clean fuel injection was not used; however, fuel intake was recorded and monitored daily. Without clean fuel injection, vehicle maintenance is imperative. It was revealed that vehicles are serviced regularly and tracked for hard braking, speeding and the use of seat belts. Rose, Chew and Hamid (2018) observe that vehicle maintenance ensures efficient driving as it prevents the leakage of harmful fluids.

Road transport was deemed the most effective and efficient mode of transport for the food retail industry and it was noted that air, sea and rail would pose many challenges. Kaack et al. (2018:2)

assert that there is still a need for transport at the origin and destination of a journey as distribution centres, warehouses and hubs are mainly inland, which means that only certain parts of distribution can be moved away from road transportation. One participant noted "*Involving air or rail would mean more skills needed, more route planning, more vehicles, more costs and ultimately a messy distribution system. This mode of transport works and has been working for years, especially with FMCG as goods need to be fast moving and available when and where needed."* Ultimately, road transport was the participants' companies' first choice as it is cost efficient and they are served by local manufacturing plants.

5.2.3 Objective Three

To assess how innovative technology influences the adoption of green warehouse operations.

The last objective was to assess how innovative technology influences the adoption of green warehouse operations. All the participants believe that innovative technology can benefit the warehouse, although they had not all implemented this strategy. Some have manual and others automated warehouse systems. Mathu and Phetla (2018) found that technology enhanced supply chain operations in the food industry and improved information flow and process speed.

The participants stated that systems, mainly manually-based, were in place to track items in the warehouse. These methods are prone to human error and cannot be considered efficient. Up-to-date tracking status is required for all items. Innovative tracking technology minimises errors in stock count and order picking. Tan et al. (2020) highlights that, when data cannot be efficiently updated in real time, it is difficult to share this information with other supply chain members, and data leakage is possible.

The challenges confronted in adopting innovative technology include employees' resistance to change. This calls for skills development programmes that are costly. However, the participants acknowledged that their companies will not grow unless they adapt to such changes. Technology drives efficient and successful business practice and in turn environmental protection and sustainability.

While little training is required to use manual systems, an automated system would reduce the impact on the environment, less paper less waste less pollution. New technology simplifies processes and renders them more efficient. Furthermore, Agyabeng-Mensah et al. (2020) asserts

that technological developments enhance a firm's ability to respond to customer demand, thus generating increased sales and improved profitability. The participants added that there would be fewer errors and shorter deadlines, which would also contribute to a greener warehouse.

5.3 Data Quality Control

Vancauwenbergh (2021) states that data can only be deemed reliable and valid if it serves the purpose that it was meant to serve. Reliability and validity are key in ensuring that a study is trustworthy. The reliability of the measurement of data indicates how consistently the same result can be obtained utilising the same method, while validity checks the accuracy of the data measurement (Ahmed and Ishtiaq, 2021). Table 5.1 sets out the trustworthiness criteria of the study, namely, credibility, dependability, confirmability and transferability.

Table 5. 1: Data Quality Control Criteria

Criteria	Aim	Applied in study
Credibility	To establish confidence in the study's ability to capture what the research aimed to study, and that the results are true, credible, and believable.	In-depth interviews were conducted and recorded; the data was transcribed for accurate interpretation by experts who coded and categorised it.
Dependability	To ensure that the findings would be repeatable if the same method were applied with the same cohort of participants, coding, and context.	Informed consent was obtained from all the participants, ensuring confidentiality. Permission was obtained to record the interviews and the participants were informed that they could withdraw from the study at any time.
Confirmability	To ensure that the data is based on the participants' narratives and words, and that the findings are shaped by the participants rather than by the researcher.	The participants selected for this research were employed in the field covered by the study and had the experience and knowledge necessary to answer the questions truthfully.
Transferability	To extend the degree to which the results can be applied to other situations or generalised to other contexts or settings.	The participants' sociodemographic details and the research setting were detailed so that the results can be applied to similar settings.

Source: Alqahtania et al. (2021)

5.4 Saturation

Guest et al. (2020 cited in Morgan et al., 2002:2) found that data saturation is attained during the first five to six interviews and that very little new information is obtained as the 20th interview is

reached. Therefore, the sample of nine participants ensured that data saturation was achieved. The researcher realised that more than nine participants would not offer new information as each participant had similar experiences and skill sets. Saturation was reached when each additional interview produced minimal new data.

5.5 Contributions of the Study

The food retail sector has a significant impact on the environment, with distribution practices being a major contributor. This study contributes to the body of knowledge in this field by identifying weaknesses in day-to-day warehouse and distribution practices and offering recommendations on how to tackle them. The sector is growing on an ongoing basis as food is a necessity for survival. As it grows, environmental degradation increases; hence the need to measure the efficiency of green practices among food retailers. The study contributes to existing literature in this field by analysing the impact of green warehousing and technology innovation. While the participants highlighted challenges, overall, it was found that the implementation of green practices in the food retail industry has introduced efficient and effective methods that decrease environmental harm and improve sustainability.

5.6 Recommendations

Green warehousing aims to reduce the environmental impact of warehouse activities. This is important not just for the sustainability of the environment, but the productivity of the business. Green warehousing simplifies processes and ensures efficient day-to-day practices. The study's results revealed that waste disposal methods are not always thought through; there is a lack of energy efficient equipment in warehouses; paper-based systems are still being used; and there is no clean fuel usage, insulated walls or systematic tracking system for items in the warehouse. These challenges can negatively impact productivity as well as the state of the environment.

It was noted during the in-depth interviews that higher-level management makes decisions when it comes to change. The participants were well aware of the situation in the company and were knowledgeable on how improvements could be made in many areas. Employees are well placed in the working space which allows them to find ways to streamline their jobs as well as find strategies to improve their working experience. Companies should draw on employees' ideas to develop and grow the company and the sector as a whole. This calls for improved communication

that encourages employees to submit ideas and suggestions on how things can be improved in the company without the risk of reprisals.

Green is the way the world is moving. Businesses that do not change the way they think, will fall behind, with severe consequences. Food retail companies need to invest in research and development. Finding new ways to green the company. This could include fuel alternatives, new equipment like light-emitting diode (LED) or sensor lights, new vehicle types for efficient driving and new warehouse technology like scanning equipment, and iPads for electronic documentation. While this has cost implications, investment is necessary to secure the company's future.

Training should be provided to employees on sustainability, environmental degradation and the impact on the company. With all employees on the same page, with the same knowledge, commitment to going green will increase. Green initiatives implemented correctly for the right reasons promotes faster more efficient success. Incentives could also be introduced to encourage each employee to play their part in contributing to a sustainable company.

5.7 Limitations and Delimitations of the Study

The study focussed on small- to medium-sized food retail companies in the Durban area of KwaZulu-Natal province. Given that it covered such a small segment of the national food retail industry, its findings cannot be generalised to the sector as a whole. There were a few limitations, such as a time restriction on conducting the interviews as it was done during working hours, as well as employee resistance. Employees were unsure about the study's findings being confidential until reassured by the manager and upon signing the informed consent.

5.8 Suggestions on future study

This research focused on the small to medium sized food retail companies, in which much insight was gained however the food retail industry has many large companies which could provide valuable insight on a larger scale. This could be very eye opening and may provide many interesting facts and perspectives.

This research can also be investigated by using a quantitative approach. This approach transforms aspects of social behaviour into reliable quantifiable data that can be represented numerically and analysed by means of statistical techniques. This method will add more value to the research as it could yield more substantial information.

Food retail industries in Kwa-Zulu Natal were the focus of this study whereas this industry isn't only situated in one province. Future studies need to investigate the impact of green warehousing out of Kwa-Zulu Natal and see how this impacts the overall food industry in South Africa.

Future research can focus on investigating how green warehousing improves a company's financial standing rather than how it helps the environment. This research will entice companies to invest heavily now for greater future financial benefit.

There is no set way to measure the success of green warehousing in an industry and companies know the risks are great. Future studies can construct a model which can be used to measure green practices, the benefits and risks that come out of it and whether it is worth the risk.

5.9 Conclusion

Against the backdrop of on-going environmental degradation, this study examined green practices utilised in the food retail industry. The research objectives were achieved and recommendations were offered on some of the challenges faced. It was found that, while companies in the food retail industry have committed to green practices such as energy efficient lighting and route planning, much remains to be done. It is management's responsibility to adopt and implement green strategies. While this has financial implications, it is necessary not only to protect the environment, but for companies to retain a competitive edge and grow. It is hoped that the findings will assist companies looking to become more sustainable and profitable while simplifying in-house practices. The study also lays a foundation for future research on how food retail companies in different areas can address the challenges confronted in green warehousing operations.

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APPENDICES

Appendix A: Interview Schedule

Date: _____

Name of Company: _____

Person interviewed: _____

Demographics

1. What is your job title in the company?

2. Age group? (20-30 etc)

3. How long have you been employed in this company?

4. What is your highest education qualification?

Section A – Distribution

1. To your knowledge, does the retail warehouse distribution practices incorporate eco-friendly practices? (Clean fuel, efficient route planning, tracking emissions, loading efficiently, temperature controls in vehicles etc) **YES/NO**

2. What are different methods and techniques of green distribution practices followed by your organization?

3. What do you think is the environmental impact of the current distribution process?

4. Are there any advantages of the current green distribution practices?

5. What modes of transportation are used for deliveries?

6. What types of vehicles are used?

7. Why in your opinion are those specific modes of transport used?

8. Would you say this is the most efficient mode of transport for your specific industry

9. If not, what would you say is the most efficient mode of transportation?

10. How would you rate your mode of transport in terms of energy efficiency? **(High-medium-low)**

11. Approximately how many deliveries are done a day?

12. Are your vehicles making use of clean fuel injections?

13. Are vehicle emissions recorded?

14. If yes, how is it recorded and controlled?

15. Are delivery vehicles loaded to capacity when making deliveries?

16. Does your route planning consider traffic congestion?

17. How is efficient route planning ensured?

18. Would you say that environmental sustainability is highly regarded in the transport process of this company?

19. Are there on board temperature setting in the vehicles for certain food items?

20. What do you think are the impacts of green distribution on the performance of the company?

21. How would you describe the willingness of the company to invest in green distribution practices?

22. Do you have any questions?

23. Would you like feedback from this study's research?

Section B – Warehousing operations

1. Is storing of bulk stock encouraged in the warehouse, or is it seasonally stored?

2. Is stock keeping measured by forward cover in months?

3. Is there a system in place which assists in maximizing space utilization in the warehouse?

4. How is efficient space and storage utilization ensured?

5. Are recyclable and biodegradable materials used in packaging?

6. How is waste disposed of?

7. What equipment is used to store perishable stock? (Fridges etc)

8. Do you know what kind of materials are used in the manufacture of the packaging of items stored?

9. How do you rate your equipment in terms of energy efficiency? **(High-medium-low)**

10. Are energy efficient lighting systems utilized in the warehouse? (Sensor lights, LED lights)

11. Are there insulated walls in the warehouse?

12. Have there been ongoing improvements done on the heating, ventilating and air-conditioning equipment?

13. What are the challenges faced with regards to installing energy efficient equipment, if any?

14. What is the environmental impact of current warehousing operations? (Waste disposal, lighting, storage)

15. Do you think there are positive impacts on the performance of the company when using energy efficient equipment?

16. What are different methods and techniques of green warehouse operations followed by your organization?

17. What checks are in place to evaluate or assess the efficiency of current warehouse operations?

18. Do you think there are any advantages of green warehousing?

19. Does the company budget for warehouse improvements?

20. How would you describe the willingness of the company to invest in greening warehouse operations?

21. Do you have any questions?

22. Would you like feedback from this study's research?

Section C – Adoption of technology

1. What warehouse systems are utilized in this distribution centre?

2. Are these systems easy to operate?

3. Is there a tracking system for stored goods in the warehouse?

4. Would you say this system is effective in tracking stored goods?

5. Is there a system/method for picking goods?

6. How often are incorrect items picked and what are the causes?

7. Does this system track what specific items are in a delivery vehicle?

8. Does this system constantly update the delivery status of the retail stores?

9. In your opinion what are the advantages of this system?

10. In your opinion what could be improved/added on this system to make it more efficient or user friendly?

11. Describe the level of expertise needed to operate current warehouse technology**. (High skilled-medium skilled-low skilled)**

12. What checks are in place to evaluate or assess the efficiency of current warehouse technology?

13. Do you believe that innovative technology can help green the warehouse?

14. What challenges do you think will be faced with the implementation of new innovative technology? (Skills, maintenance, mistakes and losses, finances)

15. Are current systems environmentally friendly?

16. How important would you consider the adoption of technology to be regarded in your company?

17. What would be the advantages of innovative technology?

18. How do you rate the current warehouse technology in terms of energy efficiency? **(High-medium-low)**

19. Is the company open to discussions of new and improved technology?

20. Is there a budget for the implementation of new innovative technology?

21. Do you have any questions?

22. Would you like feedback from this study's research?

End

Appendix B: Ethical Clearance

14 December 2021

Kylie Laurelle Govender (212513657)
School Of Man Info Tech & Gov
Westville Campus

Dear KL Govender,

Protocol reference number: HSSREC/00003533/2021
Project title: Going green: green warehousing in selected food retail enterprises in Durban, South Africa
Degree: Masters

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 14 October 2021 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**.

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

This approval is valid until 14 December 2022.
To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

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

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

Yours sincerely,

Professor Dipane Hlalele (Chair)

/dd

Appendix C: Informed Consent

UKZN HUMANITIES AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE (HSSREC)

APPLICATION FOR ETHICS APPROVAL

For research with human participants

Information Sheet and Consent to Participate in Research

Date:

Greetings,

My Name is Kylie Govender, I am a UKZN master's student currently completing my dissertation for the MCom Supply Chain Management qualification. Below are my supervisors' details if you would like further verification.

Supervisor: Dr Thokozani Patmond Mbhele
Contact number: 0312607524
Email address: mbhelet@ukzn.ac.za

You are being invited to consider participating in a study that involves research on green warehousing. The aim and purpose of this research is to identify the environmental impact of a warehouse's day to day processes. This study is expected to include 9 participants in total from 3 different warehouses around KwaZulu-Natal and 3 participants will be needed from each site. It will require the participation of an interview. The duration of your participation if you choose to participate and remain in the study is expected to be 30-45 minutes.

The study may involve a few risks and/or discomforts such as unstable internet connection if interview is done via zoom. The study will provide no direct benefits to participants. This study

will assist in identifying challenges in the warehouse operations which will act as guidelines for improvement. Another benefit hoped for in the study will be the implementation of innovative technology which could speed up the greening process and ultimately reduce environmental impact.

This study has been ethically reviewed and approved by the UKZN Humanities and Social Sciences Research Ethics Committee (approval number HSSREC/00003533/2021).

In the event of any problems or concerns/questions you may contact the researcher at 212513657@stu.ukzn.ac.za/074 774 9492 or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

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Tel: 27 31 2604557- Fax: 27 31 2604609

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

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

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

Sincerely
Kylie Govender

CONSENT TO PARTICIPATE

I (Name) have been informed about the study entitled Going green: green warehousing in selected food retail enterprises in Durban, South Africa by Kylie Govender.

I understand the purpose and procedures of the study.

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

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

I have been informed about any available compensation or medical treatment if injury occurs to me as a result of study-related procedures.

If I have any further questions/concerns or queries related to the study I understand that I may contact the researcher at 212513657@stu.ukzn.ac.za/074 774 9492.

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

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001
Durban
4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557 - Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

Additional consent, where applicable

I hereby provide consent to:

Audio-record my interview YES / NO

_____ _____

Signature of Participant **Date**

_____ _____

Signature of Witness **Date**
(Where applicable)

_____ _____

Signature of Translator **Date**
(Where applicable)

Appendix D: Editor's Letter

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

22 September 2022

This serves to confirm that I have edited the dissertation, "Going green: green warehousing in selected food retail enterprises in Durban, South Africa", by Kylie Laurelle Govender, student number 212513657.

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

Yours sincerely,

[redacted]

(Ms) Deanne Collins (MA)