Transportation constraints for third-party logistics capacity in the grain industry: a case of Twilight Zone

by

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Declaration

I, **Simone Raquel Maclou** declare that

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ABSTRACT

Road and rail freight truck capacity constraints have adversely impacted Twilight Zone's economic competitiveness and have contributed to a loss of production and revenue throughout the supply chain network. Therefore, the main purpose of this study is to evaluate and understand the logistical capabilities and capacity constraints of road and rail transport. The research objectives of the study are, firstly, to ascertain the strategic influence of third-party logistics partners in managing sustainable transport systems; secondly, to examine the extent of organisational collaboration to assess transport capacity risks in the grain industry; and lastly, to determine the influence of technological innovations on sustainable transport systems in the grain industry. A qualitative research method, using seven semi-structured interviews with open-ended questions to collect data, was used. A non-probability, purposive sampling method was used to select participants from the target population, from top-tier management to lower management. Sound recordings of the interviews were transcribed and analysed using thematic data analysis. This qualitative study will provide insights into the third-party logistical transport capacity shortages that Twilight Zone employs to support its upstream supply chain network operations. The main findings regarding overall transportation constraints in the grain bulk industry reveal the complexity in the supply chain logistics; the magnitude of organisational collaboration; extended lead times because of truck capacity shortfalls; and the propensity to invest in technological innovation for supply chain visibility. The study will provide a basis for senior managers to review current third-party logistical transport integration for information sharing, as well as key performance indicators of third-party logistics transport. The addition of value to current business processes to improve customer delivery throughout the supply chain network should ultimately increase the overall efficiency and profitability of Twilight Zone's supply chain.

Keywords: **supply chain management, logistics management, transport constraints, road freight transport, rail freight transport**

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Abbreviations

3PL	Third-Party Logistics
API	Application Programming Interface
CEO	Chief Executive Officer
CFO	Chief Finance Officer
Covid-19	Coronavirus Disease
CRM	Customer Relationship Management
CTN	Collaborative Transport Network
DBS	Durban Bulk Shipping
ERP	Enterprise Resource Planning
IoT	Internet of Things
IT	Information Technology
ITS	Intelligence Transport System
JIT	Just-In-Time
JSE	Johannesburg Stock Exchange
KPI	Key Performance Indicators
KZN	KwaZulu-Natal
MRP	Materials Requirements Planning
OPT	Optimised Production Technology
PRASA	Passenger Rail Agency of South Africa
RBT	Rennies Bulk Terminals
SA	South Africa
SABT	South African Bulk Terminals
SAPS	South African Police Services
SARS	South African Revenue Services
SC	Supply Chain
SCM	Supply Chain Management
SME	Small and Medium Enterprises
SOC	State Owned Company
TFR	Transnet Freight Rail
TOC	Theory of Constraints
TOE	Technology, Organisational, Environment
TPT	Transnet Port Terminals
TQM	Total Quality Management

CHAPTER ONE
INTRODUCTION AND BACKGROUND

1.1 Introduction

According to a study conducted by the Council of Supply Chain Management (2021), logistics and supply chain management practices have grown across all industries, owing to the diversity and complexity of numerous variables in supply chain systems. Due to exponential advances in technology and evolving business processes, staying abreast of these changes will contribute to a firm's competitive edge, leading to success in domestic and global markets. It is understood that most of the stakeholders in the South Africa's grain industry collaborate and engage external 3PL freight transport companies to outsource transport functions in order to focus on their primary, core business functions. An earlier study indicated that freight transport companies are faced with numerous challenges and obstacles in the process of transporting grains throughout the supply chain, from point of origin to point of destination. Logistics outsourcing, also referred to an 3PL, (Knemeyer, 2003), has received much attention from logistics academics, resulting in a plethora of research and writing on this subject. A study conducted by Lahiri (2022:5) defines "3PL as an outside company that performs all or part of the firm's material management and product distribution functions". The study further states that 3PL partners compete and/or survive based on their operational efficiency in an era of downsizing and budgetary reductions (Dvorak, 2020). The 3PL partners typically specialise in integrated operations of various logistical services, such as warehousing and transportation services, that can be adapted to a customer's needs, based on market conditions, to align with the needs and delivery service requirements for their products (Guiterrez-Franco, 2021).

This research presents and discusses a case study of Twilight Zone in the grain industry and also addresses the research problem of transportation constraints of 3PL transport capacity under interrogation. It has focused on the business processes which managers from information technology (IT) and logistics can employ and implement to improve supply chain visibility to mitigate the short supply of transport capacity that currently exists in the vertically integrated network. The key research questions and objectives of this study intend to discover the strategic influence of 3PL partnerships, and the supply chain collaborative approach in transportation systems for efficient and responsive service competence from fleet outsourcing; and also to establish the effects of emerging technological innovations to improve management of transportation system. A qualitative case study approach will be used to identify the root causes of transportation constraints, the impact on the business, and initiatives to overcome transport

capacity shortages. The research is aimed at identifying transportation constraints and solutions to counter the capacity challenges confronting Twilight Zone; as well as how the organisation can implement improved business processes to revolutionise the transport logistical portfolio process. The pseudonym, Twilight Zone, was used to protect the image, anonymity, and reputation of the organisation.

This dissertation is organised as follows: Chapter One is introductory and contextualises the research problem of the study. An overview of the academic literature review, based on the current knowledge in the field, is presented in Chapter Two, organised into sub-headings. Through the literature review, the author of this dissertation has identified the criteria used by various authors in the field by referring to the Theory of Constraints; constraints in transport capacity; logistics technology; the logistics environment; and the organisation of logistics. Chapter Three describes the research methodology, including the research questions; the research objectives; data collection; and analysis-related tasks in the dissertation. Chapter Four deals with methods for the presentation of results. The main contribution of the dissertation may be found in Chapter Five, where the results of the findings and the significance of the findings are discussed; recommendations are offered, and conclusions drawn.

1.2 Background of the study

Twilight Zone, a trading and shipping company founded in 1996, is significant in South Africa as an importer and exporter of dry bulk grains in domestic and international markets. Twilight Zone, as a trading and haulage firm, is vertically integrated into the grain supply that feeds its business partners up the value chain by supplying bulk grain commodities such as maize, soybeans, wheat, and sunflower seed directly to its supply chain manufacturing plants, using outsourced 3PL. Increased competition and faster responses have compelled firms to focus on their primary core business functions and outsource non-core functions, such as transport, warehousing and logistics (Singh, 2022). Twilight Zone does not possess its own fleet of road freight trucks, due to the mainstream core business portfolio ranging from procurement to sale of bulk grains. Road freight transporters and Transnet freight rail play a pivotal role in the transport logistics sphere of the firm's business by supplying vehicles in the form of side-tipper trucks, bottom dumpers and back-tipper trucks for road; and vacuum or airbrake wagons for rail. There is a shortfall in Twilight Zone's trucks and rail wagon capacity for supplying vertically integrated customers, due to transportation constraints in the agri-bulk industry. The theory of constraints (TOC) is a methodology for improving processes by focussing on

identifying and correcting constraints or root causes of bottlenecks (Rodrique, 2020). Twilight Zone's 3PL transportation partnership is characterised by existing truck and rail wagon constraints, and limitations in the fleet due to exogenous factors (fleet constraints, load shedding, and cable theft), which also negatively affect the movement of trucks. Transportation is a component of logistics, which involves movement from one place to another, using road, air and sea transport. Fleet vehicles used in the spatial movement of grains all consist of transport freight trucks owned by 3PL, and rail wagons that are owned by a state-owned company (SOC), Transnet Freight Rail.

Supply chain management is an overarching concept that links together multiple processes to achieve a competitive advantage, while logistics in the supply chain refers to the movement, storage, and flow of goods, services, and information within the overall supply chain (Pontius, 2022). Road freight transport is an important sector in the global economy and directly affects the efficiency of national economies (Collaço, 2022). Road freight transportation is important to the grain industry of South Africa because it enables the movement of grain from the production areas to the markets, as well as the export of surplus grain to other countries (Mondor Intelligence, 2020). There is a growing demand for food grains, which has placed additional pressure on the agricultural sector for better crop production (Mondor Intelligence, 2020).

Transportation is one of the key elements in the supply chain, due to its importance (Anderson, 2022). Jacoby (2008) states that transport is an integral element of the supply chain, and the integration of the transport infrastructure into business operations is of the utmost importance. Therefore, investing in freight transportation infrastructure will have a positive impact on the business. The fundamental concept that organisations must pay attention to, is the fact that sustainable, long-term organisational performance is strongly associated with road transport infrastructure (Cedillo-Campos, 2022). Business success relies on having the right product, in the right place, at the right time: Insufficient inventory can lead to a loss of sales, while excess inventory will also have adverse effects (Kremer, 2010). The operation of a transport system, impacted by any type of system interruptions or opportunities, will affect the flow of goods (Zhao and Lee, 2022).

Supply chain performance is significantly impacted by road infrastructure (Hossain, 2020). A well-maintained network enables effortless product circulation, reduced transportation costs, and rapid distribution (Bayoumi, 2021). It ensures communication among manufacturing

facilities, delivery hubs, and end users, improving responsiveness and reducing interruptions (Giannakis, 2019). An optimised road infrastructure reduces congestion, costs and delivery delays, increases reliability, and enables companies to access a larger market and contribute to economic development (Al-Turki, 2020). Improving accessibility and mobility in the supply chain network are crucial for a consistent flow of products and services (Attaran, 2020). Accessibility ensures the efficient circulation of supplies, data and goods, (Leviäkangas, 2020); while mobility facilitates the smooth and quick transfer of goods and resources (Gohar, 2021). High accessibility and mobility mean a faster transit, shorter lead times, and adaptability to unexpected demand shifts (Saif, 2019). Reliable supply chain performance relies on seamless integration, resulting in faster reaction times, reduced stock-outs, increased order fulfilment, and increased consumer satisfaction. (Hossain, 2020). Twilight Zone uses road trucks for 80% of its transportation. As such, it is the cornerstone for vital operations. An efficient road freight system is essential for successful, on-time delivery. The supply chain has been impacted by a lack of supply of grain products to its customers at the right time, due to the short supply of road and rail trucks. Consequently, this has led to a loss of production and revenue.

Due to the Covid-19 pandemic, many supply chains have encountered disruptions; lack of supply chain visibility; informational sharing; and real-time updates along the movement stream of products (Damiani, 2022). To promote supply chain visibility, traceability and resilience in supply chains, new 4th Industrial Revolution technologies have been developed and implemented in many supply chain firms, for example, the internet of things (IoT); robotics; artificial intelligence (AI); machine learning (ML); big data predictive analysis (BDPA); and blockchain technology (Khan & Manzoor, 2021). The IoT is a network of internet-connected objects that are able to collect and exchange data using embedded sensor technologies, enabling devices in the network to autonomously 'make decisions' based on real-time information (Shackelford, 2020). Businesses in different sectors, such as IBM Food Trust and Bumble Bee Foods in food and agriculture, Ripple and Libra in financial services, and ProCredEx and MediLedger in healthcare and pharmaceutical supply chains, have invested in blockchain technology in their operations to enhance and strengthen supply chain visibility (Khan, 2023). Prashar (2020) stated that supply chain visibility and resilience are much improved with the utilisation of technologies such as blockchain. This study will investigate the current technologies used by Twilight Zone, as key components of supply chain visibility, and the efficiencies, capabilities and outputs of their existing systems. The findings could, potentially, explore IT initiatives that could be implemented to promote efficient product

delivery to customers and better customer satisfaction, ultimately increasing revenue and enlarging the customer base.

1.3 Research Problem

3PL is an evolving area in the volatile and competitive market environment (Narkhede, 2019). Twilight Zone uses 3PL transport to compete in the grain sector, which is highly concentrated, with fierce competition for market share. Logistics is used to forecast the development of various global processes and systems; as well as efficiency, the need for responsiveness, and capabilities (Milenkov, 2020). It is also used to optimise such processes and systems economically, technologically, environmentally and organisationally (Melinkov, 2020) The core focus of this research study is the failure of 3PL to deliver the grain to customers within the required time frames. It has been understood that Transnet Freight Rail has struggled with the capacity turnaround from collection points to delivery points due to cable theft and electricity outages due to load shedding. 3PL road truck movements have also been hampered due to trucks standing at collection points and pick-up points due to a lack of electricity, affecting the loading and offloading of grains. Neither mode of transport is delivering perfect orders to Twilight Zone's customers, due to delays experienced, caused by these factors. South Africa is spatially challenged: The country has a relatively small economy in relation to a large land mass, with both commodity and production centres located far from ports and coastal areas (Havenga, 2018). Twilight Zone must focus on financial factors, service competencies, flexibility, and on its core activities. However, the challenges posed by trucking constraints and shortfalls in rail wagon capacity result in supply shortages for vertically integrated customers. The overall transportation constraints in the grain bulk industry reflect the complexity in supply chain logistics and the magnitude of organisational collaboration, leading to extended lead times due to truck capacity shortfalls, and a propensity to invest in technology innovation for supply chain visibility (Zhao & Hou, 2022). This study lends an insight into the difficulties the firm is challenged with, with regard to transport constraints, technological innovation to ensure tracking visibility in the trucking/railing process, and an interrupted supply of freight transport.

1.4 Research Questions

1. What is the strategic influence of third-party logistics partners for an efficient and responsive transportation system at Twilight Zone?

2. To what extent does organisational collaboration enhance effective transportation management in the grain industry?
3. How do technological innovations influence better collaborative transportation systems in the grain industry?

1.5 Research Objectives

1. Determine the strategic influence of third-party logistics partners for an efficient and responsive transportation system in the grain industry.
2. Examine the extent of organisational collaboration in managing effective transportation in the grain industry.
3. Establish the influence of technological innovations on better collaborative transportation systems in the grain industry.

1.6 Preliminary Literature Review

This section discusses the key literature which will be the foundation of this study. A literature review involves the collection and reviewing of current data relating to the research topic (Lane, 2022). The reason for conducting a literature review is to determine the material associated with the conceptual focus of the research problem. A literature review is described by Chigbu (2023) as an evaluation of the researcher's findings available on a specific academic theme or topic or subject under investigation. The researcher asserts that it also involves a process investigating already written and published literature to achieve relevant research objectives other than those already achieved by the works under investigation.

1.6.1 Supply Chain Management

Supply chain management is the active management of supply chain activities to maximise customer value and achieve a sustainable competitive advantage. It represents a conscious effort by the supply chain firms to develop and run supply chains in the most effective and efficient ways possible (Handfield, 2021). Pontius (2022), on the other hand, defines a supply chain as a network of entities that starts with suppliers and ends with customers, supporting the flow of production and the delivery of goods and services. SCM is considered a vehicle for service delivery since it incorporates the forecasting and controlling of all undertakings embodied in outsourcing and purchasing, transformation, and logistical administration (Handfield, 2021). Risk assessment is viewed as the longitudinal tool for analysing and evaluating contingencies and vulnerabilities facing critical societal functions and services and provides a basis for taking action (Cedergren, 2022). Valis (2022) conducted a study in Warsaw

(Poland) and stated that entities operating within the rail transportation system should conduct risk assessments related to their activities. Authors have also mentioned that perceptions of risk have changed over the years. Zekhnini, Cherrafi, Bouhaddou, Benghabrit and Garza-Reyes (2020) defined a supply chain as a network of entities that support the flow of production and delivery of goods and services. A supply chain thus starts with suppliers and ends with customers. Supply chain management is considered a vehicle for service delivery, since it incorporates forecasting and controlling all undertakings embodied in out-sourcing, purchasing, transportation, and logistics administration (Handfield, 2021). As the departmental role players charged with ensuring that the supply chain fulfils its mission, SCM managers should identify potential clients and end-users to enhance the flow of the process, thus eliminating variability of demand and activities that do not add value to the organisation. Performance management reports must be produced to measure the opportunity, cost and value-for-money, and the financial impact on the organisation (Habib, Bao, Nabi, Dulal, Asha & Islam, 2021). In the SCM, the 3PL transport partners, together with Twilight Zone, should constantly assess the risks facing service competence and responsive capability, capacity constraints, and operational costs.

1.6.2 Third-Party Logistics (3PL)

Logistics outsourcing (Knemeyer, 2003), or 3PL, has received much attention from logistics academics, resulting in much research and writing on this subject. A study conducted by Lahiri (2022) defines 3PL as an outside company that performs all or part of the firm's material management and product distribution functions. The study further states that 3PLs compete and/or survive based on their operational efficiency in an era of downsizing and budgetary reductions (Dvorak, 2020). 3PLs typically specialise in integrated operations across various logistics services, such as warehousing and transportation, that can be tailored to a customer's needs based on market conditions, and aligned with the needs and delivery service requirements for their products (Guiterrez-Franco, 2021).

1.7 Theoretical and Conceptual Framework

This study makes use of reviews of both the theory and the conceptual framework structure in this research into Twilight Zone's 3PL capacity constraints. All the variables are interconnected to provide an overall view of the logistical system's functionality throughout the various business functions of Twilight Zone. This study combined two theories, using key propositions to formulate the theoretical framework.

1.7.1 Theoretical Framework

A theoretical framework is a basic review of the existing theories that serve as a guide for drafting the arguments the researcher will use (Vinz, 2022). The researcher explains the existing theories that support the research, and the framing methodology that clearly defines the field on which the study rests. Also, the author provides guidelines by following three steps: identifying key concepts, evaluating and explaining relevant theories, and showing how the current research fits into existing research.

1.7.1.1 Technological Organisational Environmental (TOE) Theory

Tornatzky and Fleischer (1990) proposed the TOE framework to outline the process of innovation. It notes three contexts in an enterprise that influence the implementation of innovation, efficiency and responsiveness in a transportation system: technology, organisation, and environment. The technological context refers to the internal and external technology applicable to the organisation, and the relevant technologies that are available for future integration to improve the service efficiency of the 3PL. The technology-organisation-environment (TOE) framework developed by Tornatzky and Fleischer is a useful theoretical lens for understanding technology adoption within organisations (Kulkarni & Patil, 2020). The TOE framework not only offers a framework that explains the decision to adopt a technological innovation based on technological considerations, but also in terms of the organisational and environmental contexts. The TOE is a classic framework that proposes a generic set of factors that explain and predict the likelihood of innovation/technology adoption (Jana & Kaushik, 2022). The organisational context refers to the visible characteristics of the firm (that is, firm structure, firm size, managerial structure, degree of centralisation); resources (human resources and slack resources); and method of communication (formal and informal) among employees and supply chain collaborators in the transportation system (Curtis & Payne, 2008). The environmental context comprises the market elements, competitors, and the regulatory environment (Tornatzky & Fleischer, 1990). The technological aspect of the TOE framework refers to both the availability and the characteristics of the technologies; so any internal and external technology that is relevant to the firm. The theory aims to ascertain the strategic influence of 3PL partners on efficiency and responsiveness in the collaborative transportation system. It has to determine the effects of technological innovations to influence better collaborative transportation systems in the grain industry.

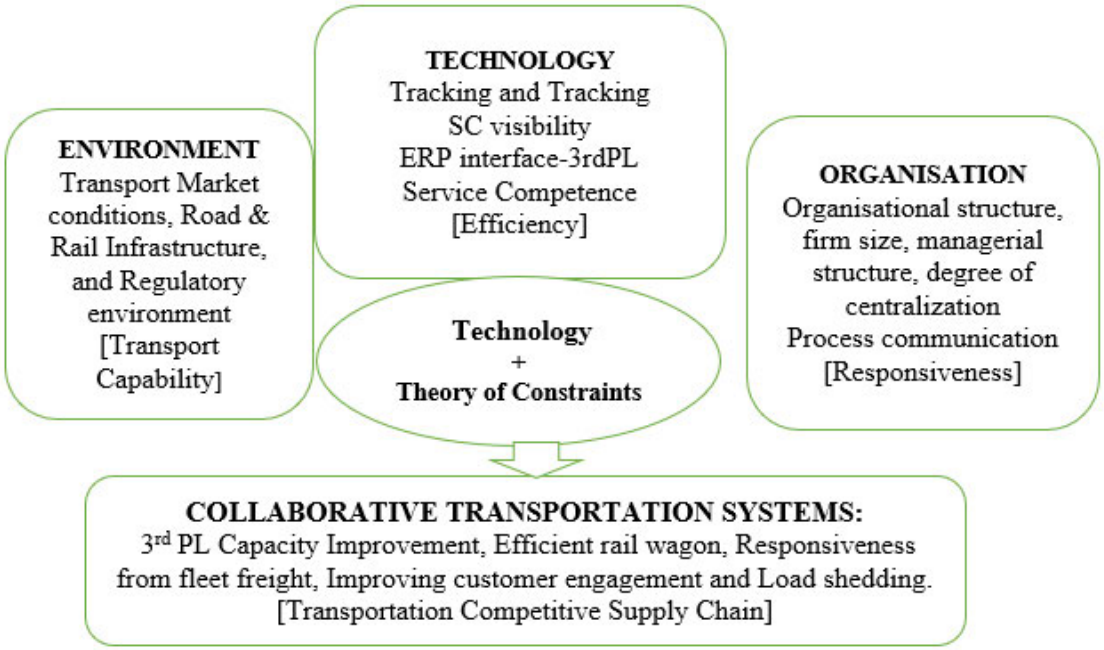
1.7.1.2 Theory of constraints

Dr Eliyahu Goldratt introduced the Theory of Constraints (TOC) as an overall management philosophy in his 1984 book, 'The Goal'. TOC is seen as a philosophy or a management approach that is geared to help organisations to continually achieve their goals. According to TOC, the goal of any organisation is to make profits , and in the future (Goldratt & Fox, 1993). The TOC dictionary defines a constraint as a factor that restricts the outputs of a system or an organisation (Cox, 2012). A resource constraint (bottleneck) is defined as a resource where demand exceeds or is equal to capacity during a given time frame (Cox, 2012). The theory of constraints (TOC) is a methodology for improving processes by focussing on identifying and correcting constraints or root causes of bottlenecks (Rodrigue, 2020). A constraint is described as a limitation or restriction, and the five steps in the theory of constraint are: identifying the constraint; exploiting the constraint; subordinating everything to the constraint; elevating the constraint; and repeating by finding the next constraint.

1.7.1.3 Conceptual Framework

A conceptual framework represents the relationship between the variables and the characteristics in the study (Scribbar, 2022). As shown in Figure 1.1, the conceptual framework is an organisational-level theory, comprising four primary contexts: technology, organisation, environment and constraints. Each context has a set of indications that influence collaborative transportation systems.

Figure 1.1: Conceptual Framework



Source*: Researcher's design*

Figure 1.1 shows the framework which maps the important concepts around which the study centres; that is, the logistics environment; the organisational environment; technologies and the theory of constraints on logistical capabilities.

1.8 Significance of the study

In previous studies conducted by a researcher at the University of South Africa on 3PL sustainability, it was established that 3PL transport in a supply chain network in the South African agribusiness industry was limited due to insufficient road trucks to sustain the industry's demand (Makhetha, 2022). Therefore, it is suggested that this study will contribute to the existing body of knowledge by identifying sustainable initiatives in 3PL fleet outsourcing in South Africa. The study is significant to the extent that it will assess the transport constraints in Twilight Zone and will identify best management practices to benefit both the supplier, Twilight Zone, and the upstream partnerships.

1.9 Justification for the Study

In carrying out this study, the researcher was able to investigate the mechanics that drive shortfalls in transport capacity and the associated constraints. The researcher also investigated alternatives to mitigate the risks of client stock shortage under these circumstances, and the

subsequent losses due to production downtime, loss of turnover, and ultimately, loss of revenue. Therefore this study will be valuable to the grain industry. Studies done on companies in South Africa are related to firms listed on the Johannesburg Stock Exchange (JSE), and thus do not specifically address the logistics companies, most of which are unlisted (Khan, 2020). Therefore, studies of transportation in the grain industry are limited.

1.10 RESEARCH METHODOLOGY:

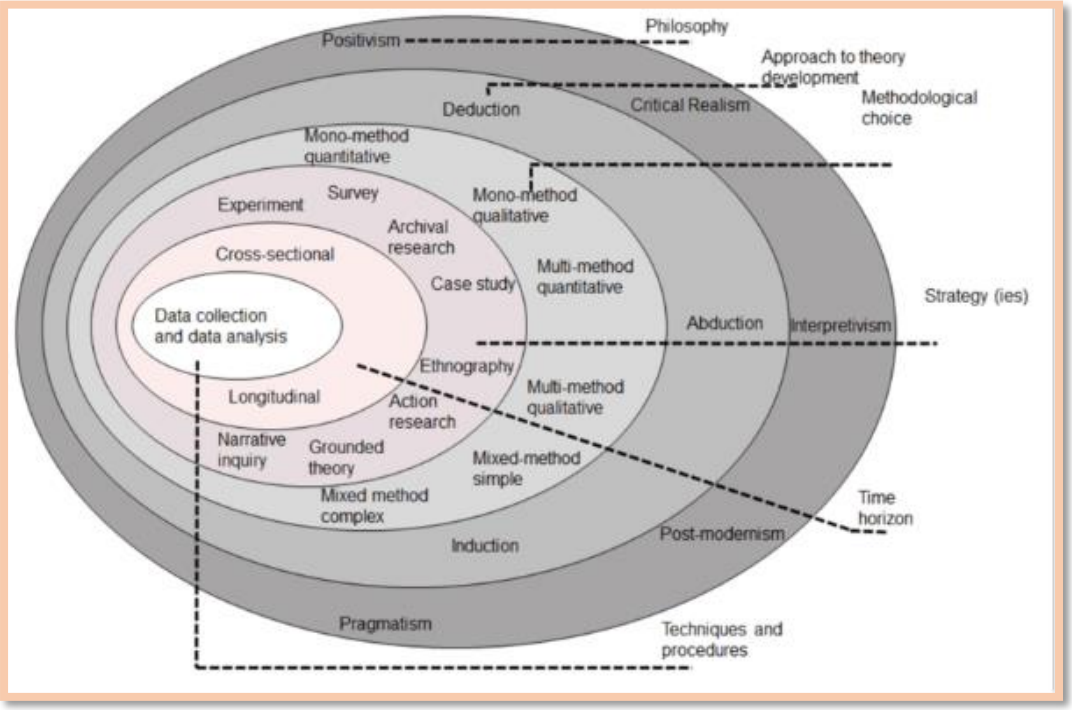
1.10.1 Research Design

Research designs include quantitative, qualitative, and mixed methods approaches that a researcher can use to describe the specific direction that a research study can take; sometimes referred to as 'strategies on inquiry' (Creswell, 2020). For this study, an exploratory case study design has been used.

Research designs are the types of study in quantitative, qualitative, and mixed method approaches, with explicit instructions, that researchers follow in the procedure of study design (Creswell, 2020). Qualitative research describes and analyses, data based on respondents' experiences that they express in their own words. It 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. Therefore, a qualitative method was deemed most appropriate for this study. It is exploratory and descriptive in nature, which is useful, given the lack of published research on this topic. This study is exploratory in that it seeks to understand the advantages and difficulties that Twilight Zone encounters when using 3PL transport. The purpose of the descriptive data was to present an overview of the existing capacity shortages in the firm's business operations and to explain the ideas, details, and operational and financial constraints and impact thereof. This study aimed to pinpoint the benefits and difficulties of using 3PLs at the firms, as well as to explain the driving forces behind doing so. It was intended to demonstrate the advantages realized, the difficulties encountered, and eventually how to overcome the difficulties. The researcher has made use of a pseudonym, Twilight Zone, to protect the image of the organisation where the data was gathered; and it adopted a exploratory case study approach which provided information about the shortage of truck capacity within the organisation, and identified the factors that contributed to the shortfall, before offering possible solutions.

Saunders's research onion (2019) as summarised by Phair (2021), at its simplest level describes different decisions the researcher will make when developing the research methodology; peeling the 'onion', layer by layer, as the researcher works from the outside of the onion inwards, with a range of choices that progress from high-level philosophical to tactical and practical in nature. The research onion is made up of six layers, as shown in the diagram, below.

Figure 1.2: Saunder's research onion model



Source: *Saunders (2019)*

Research philosophy can be described from an ontological or epistemological point of view. Three main research philosophies that operate from ontological and epistemological assumptions are positivism, interpretivism and pragmatism (Warren, 2021). A quantitative approach is used to deduce the problem by gathering numerical data, or data that can be transformed into useable statistics. This type of research uses measurable data to uncover facts and reveal patterns in research (Teherani, 2017).

Interpretivism requires researchers to interpret elements of the study. Thus, interpretivism integrates human interest into a study. Accordingly, interpretive researchers assume that access to reality (given or socially constructed) occurs only through social constructions such as language, consciousness, shared meanings, and instruments (Collins, 2018). This study has adopted the lens of interpretivism in line with the qualitative inductive approach.

1.10.2 Study Site

A research site is a place where people conduct research to gather the required information. It is the physical location where the primary research is conducted (Burke, 2020). This study was conducted at the head office of Twilight Zone, located in Umhlanga, Durban, in the South African province of KwaZulu-Natal.

1.10.3 Sampling Method

The method that is applied for selecting participants is known as the sampling method. It helps in drawing conclusions for the entire population, based on the outcomes of the research (Nicolas, 2021). Probability sampling and non-probability sampling are two types of sampling methods that are used. In probability sampling, the known population is represented in the sample (Shukla, 2020). This means that, in probability sampling, each sample has an equal probability of being chosen. Turner (2020) defined non-probability sampling as a sampling technique where the likelihood of any individual being selected for a sample cannot be calculated. The participants in are chosen using a practical, non-probability sampling technique.

Purposive non-probability sampling was used in this study to choose the participants. Purposive sampling, also referred to as selective or subjective sampling, is virtually synonymous with qualitative research. In this sampling method, the researcher selects a sample of experts and subjects according to the type of topic and their skills concerning that topic (Turner, 2020).

1.10.4 Population

A research population is generally a large collection of individuals or objects that is the focus of a scientific inquiry (Shukla, 2020). In this study, the target population is the personnel in various departments at Twilight Zone at the Umhlanga office. The personnel from the chosen departments comprise eighty-four employees, that are spread across different departments that is, trading, shipping, logistics, IT, human resources, and finance. The study will be focussing on functional and top-level managers in different functional areas as a strategic sampling set.

1.10.5 Sample Size

The sample is the group of people who participate in the research. These are the people who will be interviewed (for example, in a subjective report) or who will be surveyed (in a quantitative report). Individuals who could have been part of the research, yet have decided not

to participate, do not compromise the sample (Soetewey, 2020). For the purposes of this study, the researcher selected seven (7) subjects to be interviewed in the logistics department, that is, the logistics manager; the assistant logistics manager; the transport manager; and two logistics co-ordination team leaders. From the trading department, a senior trader (procurement) was interviewed and, finally, an IT manager was interviewed. The sample comprised top-tier senior management and middle management with adequate knowledge of the processes, based on their logistics expertise and technology, who could provide insight on the topic. The researcher selected a sample of experts and subjects according to the topic and their relevant skills (Turner, 2020), based on their expertise and familiarity with the problem that was the subject of the research (Sekaran and Bougie, 2018). Purposive sampling is commonly referred to as subjective sampling, or judgmental, discretionary, or selective sampling, and is a form of non-probability sampling in which the researcher relies on his or her own judgment in the process of selecting members of the population to participate in the study.

1.10.6 Data Collection Methods

Data was obtained from the participants in a research process, and in-depth interviews were conducted for gathering data (Creswell & Clark, 2020). In this study, in-depth semi-structured interviews were be used as the research instrument. This choice was based on the nature of the qualitative research design. In-depth interviews with experts in Twilight Zone's organisation were used to collect qualitative data. Primary data in this study was collected through interview s with the sample participants. Interviews were conducted using a semi-structured interview guide. To gain adequate data for this research, secondary data was also collected. This was done by reviewing academic journals, textbooks, dissertations, theses, and articles. "Secondary sources like academic journals provide credible backup because they are peer reviewed. Therefore, there is an in-depth understanding of the literature relating to the ground-breaking aspects of the researcher's study" (Coldwell & Herbst, 2014:301). Subsequently, the recorded interviews were transcribed, and thematic analysis was used to identify themes and patterns. Secondary data was gathered and used in this study to provide a perspective on the road freight transport and logistics industry, on the concept of 3PL partnership, and to provide insight into best service endeavours across the supply chain network.

1.10.7 Data analysis

The motivation behind analysing data is to obtain insight that is practical and applicable. According to Nassaji (2015:132), data analysis is "the art or science of examining raw

information to conclude that information". In understanding the need for data analysis, understanding the meaning of data is imperative. Data and information are often confused. While these words are often used synonymously, their meanings are very different. According to Calzon (2022), data represents all available statistics, opinions, facts, and predictions. Information, on the other hand, represents interpreted, formatted, and organised data, which is usable for decision-making (Cant & Van Heerden, 2017). The primary data was analysed using thematic data analysis. The raw data was categorized into themes, patterns, trends, and relationships (Nowell, 2017). To analyse the data and convert it into meaningful, usable information, data reduction was used to ascertain what data from the research was relevant to the research questions and objectives. Thereafter, coding took place. This early step in the data analysis process is defined by Calzon (2022:41) as: "the process of categorizing and sorting data". Coding is used for content analysis by deriving keywords to identify patterns in those keywords and interpreting the meanings of these word patterns (Maguire & Delahunt, 2017). A general inductive approach for the interpretation of qualitative evaluation data was used. The reason for the use of an inductive approach is to disentangle unprocessed textual data into a concise, summary format; to establish a clear connection between the evaluation or research objectives and the summary conclusions derived from the raw data; and to build a framework of the fundamental structure of experiences or processes that are evident in the raw data. The researcher used Nvivo version 14 software to create narrative references and word trees to upload interview information templates.

1.10.8 Data quality control

Structured interviews with seven participants served as the primary source of information for this study. To post precise information without missing or distorting important details, audio recordings were made, with the consent of all the interviewees. A semi-structured interview guide was used to conduct thorough personal interviews. The researcher provided a semi-structured interview guide that was based on the research goals and interview guides, but with the flexibility to allow for more spontaneous and narrative responses from the participants. Two weeks before the interview, contact with the participants was made to set up at a time and day that was convenient for all parties.

To facilitate the use of numerous data collection methods, triangulation was also used in this study. Oslen (2004) noted that the triangulation of procedures verifies information from several sources, offers integrity and confirmation, and creates a balance between two or more different types of surveys. Interviews have the benefit of allowing participants to express their

experiences on the subject in their own words. Semi-structured, in-person interviews were carried out utilizing a semi-structured interview guide to accomplish the aim of this study. Lastly, authenticity was assured by voice-recording the interviews and appreciating each participant's viewpoint. In this study, after the interviews were voice recorded, they were transcribed verbatim.

Data quality control measures credibility and is the process of ensuring that data-gathering instruments consistently measure what they are supposed to measure (Vosloo, 2014). Qualitative research has been criticized for lacking the rigour and credibility associated with traditional quantitative research (Horsburgh, 2003; Dawadi, 2021). Trustworthiness is defined as dependability, credibility, transferability, and conformability. To ensure the trustworthiness of the data collected, the following measures were employed: transparent research procedures, research methods available for review and inspection, and clear rational reasoning that could be provided (Du Plooy, Davis & Bezuidenhout, 2014). To ensure the trustworthiness of the data collected, the following measures were employed: The researcher used thematic analysis, a recent literature review, and triangulation to maintain credibility. Dependability is the "relationship between the methodology, methods, data, and findings Baumgart" (2021:538). This research is dependable because the researcher applied procedures to guide the interview process and ensure confidentiality. Confirmability is the ability of participants to evaluate the integrity and quality of the research. An audit trail was established to ensure that the findings were sound and to confirm these findings. Transferability is the "degree to which findings are relevant and have implications in other populations and settings" (Baumgart, 2021:539). Researchers should "provide sufficient details about the study setting and participant characteristics and compare findings to other studies conducted in different contexts or populations" (Baumgart, 2021:539). Credibility was ensured by reviewing the transcribed text data and analysis before writing up the report (Shen, 2019). Triangulation is an effective approach for validating data by combining information from two or more sources (Fusch, Fusch & Ness, 2018:20). Different viewpoints on key concepts of transportation constraints from the logistics senior management and middle management of Twilight Zone's participants were combined to achieve triangulation.

1.11 Ethical Considerations

Ethical principles are enforced during the process of conducting the study to ensure that the participants are respected and protected from harm and that there is fairness in terms of how the research study is conducted (Bhandari, 2022). The researcher applied for ethics clearance

with the ethics committee at the University of KwaZulu-Natal before any form of primary research was undertaken. Before the interviews were conducted, participants were provided with an informed consent form to complete and sign, noting that they would be participating of their own free will. Gatekeeper permission was applied for, granting the researcher permission to collect data from the participants. This was done before approaching the prospective participants. Any confidential information obtained from the research will be kept confidentially and the participants were assured of anonymity. Participants were guaranteed anonymity, and all private information gathered during the interview was kept private. This study followed all ethical guidelines, which prompted the researcher to conduct herself ethically. The Harvard reference style has been used to cite all secondary sources.

1.12 Conclusion

Chapter 1 proposed and justified the study. It focussed on the problem addressed in the study, which investigated the shortfalls in transport capacity in an upstream supply chain network in the grain industry. It also discussed the aim of the study, the research questions, and the rationale for conducting the study. The chapter included the background to the study and its significance, as well as the research methodology that the researcher used for the study. This chapter provided an outline of how the researcher navigated the study. This is an introductory chapter that introduced the content that will be discussed in this research and discussed why it has been important to conduct this study. The next chapter will discuss the literature relevant to the area of logistics; 3PLs; the nature of the firm's business model; and the framework that underpins this study and guides the research.

1.13 Summary of Chapters

The chapters are organised as follows:

Chapter One	**Introduction and Background to the Study** Chapter One introduced the background to the study**.** The research into the problem was reflected in the presentation of research objectives and research questions which paved the way to the theoretical and conceptual frameworks which were combined to underpin the study. Lastly, the research methodology was discussed, and the chapter concluded with the structure of the dissertation.
Chapter Two	**Literature Review** Chapter Two provides the background to Twilight Zone and reviews theories in the literature to explain transportation constraints.
Chapter Three	**Research Methodology**

	Chapter Three discusses the research methodology from a scientific point of view, discussing the research design, the approach of the study, the need for a qualitative research structure, and ethical considerations.
Chapter Four	**Data Presentation** Chapter Four presents the results that were obtained from data collection. It presents and analyses the data collated from the interviews.
Chapter Five	**Discussion of Findings** Chapter Five discusses the findings of the study and explains the transportation constraints in Twilight Zone, supported by theories in the literature.
Chapter Six	**Conclusion and Recommendations** Chapter Six revisits the research objectives and provides recommendations and suggestions for future research.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This section presents the literature review of relevant studies and theoretical concepts which serve as the foundation for this study. A synopsis of the nature of Twilight Zone's upstream operations will be provided to outline its core business operations within the supply chain network. A literature review entails the collection and review of related theoretical and empirical studies relevant, or applicable, to the research topic. In other words, a literature review is an evaluation of available research findings on a specific academic theme, topic or subject under investigation. This chapter introduces the concept of logistics and supply chain management. The chapter will explain the role of 3PL; highlight the different modes of transport used by Twilight Zone; discuss logistics technology, the logistics environment and logistics organisation, as well as the transportation system; and will explore the principles under which all these spheres operate. The terms '3PL', 'services providers' and 'partners' will be used interchangeably throughout this study.

2.2 Logistics and Supply Chain Management

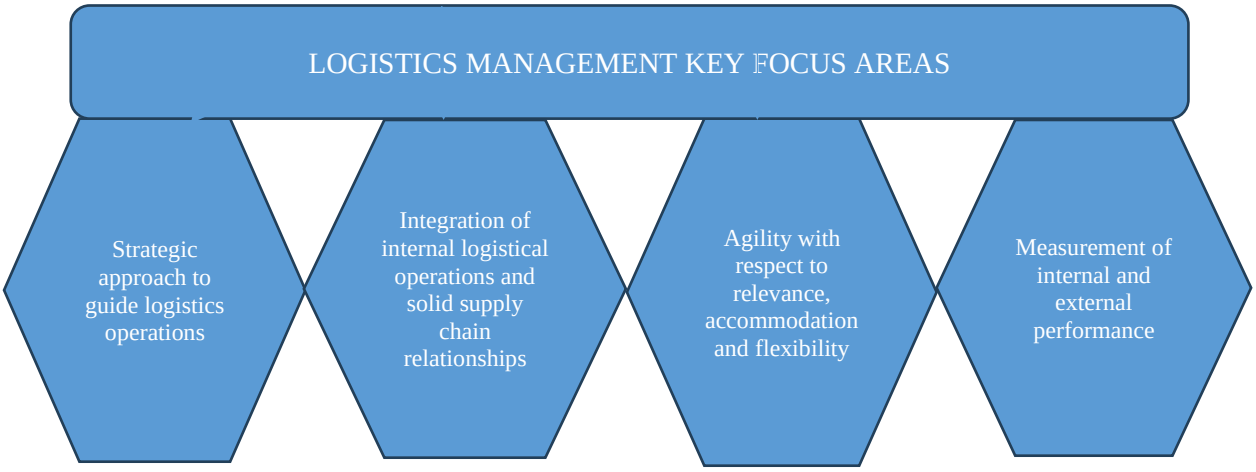
A supply chain produces and distributes products and services to all clients. Supply chain logistics manages commodities, service storage and transportation (Khandelwal, Singhal, Gaurav, Dangayach & Meena, 2021). Logistics and supply chain management may boost competitiveness and customer value when done correctly. Logistics and supply chain management have a relationship, yet include various other operations. Both supply chain and logistics management focus on the flow of goods from the point of origin to the endpoint. Both disciplines require careful co-ordination of supplies, labour and facilities to make sure items can move through the supply chain as required. Supply chain management outlines the strategy, while logistics focuses on the right products being in the right place at the right time (Khandelwal, 2021). This means that these intersect, but differ, when it comes to their scope and focus. This simply means logistics is a key component of supply chain management, but just one piece of the equation. Logistics and supply chain management both work to move, store and deliver goods as efficiently as possible. A detailed review of logistics and supply chain management follows.

2.2.1 Logistics Management

Logistics focuses on the movement and storage of products in the supply chain. This means that logistics focuses on the internal and external movement of goods within an organisation and between extended enterprises. Logistics is the aspect of the supply chain that stores or delivers raw material, component parts, work-in-progress, and finished goods or services to customers, be they manufacturers, distributors or consumers (Demir, Paksoy & Kochan, 2020). The goal of logistics is to deliver goods and services, on time and at a competitive price, to the customer. The processes that fall under logistics include demand planning; transportation; fleet management; inventory management; material handling; and order fulfilment. In other words, logistics co-ordinates people, facilities, equipment and other resources to ensure products move on time (Demir, 2020).

According to Rodrigue (2020), logistics management is the process of planning, implementing and controlling the efficient distribution of services, and the transportation goods and information, from the point of origin to the end user, in a process which satisfies the customers' needs. Rodrigue (2020) further stated that logistics is the system that designs and operates the physical, managerial and informational systems required to allow goods and services to move through time and space. Logistics entails the planning and controlling of all activities that will have an impact on getting the right product to its destination at the right time, in the most cost-efficient manner (Rushton, Croucher & Baker, 2022). Superior logistical performance is a primary area in which organisations participating in an integrated supply chain management initiative can make significant improvements. Logistics management is vital, not only to manufacturing and assembly industries, but also to retailing, transport, and other distribution or service-oriented industries. Owing to intensive competition in global markets, logistical management is considered an important source of competitive advantage (Rushton, 2022). A study done by the Council of Logistics management found that world-class firms are more apt to exploit logistics as a core competency than their less advanced competitors in less developed countries (Tien, Anh & Thuc, 2019) This logic can certainly be extended to all the inter-organisational, cross-boundary, and global supply chains. The Council of Logistics management mentioned four key strategies which contribute to achieving top performance, and therefore, success (Tien, 2019), as shown in Figure 2.1 below:

Figure 2.1**:** Key logistical areas



Source: *Adapted from Tien (2019)*

2.2.2 Definition of Supply Chain Management

Supply chain management (SCM) is the active management of supply chain activities to maximize customer value and achieve sustainable competitive advantage, and it represents a conscious effort by the supply chain firms to develop and run supply chains in the most effective and efficient ways possible (Xu, Kim, You & Lee, 2022:1). Supply chain management is more comprehensive, covering all the co-ordination between the partners that have a role in this network, including sourcing, manufacturing, transporting, storing and selling (Xu et al., 2022). The ultimate goal of SCM is, therefore, to find processes that ensure an efficient flow of goods that provides customers with an excellent experience. Also, SCM sets the strategy and directs daily logistical activities in factories, warehouses or local shipping centres.

It focuses on improving supply chain processes, which can benefit both customers and business partners (Azizian & Sepehri, 2022). Raja, Santhi and Muthuswamy (2022:15), on the other hand, describe a supply chain as "a network of entities that starts with suppliers by way of procurement and ends with customers who support the flow of production and the delivery of goods and services". Supply chain management (SCM) is considered a vehicle for service delivery since it incorporates the forecasting and controlling of all undertakings embodied in outsourcing, purchasing, transformation, and logistical administration (Fernie & Grant, 2019). The key components of supply chain management for Twilight Zone are procurement (farmers harvest), distribution (3PL transport) and storage (warehouse/silo), which capture the essence of the overall supply chain management activities. Therefore, in the SCM, the 3PL partners,

together with Twilight Zone, should constantly assess and monitor transport service competence, responsive capability, capacity constraints, and operational costs in the logistical management portfolio.

2.2.3 Role of 3PL

According to Narasimharajan and Venkatesan (2022), 3PL is the activity of outsourcing activities related to logistics and distribution. The 3PL industry includes logistics solution providers (LSPs) and the shippers whose business processes they support. 3PL describes businesses that provide one, or many, various, logistics-related services. Types of services would include public warehousing; contract warehousing; transportation management; distribution management; and freight consolidation. 3PL is an outsourced provider that manages all, or a significant part of, an organisation's logistical requirements and performs transportation, locating, and sometimes, product consolidation activities (Narasimharajan & Venkatesan, 2022). According to Yadav, Garg and Luthra (2020), 3PL companies play an important role in the transportation industry. It saves time for a business to use a 3PL company, with its core expertise in transportation and logistics. 3PLs normally have state-of-the-art technologies which specialize in the transport and logistics area. A 3PL has an ultimate and customised approach to every complex logistics problem. This enhances the efficiency of the parent company by doing the job better and re-engineering of the distribution network (Yadav, 2020).

The 3PL partners offer logistics services and support some, or all, aspects of a business's shipping operations, managing all aspects of moving goods from manufacturers and distributors to the end customer (Goswami, De, Habibi & Daultani, 2020). 3PL companies provide outsourced logistics services. They provide efficient inventory management and control, avoiding stock-outs and also saving time. A 3PL is commonly used in outsourced logistics and supply-chain management to outsource a company's shipping organisation to increase its competitive advantage (Skipworth, Delbufalo & Mena, 2020; Bian, Yang, Li, Yang & Hua, 2021); to improve the service quality and reliability (Zhu, 2017; Ali, 2023); and to offer greater flexibility (Hwang & Kim, 2019; Zhu, 2017) in dealing with external forces, such as regulation and technology; fluctuating demand; expansion into foreign markets; overcoming restrictive practices and industrial action; and geopolitical disruption, such as

Brexit (Fink & Benz, 2019). Firms may also outsource their logistics activities to 3PL partners in an effort to increase capacity, productivity, efficiency, and profitability (Ali, 2023).

Following is a review of some studies that specifically look at the role of outsourcing logistics in different industries. Heiyantuduwa, Wannisingha and Rupasinghe (2015) conducted a strategic analysis of the use of 3PL service providers in fast moving consumer goods (FMCG) industries using a systematic review of the literature in Sri Lanka. The study found that outsourcing the logistics functions allowed the users to focus on their core competencies, while experts took care of the logistics functions, giving the benefits of increased flexibility, reduced costs and improved services. The review identified several knowledge gaps where the strategic use of 3PLs in the industries could be optimised and developed proposals for future research.

Zailani (2017) studied the influencing factors and the performance of logistics outsourcing practices in Malaysia. The study found that, despite the growing trend in logistics outsourcing, there is very limited literature on logistics outsourcing, especially regarding determining the relationship between the factors influencing outsourcing and the extent of logistics outsourcing practices. The results show that lack of human and physical asset capabilities, as well as transaction uncertainty, influence the extent of different logistics outsourcing practices (Zailani, 2017). The four logistics outsourcing practices under study were found to have a positive relationship with logistics outsourcing performance, particularly strategic focus. This study showed that, although theoretically firms aim at cost reduction by employing a logistics outsourcing strategy, it was not proven, as only one of the four logistics outsourcing practices under study had a positive financial benefit.

Besides that, the results from this study also supported the suggestion that most firms outsource their non-core logistics activities in response to the transaction uncertainties that their businesses experienced. Altahir (2023) investigated the drivers of logistics outsourcing in the United Kingdom's pharmaceutical manufacturing industry using exploratory factor analysis and the t-test. Improving quality and reliability and reducing logistical costs were the most significant reasons for outsourcing logistics services. Improving techno-commercial performance and enhancing delivery performance were identified as factors that influence the selection of vendors. Findings from this research were a guide to outsourcing practitioners' decisions about the selection of logistics service providers. In addition, the study could assist

in enhancing the service providers' understanding of why firms buy logistics services and which services they are likely to buy.

Akhtar (2022) studied logistics services outsourcing decision making using a literature review. The results indicate that outsourcing to 3PL service providers (LSP) helps companies to reduce costs; and improves performance, sustainability, customer satisfaction and profitability. The analysis found that 44 major selection criteria had been used by different authors, but those most commonly used were price; on-time delivery; service quality; reliability; flexibility; equipment and technology; and customer relationships; while environmental and social criteria were rarely adopted. In conclusion, the implications for researchers and practitioners, limitations, and direction for future research were provided.

Mageto (2020) studied the determinants of logistics outsourcing performance among small and medium enterprises. The purpose of this study was to establish the determinants of logistics outsourcing performance and their relationship with logistics performance among small and medium manufacturing enterprises (SMEs). The increasing use, and challenge, of logistics outsourcing require that SMEs establish relationships that ensure good outsourcing performance to enhance overall logistics performance. Communication-trust, innovation and co-operation between the manufacturing SMEs and logistics service providers were identified as key determinants in logistics outsourcing performance. Strong associations were identified between communication-trust, innovation and co-operation. Only communication-trust was positively associated with logistics performance. The results can guide SME managers to promote communication-trust in logistics outsourcing relationships.

In summarising to the discussion on 3PLs value to the supply chain, it is evident that there is an emerging trend for more logistics activities to be outsourced in all industries looking for better viability and sustainability. There are key drivers for this trend: 3PL transporters are one of the main contributors to the success of Twilight Zone's business, and the sustainability of its business operations lies within this function.

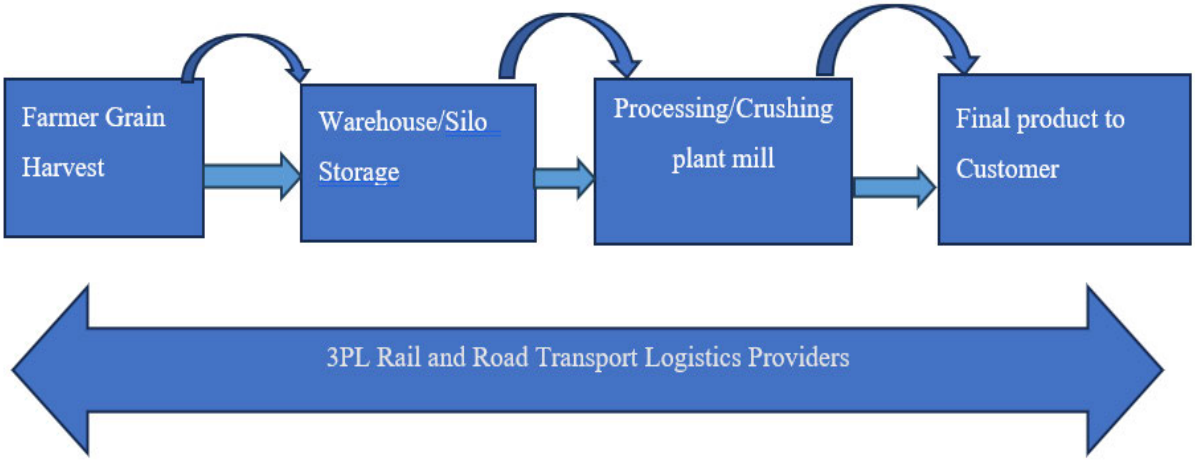
2.3 Background of the Study

2.3.1 The Dynamics of Domestic and International Supply Chain Networks

Twilight Zone's core business function in the local domestic market is based on the supply chain network, as shown in Figure 2.2. The purchase and sale of grain commodities occur within the value chain as the raw grains are sourced from the farmer and transported by road

trucks to the silo storage facility, to manufacturing, and are then transported as a final product to the customer (Ndebele, 2023).

Figure 2.2. Domestic Supply Chain Model of Twilight Zone

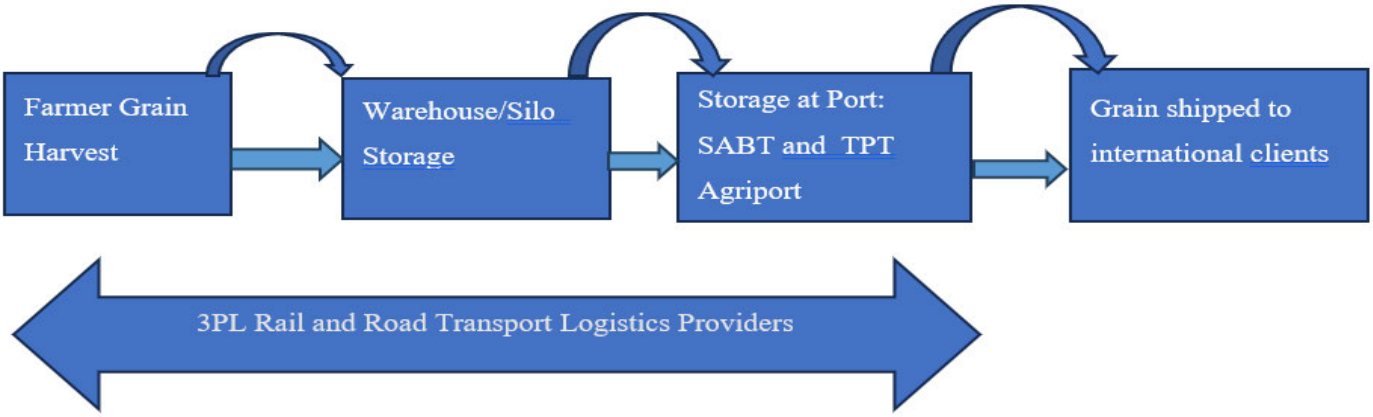


Source: *designed by Researcher*

As shown in Figure 2.2, above, Twilight Zone's value chain consists of the various cycles from sourcing of raw bulk grains, that is soybeans and sunflower seeds, from the farmers' land which and transporting them by bulk freight trucks to be offloaded at grain silos (warehouses) throughout South Africa. Thereafter, the grains are cleaned and dried (when necessary) at the silo storage facility before the product is transported, again using road trucks, for crushing/manufacturing at the crushing plants which are situated in Gauteng, Limpopo and KwaZulu-Natal. Once the soybeans are crushed and manufactured into oil and soya oil cake, the final product is transported to Twilight Zone's domestic customers.

Figure 2.3 shows the supply to international markets, which operates on a similar basis to the domestic supply chain model: The maize bulk grain is transported from the farmers to silo warehouse storage and is then transported by both modes of transport, that is, bulk road trucks and rail wagons, to port storage facilities. The product is then stored at the port terminals and is loaded onto the large bulk vessel (ships) carriers to be transported to global customers (Kolli, Garg & Shirkole, 2023). The success of Twilight Zone's value chain model rests on efficient, timeous, and reliable road and rail transport.

Figure 2.3: International supply chain model of Twilight Zone



Source: *designed by Researcher*

The next section will expand on the different levels within the supply chain and share insights into each link in the chain of business operations which guide the process; and how each value unit plays a role in business and fulfilling orders.

2.3.2 Farmers Grain Harvest and Silo Storage

The agricultural sector in South Africa experienced a good harvest from 2019 to 2020 (Sihlobo & Qobo, 2021). The farming sector output grew by 14% in 2020, 8.8% in 2021, and modestly by 0.3% in 2022 (Statistics SA, 2022). The agriculture sector has been hampered by various factors. These factors include worsening power cuts, deteriorating roads, collapsing water infrastructure, and the crime rate. The energy crisis in South Africa has led to decreased output by farmers due to their heavy reliance on the power supply for irrigation. The poor condition of the roads has compelled farmers to take the initiative to repair roads, increasing their operating costs (Sihlobo & Qobo, 2021).

These challenges highlight the effects of weak governance across all spheres of activity in South Africa. More than two-thirds of South Africa's agricultural produce is now transported by road trucks, as rail transport has faced many challenges in recent years (Statistics SA, 2023). This is a major change from two decades ago, when rail played an important role in transporting produce, especially grains. Water resources have been highlighted by farmers and agribusiness as another major problem. Water infrastructure, such as dams and purification systems, needs constant maintenance to ensure the sustainability and growth of the grain industry.

Agribusiness in various regions throughout South Africa has had to manage the burden of maintaining water systems to ensure the survival of the agriculture industry (Kolli, 2023).

2.3.3 Constraints in Logistical Services

A constraint is defined as a limitation or restriction. Twilight Zone's truck and rail wagon capacity is in short supply for vertically integrated customers, due to transportation constraints in the agri-bulk industry (Zhao & Hou, 2022). Twilight Zone does not possess its own fleet of road freight trucks, as its mainstream core business is the purchase and sale of bulk grains. The executive managers decided to outsource the transport logistics portfolio due to the complexity in, and substantial financial investments required for, this function. Twilight Zone has experienced delays in delivering bulk grains to the port timeously before the vessel arrives. To deliver the full consignment of grain product into the harbour, a bulk vessel carriers' capacity needs to be between 50 000 and 55 000 metric tons. Therefore, if Twilight Zone transports the grain by road only, the firm would require between 1400 and 1700 road trucks in the space of two weeks, or between 1100 and 1250 rail wagons in the same period. A review has been conducted on the constraints in road and transport logistics.

Mgangira (2014) studied the impact of capacity constraints on the delivery of road infrastructure. The delivery of an adequate road infrastructure to communities is one of the core responsibilities of local municipalities and provincial transport, roads and infrastructure departments. However, it was found that local decision making is key to how this is achieved and capacity constraints impact on the process. This paper reflects on observations made regarding separate road projects, one at municipal level, and the other at provincial level, following investigations into the probable causes of the premature failures the roads experienced. The investigation clearly revealed an inability to design the roads, and to access material use during the implementation of the projects to ensure that they were suitable for the intended purpose. Upon reflection, this could be attributed to capacity constraint.

Spiegler and Naim (2014) studied the impact of freight transport capacity limitations on supply chain dynamics. The study investigated how capacity limitations in the transportation system affect the dynamic behaviour of supply chains. The results indicate that transport capacity limitations negatively impact on inventory and backlog costs, although there is a positive impact on the 'backlash' effect. We show that it is possible for both backlog and inventory to occur simultaneously, a situation which does not arise in a compromised scenario. A vertical

collaborative approach to transport provision was the only solution found which is able to overcome such a trade-off.

Modipa (2022) evaluated the impact of cable theft on the free flow of traffic in South Africa. The research also drew on findings from around the world on the impact of cable theft on the free flow of traffic and formulated steps to counteract the problem. The research proposed key steps to prevent cable theft in South Africa. The steps included capacitating law enforcement agencies with the resources to combat cable theft; strengthening partnerships between law enforcement agencies, the business community, and all other significant stakeholders; and increasing the visibility of traffic officials to ensure the free flow of traffic.

Ramuhulu (2018) conducted an investigation into the causes of failures in the railway infrastructure at Transnet Freight Rail. The purpose of the study was to investigate the causes of railway infrastructure failures in relation to TFR's steel and cement business unit. It suggested methods to improve the reliability of the business unit's railway infrastructure and recommended policies to increase the reliability of the railway infrastructure. A quantitative approach was used to conduct the research and questionnaires were distributed to a population of 1048 employees who worked for the business unit, with the participants chosen based on their railway infrastructure experience and railway exposure. The study revealed that extreme weather conditions; ageing railway infrastructure; vegetation; lack of maintenance; other Transnet departments; poor railway infrastructure maintenance; and theft and vandalism, are the major causes of railway infrastructure failures in the business unit. The research made several recommendations, including that the business unit develop a lifecycle management programme for its ageing infrastructure and put skills transfer programmes in place. Railway maintenance was suggested as a key performance measure. These factors will be investigated in the current study.

Mokoena, Rust and Christoffel (2018) conducted a review on the current condition of the rail infrastructure in South Africa. The evaluation was based on the state of primary rail infrastructure components (formation; railway structures; signalling; telecommunications, per way; and electrical systems), as well as key factors contributing to the current condition of the rail infrastructure, such as theft and vandalism of railway assets; a number of train derailments; collisions; and fires. In addition, a national and provincial survey grading system of the current condition of rail infrastructure was assessed. The primary findings of the assessment indicated

a significant and increasing maintenance backlog of track infrastructure along the general freight and branch line network, and more especially on PRASA's passenger rail network. In addition, an increasing trend of theft and vandalism, and an underinvestment in the resources required to maintain the condition of certain network sectors were identified. This has left the overall condition of the majority of the networks in a poor state. The current research will go further to alert government, and the public at large, of the current state of the rail infrastructure in South Africa and the necessity for well-maintained infrastructure to allow the continued and sustainable operation of the railway network.

Bera (2020), studied the challenges affecting the reliability and maintainability of rolling stock operating at Thabazimbi Channel. This research aimed to determine the challenges that affected the heavy haulage company's rolling stock and to identify critical success factors that could improve and optimise the reliability and maintenance of the rolling stock operating at Thabazimbi Channel, a South African company. The research utilised statistical data and a questionnaire to answer the research questions and gain an in-depth understanding of the situation at the case-study company. The results revealed that the fleet was experiencing a decreasing failure rate, meaning the failures were emanating from the production or manufacturing design phase from the original equipment manufacturer (OEM). The results and operational data reinforced that the heavy haulage company's railway infrastructure was experiencing theft and vandalism.

Based on the review in the preceding paragraphs, various factors, both internal and external, hamper operations in the transport industry. This research explores the constraints of road and rail transport and identifies possible solutions and recommendations to support further research and assist the grain industry as a whole.

2.3.4 Logistics – Modes of Transport

According to study conducted by Yannis, Kopsacheili, Dragomanovits and Petraki (2020) in the transport sector, modes of transport are identified as either natural ways or built ways. This section discusses the modes of transport that fall into these two classes, highlighting their characteristics and advantages.

'Natural ways' of transport utilise natural elements like water, air and land for transportation. Transporters and shippers take advantage of the inherent properties of these elements for movement. Waterways include oceans, seas, rivers, and canals. Shippers facilitate

transportation using ships, boats, and barges. Some characteristics and advantages of water transport include high carrying capacity, allowing large quantities of goods to be transported cost-effectively for long-distance distances, especially bulky or heavy cargo; low energy consumption compared to other modes of transport; and reduced traffic congestion on roads and highways (Yannis, 2020). Air transportation uses aeroplanes and helicopters. Some characteristics and advantages of air transport include rapid and efficient transportation, especially for long distances; global connectivity, enabling travel between distant locations, facilitating international trade; the ability to overcome geographical barriers and difficult terrains; and saving time, particularly for urgent or time-sensitive shipments (Bergantino, and Madio, 2020).

According to Hlavatý and Ližbetin (2021), 'built ways' of transport refer to man-made infrastructure that enables movement and connectivity. They include roads, railways, and pipelines. Roads consist of paved surfaces and a networks of roads. They are used by vehicles such as cars, buses, trucks, and motorcycles. Some characteristics and advantages of road transport include flexibility and accessibility, providing door-to-door transportation; easy construction and maintenance compared to other modes of transport; suitability for short-to-medium distances and for reaching remote areas; and allowing for individual transportation and personal mobility (Hlavatý & Ližbetin, 2021). Railways involve transportation on tracks using trains and trams. They are characterised by fixed routes and infrastructure. Some characteristics and advantages of rail transport include high capacity for carrying both passengers and goods; being energy-efficient and environmentally friendly compared to road transport; suitability for long-distance transportation and bulk cargo shipments; and less susceptibility to weather conditions, compared to air or road transport (Yannis, 2020).

Pipelines are used for transporting liquids, gases, or slurry-like substances. They are often used for transporting oil, natural gas, water, or other fluids (Wang, Cheng, Zhao, Liao & Zhang, 2022). Some characteristics and advantages of pipelines include efficient and continuous transport without the need for intermediate handling; lower operating costs and reduced energy consumption; minimal environmental impact, with reduced risk of accidents or spills; and long-distance transportation capability for fluids (Wang, 2022).

It is worth noting that some modes of transport can have characteristics that fall into both natural and built ways, depending on how they are utilised. Ships (waterways) and aeroplanes

(airways) are man-made, but they primarily rely on natural elements for transportation. Each mode of transport has its strengths and is suitable for specific purposes. The choice of transportation mode depends on factors such as distance; the nature of the cargo; time requirements; cost considerations, and geographical factors (Yannis, 2020). Due to the nature of Twilight Zone's business in the agricultural sector, the firm makes use of two modes of transport: bulk road freight trucks and rail wagons. Twilight Zone's selection of both road and rail transportation is mainly due to their storage holding capacity and the speed at which they can deliver commodities to the end point.

2.4. Theoretical and Conceptual Framework

This study made use of reviews of both the theory and conceptual frameworks, for the research into the 3PL capacity constraints experienced by Twilight Zone. The reviews served as a road map to explain phenomena and draw conclusions and connections. The conceptual framework's variables, including technology, the environment and the organisation, were interconnected to provide the overall review of the collaborative transport logistical system's functionality through the various departments in Twilight Zone.

2.4.1 Theoretical Framework

A theoretical framework consists of existing theories that serve as a roadmap for developing the arguments the researcher will use (Vinz, 2022). Vinz explained that, in the theoretical framework, the researcher will explain the existing theories that support the research and the framing methodology that clearly defines the field, on which the study rests. Vinz also provided three steps to follow, as a guideline: identifying key concepts; evaluating and explaining relevant theories; and showing how the current research fits into existing research. The conceptual frame that combines both TOE theory and the TOC was used to ascertain the strategic influence of 3PL partners on efficiency and responsiveness in the collaborative transportation system.

2.4.1.1 Technological Organisational Environmental (TOE) Theory

Tornatzky, Chakrabarti and Fleischer (1990) proposed the TOE framework to outline the process of innovation and the factors that affect its adoption. TOE was initially created to study business organisations' use of information systems and their adoption of information technology (Tornatzky, Chakrabarti & Fleischer, 1990). Tornatzky (1990) provided a good organisational structure, technology portfolio, and environmental approach for complex IT innovation. This research needed a theoretical framework to understand third party logistics as

an innovation. Technological, organisational, and environmental aspects have determined Twilight Zone's 3PL adoption. The researcher will discuss the TOE theory as a 3PL adoption model. This research has used the TOE framework for numerous reasons (Ijab, 2019): Firstly, the TOE theory is well-founded, theoretically and empirically (Matandela, 2016). Secondly, it matches other innovation theories like DOI (Baker, 2012). Thirdly, incorporating three-tier content (technology, organisation, and environment) is preferable over other models, because the TOE theory provides a complete picture of the elements impacting technology decisions and choices. Also, it summaries three features (technology, organisation, and environment context) that influence the implementation of innovation in the transportation system. Finally, the TOE theory has examined the introduction of numerous technologies, which was useful in investigating technology acceptance (Ijab, 2019).

i. Technological Context

Technological context refers to corporate technology, both internal and external (Lee & Penning, 2001). External technologies are those accessible on the market, but not used by the company. The firm's present technologies determine how much technological development it can embrace; hence they impact its smart technology use (Davis, 1989). The Twilight Zone's logistics technology adoption decision was influenced by market technologies it does not use. Logistics technology might change gradually, synthetically, or abruptly (Tornatzky, 1990). Although the successful adoption of logistics technology depends, to a large extent, on the organisation's technical competence (Martin, 2016), there is little research that takes technological features into account when examining the aspects influencing logistics technology adoption in supply chain management. The technological context may be examined from three perspectives: complexity, relative advantage, and compatibility (Tornatzky, 1990). The technology context, therefore, refers to the internal and external technology applicable to the organisation, and the relevant technologies that are available for future integration to improve the service efficiency of 3PL. The technological aspect of the TOE framework therefore refers to both the availability and the characteristics of the technologies in logistics and supply chain management. Any internal and external technology that is relevant to the firm is part of the technological context.

ii. Organisation context

Company resources and characteristics constitute the organisational context (Tornatzky, 1990). Baker (2011) posited that the organisation context features and resources of a company include connecting structures between personnel; internal organisational communication procedures; organisational scale; and the quantity of spare resources. Management structure and centralization often determine organisational context. Supply chain management structures need to stay competitive. The organisational context in this research is two-fold, that is, technology readiness and senior management support. To be competitive and adopt logistics technology, organisations need top-level management support. Explorers are the people who first embrace new technology, while the last adopters of new technology are referred to as laggards. The organisational context refers to the characteristics of the firm (firm structure, firm size, managerial structure, degree of centralization); resources (human resources, finances, information); and method of communication (formal and informal) between employees and supply chain collaborators in the transportation system (Baker, 2011).

iii. Environmental Context

The environmental context includes the industrial sector a company operates in, competitors, and government goals. Tornatzky (1990) identified competitive pressure, trade partner pressure, and vendor scarcity as environmental factors. Thus, the organisation's environment includes industry members; rivals; suppliers; consumers; the government; and the community (Tornatzky, 1990). Stakeholders may affect how a corporation views innovation, its capacity to fund it, and its ability to implement it. Stakeholder control over the environment often drives technological innovation.

2.4.1.2 Theory of Constraints

Goldratt and Fox (1993) presented the TOC as a management theory in their 1984 book, 'The Goal'. The TOC is a philosophy or management strategy that helps firms accomplish their goals. The TOC says every company's principal goal is to create money now, and in the future (Goldratt & Fox, 1993). The TOC defines a constraint as a factor that limits the outputs of a system or an organisation. When demand exceeds capacity at a particular moment, a resource constraint exists (Cox & Boyd, 2020). The theory of constraints (TOC) improves processes by detecting and fixing bottlenecks. It is a technological strategy for system improvement (Rodrigue, 2020). The TOC implies that any complex system integrates internal and external activities. The procedure with the lowest throughput limits system performance. This impact may be temporary or permanent. The theory of constraints (TOC) offers several

analytical tools (Cox & Boyd, 2020): five focus steps, the thinking processes, and throughput accounting.

TOC Analytical Tools

Five Focus Steps:

This approach identifies and removes system limitations to determine the most important ones. Brainstorming identifies and analyses system performance constraints. Optimal segment performance is therefore achieved. Afterwards, the cycle continues (Cox & Boyd, 2020).

Figure 2.4: Five focusing steps

Source: *Cox & Boyd (2020)*

Constraint is, therefore, described as a limitation or restriction, and the five steps of the theory of constraint are delineated as identifying the constraint; exploiting the constraint; subordinating everything to the constraint; elevating the constraint; and repeating by finding the next constraint.

The Thinking Process:

The theory of constraints incorporates a sophisticated problem-solving methodology known as 'the thinking process'. The objective of this process is to first identify the primary root cause of the undesirable effects (UDEs), and afterwards eliminate existing UDEs without giving rise

to any new ones (Sproull, 2019). The methodology used by the 'thinking process' involves the utilisation of a question-answering technique. The three primary enquiries are to identify the changes needed, determine the desired state, and formulate the activities required to implement the change.

Throughput Accounting;

Conventional accounting has negative repercussions that throughput accounting eliminates; otherwise, these variations might hinder long-term profit growth. Throughput accounting has four fundamental measurements. These include net profit, which is the difference between throughput and operating expenditures, and investment ROI, which is the ratio of net profit to investments; and productivity is throughput divided by invested amount. The ratio of throughput to investment is turnover. Improvements increase throughput, decrease investments and lower operational costs, influencing management decisions. This sequence also shows the priority. To sum up, TOC focuses on revenue growth rather than expenditure reduction (Cox & Boyd, 2020).

Less attention has been paid to the supply chain dynamics of re-emerging local road and rail transport systems, including whether their constraints restrict supply capability and whether they can follow good supply chain management principles. The TOC originated in ERP software development. In the late 1970s and early 1980s, Goldratt and others created software based on a dynamic analysis of proprietary algorithms, a set of rules, actions, and measurements, to achieve specified objectives. This software, originally called optimised production timetables, but later renamed OPT, was designed for this market sector and is similar to MRP and JIT control systems (Goldratt & Cox, 1986).

In its evolution into a management philosophy, the OPT system has a common set of precepts that view a system as being more than the sum of its parts; and that constraints within systems at certain points are systematically linked and can be systematically removed (Goldratt & Cox, 1986). Central to this idea is that firms prefer to manage around constraints rather than eliminate them, leading to ineffective coping mechanisms, instead of enabling the system to become more efficient. Thus, constraints dictate system performance, and decisions must be taken to address them. This follows Goldratt and Cox's (1986) cyclical TOC approach to overcoming system constraints: identify the restriction; determine how to exploit it; subordinate every operation to it; and elevate to the next constraint. TOC thinking enhanced

decision-making by adding cause and effect. This process was designed to include behavioural and institutional constraints, which arise after physical constraints are removed or reduced. This is more beneficial to the organisation (Cox & Boyd, 2020) and offers greater opportunities to improve system performance. Goldratt and Cox (1986) acknowledged that addressing physical and conventional operational restrictions to improve operational performance might expose unresolved institutional and political issues.

TOC research is sporadic and rare, compared to JIT and TQM research (Sproull, 2019). Bacelar-Silva, Cox and Rodrigues (2022) suggest that this may be because practitioners, rather than academics, developed TOC. Some simulation modelling research favours TOC systems over JIT systems (Bacelar, 2022). The TOC literature often discusses constraints related to managers, supervisors, executives, stakeholders, and teams; but in the transport industry, TOC implementation is rarely a focus of research. The efficacy and efficiency of the supply chain partnership, as well as the supply chain's eventual success, may be determined by the strength of the logistics and supply chain connection. Using supply chain management to implement the TOC is perhaps one of the best methods to do this. The fundamental tenet of TOC is that all systems, including profit-making enterprises, are required to have at least one constraint that prevents the system from achieving more of its goals and, as a result, sets the system's output (Bacelar, 2022).

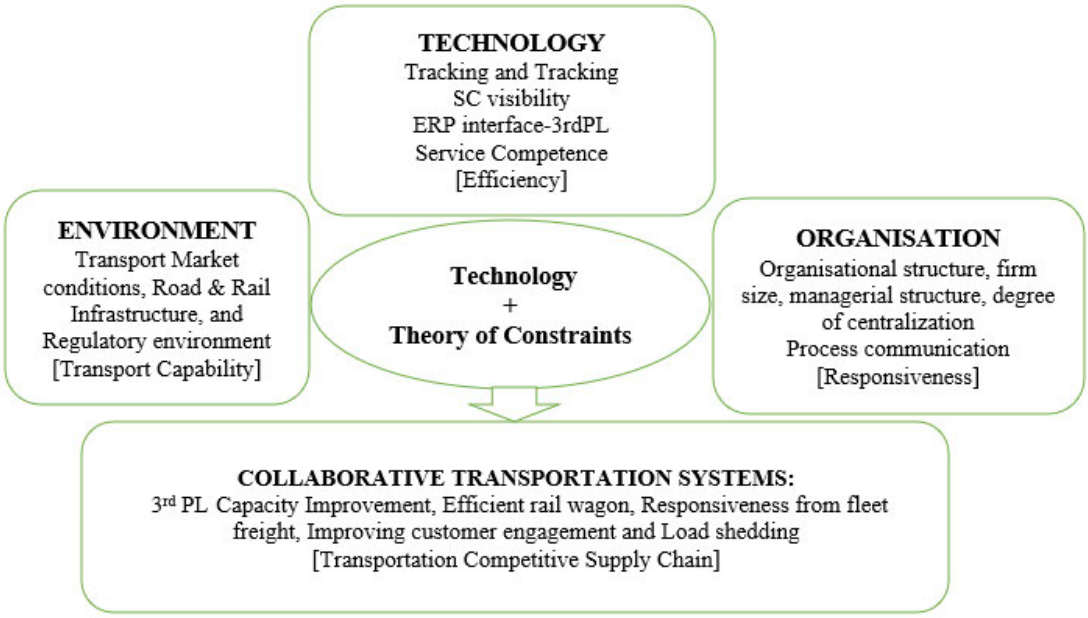
Therefore, anything inside an organisation that prevents improvement or higher throughput is considered a constraint. An analogy of the TOC may be applied to the supply chain, as a weak link in the chain can reduce the overall efficacy and efficiency of the system. In other words, the weakest link in the supply chain will cause it to fail (Bacelar, 2022). For instance, Twilight's lead time would grow due to the partial road transport slowdown and the 3PL transporter's subsequent delivery delays, which would create product shortages for its customers. Due to these product shortages, the merchant would be unable to satisfy client demands, which would lead to a decline in customer service. In this case, the supply chain's (the system's) capacity for 3PL transportation will act as a constraint. The 3PL capacity can be thought of as the 'drum' that strikes the rhythm across the supply chain, in TOC parlance. The supply chain partners, including third parties, may take into consideration the following TOC-concentrating procedures in order to maximise the advantages of the supply chain, given the value of TOC thinking in supply chain management (Bacelar, 2022). The TOC can determine the following: Which supply chain link is the weakest? Which course of action should be chosen to maximise

the benefit of the weakest link (constraint), while avoiding potentially costly adjustments? How can the efficacy of the constraint be maximised, and how can the remaining supply chain operations be adjusted to a 'setting'? What steps are necessary to remove the constraint? Lastly, continue to search for new limitations to break in order to constantly improve supply chain performances.

2.4.2 Conceptual Framework

A conceptual framework represents the relationship between variables and characteristics in a study (Scribbar, 2022). As shown in Figure 2.5, the conceptual framework is an organisation-level theory comprised of four primary contexts: technology, organisation, environment and constraints. Each context has a set of indications that influence collaborative transportation systems, as listed in Figure 2.5, below.

Figure 2.5: Conceptual Framework



Source*: designed by Researcher*

The conceptual framework that combines both TOE theory and the TOC aims to ascertain the strategic influence of 3PL partners on efficiency and responsiveness in the collaborative transportation system. The conceptual framework establishes the influence of technological innovations on better collaborative transportation systems in the grain industry. The

technological innovations include tracking and tracking; SC visibility; and an enterprise resource planning (ERP) interface. Road and rail conditions and infrastructure, and the regulatory environment, comprise the environmental context. The organisational structure; firm size; managerial structure; degree of centralisation; and process communication constitute the organisational context. The constraints, according to the TOC, consist of physical, policy and institutional constraints. The TOC has also been applied to a wide range of business areas, including manufacturing; re-manufacturing; administration; service; the military and education. The application of the TOC results in a significant improvement in organisational performance.

Following is a discussion of logistics technology, and the organisational and environmental context that constitutes the conceptual framework.

2.5 Logistics Environment

Within the grain industry, the logistical transport environment is driven by key areas of activity that control, dictate and contribute to the manner in which transport is allocated and constrained. As shown in the conceptual framework in Figure 2.5, the main areas include market conditions, road and rail infrastructure, and government regulation (Ittmann, 2017). All these factors work together in a linked transport ecosystem to either facilitate freedom of trade or impose transport constraints within the industry. The advantages of rail freight transport include that rail is environmentally friendly due to lower carbon emissions; rail is reliable as it runs on fixed schedules and is not hampered by weather; and rail is safe and has fewer accidents (Daramola, 2022). The inability of Transnet to perform in recent years, due to failing infrastructure, has placed a severe strain on the road freight industry, with both capacity and infrastructural constraints which have a significant impact on the increased demand on the road infrastructure (Munsanje, 2021).

2.6 Logistics Technology

2.6.1 Tracking and Tracing of Vehicles and Supply Chain Visibility in the Supply Chain Network

The process of tracking improves visibility in the supply chain, from the point of moving cargo to the point of offloading the cargo at destinations throughout the logistical stream. Vehicle tracking data shows the position of a vehicle at any given time, since the traceability is linked to the system with a live, up-to-date geographical position. Logistics performance is linked in a reciprocal relationship with successful tracking. Global trade has made digitisation essential

for thriving supply chains, through automation, artificial intelligence, digitised information flow, and enhanced tracking systems (El Baz, Laguir & Stekelorum, 2019). Kuteyi's (2021) research showed that sub-Sahara African (SSA) economies are still in an early stage of development, where inefficient policy frameworks, huge infrastructure deficits, and trade barriers have detrimental effects on the supply chain and lead to negative growth.

There are specific technologies that are relevant for supply chain visibility, such as blockchain and radio frequency identification (RFID), in addition to the technical aspects of collaborative systems and connectivity along the supply chain (Deng & Feng, 2020). RFID was considered a key technology in the early years, while blockchain technology has been dominant since 2019. RFID enables the visibility of goods as they move along the supply chain (Zelbst, Green, Sower & Bond, 2020). Zelbst (2020) suggested that RFID can coexist with blockchain solutions to contribute to supply chain visibility in the supply chain network. Blockchain applications can help increase the visibility of order management and product life cycles (De Giovanni, 2020; Rogerson & Parry, 2020). Kurpjuweit, Schmidt, Klockner and Wagner (2021) found that using blockchain technology, in manufacturing, creates visibility in the supply chain; and Kurpjuweit (2021) reported that blockchain technology improved visibility to offer a tracking and tracing utility of the extended supply chain. Zelbst (2019) examined the role of cloud-based collaborative planning systems in enabling end-to-end supply chain visibility of material movements and current and projected inventory levels in the supply chain network. Connectivity refers to technological infrastructure and is a key antecedent of supply chain visibility. Kurpjuweit (2021) found that visibility was significantly influenced by organisational information technology (IT) infrastructure compatibility among supply chain partners. In conclusion, the technological aspects of connecting the supply chain are an absolute prerequisite for achieving visibility along the supply chain. This means that the successful combination of warehouse robotics; the internet of things; artificial intelligence; blockchain technology; and organisational culture is going to see exponential growth. The time to invest in these technologies is now.

2.6.2 ERP Integration and Interface Connectivity

According to Langenwalter (2020), ERP implementation is the process of introducing an integrated software system into an organisation. The implementation strategy adopted by a company determines the level of customisation and system complexity. There are three main ERP implementation strategies: comprehensive, middle-of-the-road, and vanilla (Wijaya &

Utomo, 2021). The comprehensive ERP implementation strategy is also known as the 'big bang' approach. It involves extensive customization of the ERP system to match an organisation's unique requirements. This strategy can be risky and expensive since it requires significant resources, time and money to implement it. Comprehensive implementation is more suitable for larger organisations with complex business processes that require extensive customisation. The middle-of-the-road ERP implementation strategy involves a mix of customisation and standard ERP features. This strategy aims to balance customisation with the use of pre-built modules or templates within the ERP system. It is a more cost-effective approach than comprehensive implementation and is suitable for medium-sized organisations with a moderate level of business complexity. The vanilla ERP implementation strategy involves the use of out-of-the-box features of the ERP system, with minimal customization. This approach is the least complex and requires the fewest resources, and least time and money. It is suitable for small organisations with basic business processes and limited resources (Wijaya & Utomo, 2021).

Enterprise resource planning systems are complex software applications that integrate various business processes, including finance, human resources, manufacturing, and supply chain management. 3PL products, on the other hand, are software applications that are developed by external vendors to address specific business needs that the ERP system may not fulfil. Integration and interface connectivity are two different approaches to connecting ERP systems and 3PL products (Santos & Martinho, 2021). Integration involves the exchange of data in real-time, while interface connectivity involves creating a user interface that allows users to interact with both applications. Both methods can be used to extend the functionality of an ERP system and improve business processes (Grigorescu & Ion, 2022). The hardware and software infrastructure decisions are critical components of ERP implementations. Careful consideration and planning of the infrastructure can ensure the system's performance, scalability, and reliability. Additionally, the choice of the implementation methodology is also a key decision that can impact the success of the ERP implementation (Grobler-Debska, Zak, Ciurla, Domagala, Czarnoleski & Baranowski, 2022).

Integration refers to the process of connecting two or more software applications to allow data to flow seamlessly between them. ERP systems are designed to integrate with 3PL products, which can add value by providing additional functionality or meeting specific business requirements (Grobler, 2022). Integration can be achieved through various methods, such as

APIs, web services, and middleware. In an integrated environment, data is shared between the ERP system and 3PL products in real-time, allowing for greater accuracy, efficiency, and control (Younous, Belaissaoui & Taqafi, 2018). Interface connectivity, on the other hand, is the process of creating a user interface that allows users to interact with different software applications (Grobler, 2022). Interfaces can be designed to provide access to specific features or functions of an application. In an ERP system, an interface allows users to interact with 3PL products seamlessly. An interface can be created using various technologies, such as web services, APIs, and database connections (Younous, 2018).

The main difference between integration and interface connectivity is the level of interaction between the ERP system and the 3PL products (Santos & Martinho, 2021). Integration involves the exchange of data in real-time between the two applications, while interface connectivity involves creating a user interface that allows users to interact with both applications. In an integrated environment, data is shared between the ERP system and 3PL products seamlessly, while in an interface environment, the user is required to switch between applications to access different functions (Grobler, 2022).

ERP implementations require careful planning and infrastructure decisions to ensure the success of the system. Two key infrastructural components that need to be considered in ERP implementations are hardware and software (Wijaya & Utomo, 2021). Hardware infrastructure includes the physical components of the system, such as servers, storage devices, and network equipment. The hardware infrastructure needs to be carefully designed and configured to meet the performance and capacity requirements of the ERP system. Hardware infrastructure decisions include choosing the appropriate server and storage configurations; ensuring that the network can handle the data traffic generated by the system; and implementing backup and disaster recovery solutions to minimize downtime (Grigorescu & Ion, 2022). Software infrastructure refers to the operating system, database, and other software components that are required to run the ERP system. The software infrastructure needs to be optimised to support the ERP system's performance requirements and provide the necessary functionality (Grigorescu & Ion, 2022). Software infrastructure decisions include selecting the appropriate (DBMS) to store and manage the ERP system's data; choosing the operating system that is compatible with the ERP software; and selecting the appropriate middleware to integrate the ERP system with other applications (Grobler, 2022). Another key decision during ERP implementation is the choice of implementation methodology. Different implementation methodologies such as agile, waterfall, or hybrid, have different pros and cons, and choosing

the right one for the organisation depends on various factors, such as the organisation's size, budget, goals, and culture.

2.6.3 Logistics Service Competence

3PL responsiveness by way of direct information flow links is important for decision making. Alemu, Hamid, Fitri, Rahman and AL Wadhahi (2021) suggested that applications for smart technologies integrations are highly recommended. Alemu (2021) re-iterated that digital technologies support the digitization of supply chain and operations management and influence decision making. Regarding logistics and supply chain management systems in sub-Saharan Africa, the book, 'Business in Africa in the Era of Digital Technology', presented a broad overview of the impact of digital technologies on business in Africa and has a dedicated chapter that investigates the barriers in SCM systems in Africa and the factors driving collaboration in selected regions (Oyedepo, Adams & Koukpaki, 2021). As reported by the World Bank (2019), logistical challenges and barriers to efficient supply chain management have been discussed at length, in particular, the transportation infrastructure and inefficient port systems which significantly hamper development in logistics and trade across SSA. The report emphasised the application of digitization in the context of sub-Saharan Africa, and how digital technologies can significantly improve the efficiency of food systems and environmental sustainability in Africa. The report emphasised information asymmetry; improving competitiveness, especially for small-scale producers; reducing marketing markets, and improving public services.

As cited by Tolmay and Badenhorst-Weiss (2018), South Africa was ranked highest in Africa, and 22nd globally, in the World Bank's logistics performance index. However, the ranking plummeted to 33rd in 2018 and then rose to 20th in 2023. The decrease in 2018 could have been caused by pressing concerns for logistics in South Africa, which included the rising costs of transportation and the increasing cost of operational infrastructure and personnel. South Africa had a good infrastructure. However, this has not been not maintained or extended to meet the demand, and poor operations, such as lack of communication between various divisions, has led to bad planning, inefficiencies, and lack of accountability. The increase in 2023 is because South Africa become favoured as a gateway to the rest of the continent because of its well-integrated intermodal system of transportation which helps to reduce the stress of logistics and improves efficiency (Tolmay & Badenhorst-Weiss, 2018).

2.7 Logistics Organisation

Cramer and Chisoro-Dube (2021) observed that the foremost supply chain constraint in South Africa is a shortage of skills, particularly in supply chain, communications and engineering. Sundquist, Gadden and Hulthén, (2018) noted that a logistics organisation is a business that provides logistical solutions to other businesses. Logistical solutions involve the planning, co-ordination, and execution of the movement, storage, and packaging of products and materials. A logistics organisation depends on the organisational structure, firm size, degree of centralisation and communication. Each of these factors is discussed separately in the following paragraphs.

Organisational structure, as described by Parthasarthy and Sethi (2018), is the arrangement of personnel and tasks to achieve the goals of the firm. It also involves the process of creating a structure that best suits a purpose, strategy, and environment. The organisational structure and design is influenced by various factors, such technology, culture, innovation and adaptability. McKenna (2020) defined organisational structure as the way individual and teamwork within an organisation are co-ordinated. To achieve organisational goals and objectives, individual work, therefore, needs to be co-ordinated and managed. Structure is a valuable tool in achieving co-ordination, as it specifies reporting relationships (who reports to whom), delineates formal communication channels, and describes how separate actions of individuals are linked together (Parthasarthy & Sethi, 2018). Based on the above discussion, for Twilight Zone to deliver its 3PL plans, the strategy and the organisational structure must be woven together seamlessly. In other words, organisational structure is a term used to highlight the way a company thinks about hierarchy, assigns tasks to personnel, and ensures its workforce works collaboratively to achieve a common goal. Organisations need structure so they can operate effectively in a supply chain. If Twilight Zone has no structure, it will be difficult for employees to know what their roles are, and thus difficult for them to do their jobs. Structure also ensures that employees have the right resources available to them in order to perform their tasks.

A firm's size is the measure of the scale or magnitude of the firm's operations (Karlsson, 2021). There are various ways to define firm size, such as in terms of value added, sales, or the number of employees. As mentioned by Wany (2023), there is no single definition of firm size, but it can be measured by various means, such as sales revenue, market share production capacity, sales revenue, or the number of employees at the firm. For supply chain firms, which are businesses that provide consulting, outsourcing or technology services for managing the flow of goods and services from suppliers to customers, one possible measurement is the annual

revenue. The size of a firm matters in the implementation of supply chain management practices. It implies that larger firms very frequently implement supply chain management and use advanced technologies to integrate supply chain partners. A study has reported on the relationship between types of firms (private and public) and supply chain management implementation; and between size of a firm (small-to-large, in terms of number of employees) and supply chain management implementation.

Managerial structure is the way a company organises its managers according to their roles, responsibilities, and authority. There are different types of managerial structures, such as functional, divisional, matrix, network or hybrid. Each type has its advantages and disadvantages depending on the size, strategy and goals of the organisation. To achieve organisational objectives in an organisation, different levels of management are involved, with different degrees of power, authority, and responsibility (Rezvani, 2017). The breadth of authority and responsibility in an organisation depends on a clear definition of management level. Since the one management level which engages in many unique tasks within the organisation is middle management, it is essential to identify the concept of middle management and to define their functions.

The degree of centralisation is the extent to which decision-making authority is concentrated at higher levels of the organisation. It reflects how much control and influence top managers have over the activities and operations of the organisation (Jiminez, 2022). Jiminez (2022) also mentioned that a high degree of centralisation means that most of the key decisions are made by top managers, with little or no input from lower-level employees. A low degree of centralization means that more decisions are delegated to lower-level employees, who have more autonomy and responsibility. The degree of centralisation can vary depending on the size, strategy, culture and environment of the organisation. There are advantages and disadvantages to both centralised and decentralised structures, depending on the situation and goals of the organisation. Process communication in logistics is the exchange of information between different parties involved in the logistics management system, such as suppliers, senders, receivers, and operations personnel. It ensures the effective, cost-effective and agile logistics operations within the firm, and the supply chain network activities, as a whole ecosystem.

2.8 Collaborative Transport Systems

3PL road freight transport is a type of 3PL service that involves the outsourcing of road transportation of goods to a specialised provider. The Mardor Intelligence Report (2023) labelled 3PL road freight transport as a type of 3PL service that involves the outsourcing of road transportation of goods to a specialised provider. Road freight transport is currently the dominant mode of transport in South Africa, accounting for 87.9% of the total tonnage in 2019 (Statistics SA, 2020). Private fleet transportation has started to regain its importance once again, after a slight downturn. This is because many industries find it convenient to use private fleet transportation these days, even with the various pros and cons. 3PL transporters play a pivotal role in the success of Twilight Zone's ability to deliver on time to its production facilities for the processing of crushed soybeans and maize, and then to transport the products to the port for export.

Responsive transportation is a concept that refers to the ability of a transportation system to adapt to changing customer needs and market conditions. Responsive transportation can be characterized by three attributes: agility, flexibility and velocity (swiftness) (Maersk, 2023). Agile transportation means that the transportation system can quickly respond to changes in the demand, supply and environment, and can cope with uncertainty and complexity. Flexible transportation means that the transportation system can offer a variety of options and services to meet a customer's specifications and needs and can adjust its capacity and routes accordingly. Swift transportation means the transport system can deliver the goods at the right time in the right condition, thereby reducing lead times and costs. Responsive transportation can be achieved by using different technologies and strategies, such as demand-responsive transport (DRT), which is a shared mobility service that has a flexible operating schedule or will provide virtual stops and/or flexible routes (Dilip, 2023). A typical highly responsive supply chain, therefore, holds a high level of inventory to respond to high service-level requirements and has many warehouses close to the customers to respond to short lead-time requirements.

Intelligent transportation is a concept that refers to the application of emerging technologies, such as artificial intelligence; blockchain technology; cloud computing; robotics, and the internet of things (IoT), to improve the performance; safety; efficiency and sustainability of transportation systems. Intelligent transportation is part of Fourth Industrial Revolution (4IR), which is characterised by the fusion of the digital, biological and physical worlds. Three

academics have discussed intelligent transportation in relation to the Fourth Industrial Revolution:

Naidoo (2019) explored the Fourth Industrial Revolution within the context of public sector services in South Africa, focusing on how intelligent transportation can enhance the responsiveness and effectiveness of local government. Moyo (2020) proposed a framework for intelligent transportation systems based on blockchain technology, which can improve the security, transparency and trustworthiness of data sharing and transactions in the transport networks.

Kaur (2021) outlined the current state, and future trends, of intelligent transportation systems, highlighting the issues and opportunities of integrating 4IR technologies, such as artificial intelligence, big data analytics, cloud computing and the internet of things. Following are the development areas of the intelligence transportation system:

1. Fleet scheduling is a discipline that is dedicated to operating the fleets in a more efficient manner. It helps in lowering the annual business costs, without any negative impact on performances and client relationships. It helps the fleet to schedule their routes in such a manner that they not driving unnecessary miles.

2. Vehicle tracking is a system that is associated with the use of automatic vehicle location tracking in particular vehicles, with software that collects the entire fleet's data for an extensive picture of vehicle locations. GPS (global positioning system) technology is used for tracking the locations.

3. Cloud storage of operational data: The operational data store (ODS) is the primary database that provides a picture of the current data from different transactional systems for operating reports. It allows the organisation to combine the data, in its original form from different sources, to a particular destination to make it available for business reporting.

4. Interoperability is the ability to increase efficiency in communicating the information between the transportation agency and the users. The maintenance of forwarding and backward interoperability of ITS equipment reduces the need for re-investment over time. It also increases the economic enterprise's efficiencies. ITS is the operation that is used for sensing; analysis; control; and communication technology for transportation to improve its safety, mobility, and effectiveness. It includes a different variety of

operations that help in sharing information to ease obstruction, improve traffic management, and so on. The areas of intelligent transport system development are fleet scheduling, vehicle tracking, cloud storage of operational data, and interoperability.

As mentioned by Karam (2021) collaborative transportation in the road freight sector is a concept that involves competing companies sharing their transport resources and capacities to optimise their transport planning and reduce their costs and environmental impacts. By establishing collaborative transport networks (CTNs), companies can achieve benefits such as increased load factors; reduced empty running; improved service quality; lower carbon emissions; and enhanced competitiveness. Karam (2021) stated that collaborative transportation also faces many barriers and challenges, such as trust issues; legal constraints; information sharing; operational co-ordination; performance measurement; and benefit allocation among the partners[1]. Therefore, collaborative transportation requires careful design and management to ensure its success and sustainability. In the South African Road Freight Transport Market Report (2021), collaborative transportation was seen as a potential solution to improve the efficiency and effectiveness of the road freight sector, which is facing many challenges, such as high market fragmentation; low profitability; rising fuel prices; congestion; road accidents; and environmental regulations. Collaborative transportation management, therefore, is based on the idea that truckers; loaders; managers; customers; suppliers, and partners can share information to reduce confusion and improve the flow of goods.

A case study by Madhani (2020) stated that a customer-focused supply chain has two objectives: customer satisfaction and cost reduction. In general, increased sales result from higher customer satisfaction and cost reduction, which result from the decrease in material, inventory and transportation expenses. This study also highlighted the significance of a customer-focused supply chain strategy and developed the 4Rs, that is: responsiveness, resilience, reliability and realignment. As mentioned by Ackah (2014), customer satisfaction is considered to be the most important factor, whether it be for a product or a service. In the case of a failure to satisfy customers, the company will be replaced by another. Twilight Zone 3PL transporters must be measured against the factors (responsiveness, resilience, reliability and realignment) set out by Madhani (2020), for the firm itself and its customers to gain a competitive advantage, increase growth, and improve cost reductions across the vertical upstream operations. This study will explore the flexibility and adaptability of the 3PL transporters in Twilight Zone's closed-set customer-focused supply chain.

2.9 Conclusion

This chapter reviewed the literature on the logistical and supply chain concepts that are pertinent to and form the basis for, the study. The theory of constraints was discussed, as well as the important role of technology in supply chain visibility; customer satisfaction; supply responsiveness and transportation collaboration, to ensure an integrated, synergistic supply chain system for sustainability and for Twilight Zone to operate efficiently.

The chapter to follow details the research methodology used to conduct this study.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

In Chapter 2, the study gave full and detailed explanations of the theories in the literature guiding the research. It was explained that the study will apply the theory of constraints in transport, as well as the fundamental framework that supports the study, and the ethics of interrelatedness as the expository and evaluative theoretical framework for discussing and assessing the data.

Research is the methodological gathering, and objective evaluation, of data with the aim of achieving a specific objective (Phillippi, 2018). Research paradigms incorporate fundamental philosophical notions and goals about the nature of reality and the pursuit of knowledge in science (Park, Konge & Artino, 2020). The research methodology describes the procedures employed to solve the research problem (Mishra & Alok, 2017). A good research methodology should be clear, coherent, consistent, and credible. The research methodology's aim is to adequately answer the research questions posed in a reliable and valid manner (Kumar, 2019). Positivism and phenomenology are two schools of thought in this regard. According to Sileyew (2019), research methodology illustrates the process by which researchers create their problem and objectives and offer their findings, based on the data collected throughout the study period. Organisational research is a methodical search for information that can help organisations make good decisions. It seeks to distinguish between what is true and what is not true (Kyngäs, 2020).

This chapter presents the research questions and will strive to achieve the research objectives of the study. This chapter discusses the research methodology used; the target population; sampling; the research instruments; data collection and analysis. The research approach will be qualitative. This type of research explores the views, experiences and perspectives of participants (Liamputtong, 2020). The purpose of this chapter is to provide a scientific basis for the research and the research methods used. The chapter is divided into three sections: a comprehensive explanation of the research design, including the data collection methods and instruments; a description of the participants and the sampling techniques used; and the analysis techniques used, which are discussed in the conclusion of the chapter. This chapter also includes the discussion of the data analysis process and the issues of reliability and validity.

The chapter ends with a summary. The principles of a qualitative case study method are explained.

3.2 Research Objectives and Questions

3.2.1 Research Objectives

The study objectives were:

1. Determine the strategic influence of third-party partners on an efficient and responsive transportation system in the grain industry.
2. Examine the extent of organisational collaboration to manage effective transportation in the grain industry.
3. Establish the influence of technological innovations on better collaborative transportation systems in the grain industry.

3.2.2 Research questions

The study answered the following questions:

1. What is the strategic influence of 3PL partners for the efficient and responsive transportation system in Twilight Zone?
2. To what extent does organisational collaboration enhance effective transportation management in the grain industry?
3. How do the effects of technological innovations influence better collaborative transportation systems in the grain industry?

3.3 Research Design

The research design outlines the overall plan and structure that assists the study, from the initial phase to the final data analysis phase (Creswell, 2017). Research design is the systematic and logical process of planning, conducting, and reporting a research study (Kumar, 2019). Saunders (2016) defines research design as the framework of research method techniques that is chosen by the researcher. The design allows the researcher to focus on the particular research method that is appropriate for the subject matter and to set up successful research. Jongbo (2014) added that research design is a planned framework for action that will serve as a bridge between questions asked during research and the implementation of the research strategy. The research design reflects the purpose of the study: This study was based on a qualitative and interpretivism approach, which was best suited to obtain an in-depth understanding of the participants' input on the transportation constraints of 3PL transport capacity in the grain industry. As this research employed a qualitative approach, the researcher applied an inductive

method to collect data in order to build a theory, as opposed to testing an existing one through a deductive study (Bonner, Tuckerman, Kaufman, Costa, Durrheim, Trevena, Thomas & Danchin, 2021).

According to Saunders (2016), there are certain characteristics of a design. These are: exploratory; descriptive; correlational and experimental research. Exploratory research is aimed at trying to identify the problem. This type of research provides an outcome that is better and allows for a full understanding of the problem. This research will not, however, provide conclusive results. According to Greener and Martelli (2015), this type of research approach is often qualitative, inductive, and divergent in nature. Descriptive research answers questions that are factual in nature. It answers the questions of the 4 W's and 1 H. This research design is more structured that exploratory research. Correlational research looks at the association of variables or searches for relationships between variables. Causal or experimental research was developed to understand why a problem occurred, to eventually show the cause-and-effect relationships. This research design is based on both exploratory and descriptive/qualitative research. Exploratory research was necessary for this study, due to the fact that studies are limited and the issue is not widely explored in the grain industry. Sekaran and Bougie (2019) define an exploratory design as a study where little information or knowledge is available on the phenomenon under investigation, or when a new area of a topic is being investigated (Boolani, Allen, Barrios & Sames, 2022).

Furthermore, the design facilitated superior definitions and a comprehension of the industry issues being studied. This study acquired subjective data, which is not fully structured, from the participants. Nevertheless, this type of design allowed the participants to express themselves with openness and flexibility, which allowed the researcher to draw conclusions from the patterns formed (Saunders, 2016). The following types of data are utilised in a study to make it a success (Saunders, 2016).

3.4 Research Approach

The research approach focuses on the overall direction of the study, and conclusions that will be reached, rather than just the kinds of data that are employed (Winchet, 2019). A research approach is a strategy and process that specifies in-depth procedures for data gathering, analysis, and interpretation, based on general proposition and specific research objectives. The

most common research approaches are quantitative, qualitative, and mixed methods. All three can be used to conduct social research. This study adopted a qualitative approach.

3.4.1 Qualitative Approach

Qualitative research describes and analyses data based on participants' experiences that they express in their own words and assumes that these subjective descriptions are valid (Creswell, 2017). It enables the researcher to assess the participants' behaviour, personal motivation and attitudes and make deductions by identifying the themes in the data. A variety of techniques are subsumed under qualitative research, including content analysis of narratives; in-depth interviews; focus groups; participant observation; and case studies, often conducted in natural settings (Timans, 2019). Schoonenboom (2017) observed that, in analysing and making sense of unstructured data, qualitative research is "about investigating topics, explaining phenomena, and answering questions. Where little is known about a topic, or where a prior study only partially addressed the research questions, a qualitative technique is most appropriate (Shorten, 2017).

3.4.2 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. A quantitative approach measures variables using a numerical system, analyses these measurements using a variety of statistical models, and reports relationships and associations among the variables (Teherani, 2017).

3.4.3 Mixed Methods Approach

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

A qualitative research approach was employed by this study to comprehend the research problem of overcoming the challenges of transportation constraints of 3PL transport capacity in the grain industry.

3.5 Research Philosophy

The research philosophy refers to the source, nature and development of knowledge from a broader perspective. In simple terms, it is a belief about the ways in which data on a phenomenon should be collected, analysed and used (Shorten, 2017). The research philosophy deals with the specific way of developing knowledge in an empirical narrative. This matter needs to be addressed because researchers may have different assumptions about the nature of truth, knowledge and philosophy, which serve as the basis for the research strategy. Different disciplines favour different research philosophies, with the four main ones being pragmatism, positivism, realism, and interpretivism.

This research adopted an interpretivist philosophy. Interpretivism places strong emphasis on people's beliefs and motivations and is thus appropriate to comprehend social phenomena and culture (Mackenzie & Knipe, 2016). The researcher relies on the perspectives of the participants, based on their experiences. Interpretivism thus incorporates a study's human interest. Interpretive scholars "believe that access to reality (given or socially built) occurs solely through social constructions such as language, consciousness, shared meanings, and instruments" (Collins, 2018:12). In the context in which reality is situated, this philosophy seeks to interpret social reality using the various perspectives of individuals.

3.6 Sampling technique

Sampling is a technique used to select individual members, or a subset of the population, from whom to make inferences and estimate the characteristics of the whole population. Different sampling methods are used by researchers so that they do not need to research the entire population to gain actionable insights. Probability sampling is a sampling technique where a researcher sets a few selection criteria and randomly chooses members of a population. All the members have an equal opportunity of being part of the sample. In non-probability sampling, the researcher chooses participants. A non-probability sampling method is not a fixed or predefined selection process and all the elements of a population, therefore, do not have an equal opportunity of being included in the sample (Mackenzie & Knipe, 2016). Non-probability sampling was used in this study to enable the researcher to select participants with the most relevant information in order to gain a comprehensive grasp of the phenomenon under investigation. The purpose of this study was to determine the difficulties confronting the grain industry, especially Twilight Zone, which supplies grain to grain millers, grain crushers, harbour ports and other customers and business partners in the value chain. The participants in this study were chosen using a purposeful non-probability sampling method. Qualitative

research is almost always associated with purposeful sampling, often known as selective or subjective sampling, although it does not allow for the generalisation of the study's results. The researcher assesses the participants' expertise in relation to the phenomenon under study and chooses a sample of experts and subjects (Turner, 2020). The sample was comprised of seven participants from top-tier senior management and middle management with adequate knowledge of the processes, based on their logistics expertise and technology, who provided insights into the topic. Researchers can draw on a wide range of qualitative research designs when they employ purposive sampling. Achieving the goals of these designs often requires a different type of sampling strategy and technique to gather the necessary data to draw conclusions. The various techniques that are possible through the purposive approach allow the research design to be more adaptive, allowing for specific techniques to be applied in working towards the result (Saunders, 2016). Judgmental or purposive sampling is applied at the discretion of the researcher. The researcher considers the purpose of the study, alongside an understanding of the range in the population. The researcher selects volunteers based on their knowledge of, and familiarity with, the research problem (Sekaran & Bougie, 2018).

3.7 Study Site

A research site is the place where people conduct research to get the required information. It is the physical location used for conducting primary data (Burke, 2020). This study took place at the head office of Twilight Zone, located in Umhlanga, Durban, in the South African province of KwaZulu-Natal

3.8 Sampling Method

The method that is applied for selecting participants is known as the sampling method. It enables conclusions to be drawn for the entire population, based on the outcomes of the research (Nicolas, 2021). Probability sampling and non-probability sampling are two sampling methods that are used. In probability sampling, the known population is represented in the sample (Shukla, 2020). This means that each individual has an equal probability of being chosen in probability sampling. Turner (2020) defined non-probability sampling as a sampling technique where the likelihood of any individual being selected for a sample cannot be calculated. These participants were chosen using a practical, non-probability sampling technique. Purposive non-probability sampling was used in this study to choose the participants. Purposive sampling, also called selective or subjective sampling, is virtually

synonymous with qualitative research. In this sampling method, the researcher selects a sample of experts and subjects according to the type of topic and their skills concerning that topic (Turner, 2020).

3.9 Research Population

A research population is generally a large collection of individuals or objects that is the focus of a scientific inquiry (Shukla, 2020). In this study, the target population was the personnel in various departments at Twilight Zone at the Umhlanga office. The personnel from the chosen departments comprised 84 employees, spread across different departments: trading; shipping; logistics; IT; human resources; and finance. The study focused on functional and top-level managers in different functional areas as a strategic sampling set.

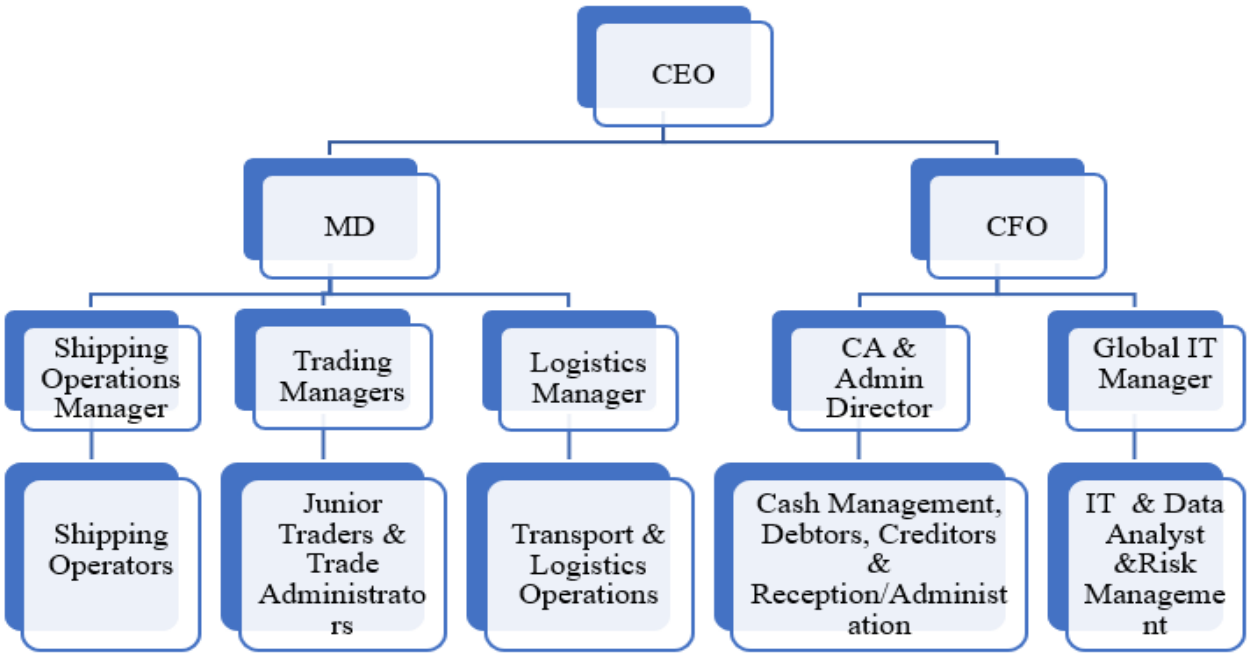
3.10 Sample Size

A sample is a group of people who participate in research. These are the people who will be interviewed (for example, in a subjective report) or those that will be surveyed (for example, in a quantitative report). Individuals who could have been members of the research, yet decided not to participate, do not compromise the sample (Soetewey, 2020). For the purposes of this study, the researcher selected seven subjects to be interviewed, from various departments: in the logistics department, the logistics manager, assistant logistics manager, transport manager, and two logistics co-ordination team leaders; in the trading department, a senior trader (procurement) was interviewed; and from the information technology department, the IT manager was interviewed. Purposive sampling is commonly referred to as subjective sampling or judgemental discretionary or selective, and is a form of non-probability sampling in which the researcher relies on his or her own judgment in the process of selecting members of the population to participate in the study. Purposive sampling is employed where the researcher selects participants who possess the specific knowledge and information required to answer the research questions (Etikan & Bala, 2017). The researcher intentionally and purposively chose the participants from the logistics and IT departments, based on their areas of expertise, their senior roles and responsibility in their portfolios, and their exposure to the current transport capacity constraints under investigation. The sample was selected, based on Martinez-Mesa's recommendations (2016), who stated that between one and thirty informants are adequate to ensure the validity of a qualitative investigation.

i) The Hierarchy of the Twilight Zone Organisation:

The Twilight Zone hierarchical structure, below, indicates the various levels, with the CEO as the head of the company, supported by the MD and CFO who oversee top-tier managers in the various departments. The staff complement comprised 57 staff members when the study was conducted. The CEO devises the strategy of the firm and the framework in which the company operates. The MD and CFO ensure the company is aligned with the CEO's objectives.

Figure 3.1 : Twilight Zone hierarchy



Source*: designed by Researcher*

ii) Overview of Interviewees:

Participants were asked about their position; work experience; current role in the organisation; highest level of education; and clarification of the modes of transport Twilight Zone utilises. Table 3.1 presents the characteristics of the key participants in the interviews.

Table 3.1 Participants' Positions and Roles

Participant	**Management Position**	**Experience (in yrs.)**	**Role**	**Education**	**Modes of transport**
P1	Top	6-10	**Assistant Transport Manager:** Managing the transport portfolio and 3PL transporters.	Degree	Road, Rail, Sea

P2	Top	1-5	**Assistant Logistics Manager:** Imports, exports, and local	Degree	Road, Rail, Sea
P3	Top	10 +	**Logistics Manager:** Leads a team for logistics and execution of all our contracts	High School	Road, Rail, Sea
P4	Middle	1-5	**Wheat Logistics Operations Team Leader:** Local and import contracts	Diploma	Road, Rail, Sea
P5	Middle	1-5	**Maize Logistics Operations Team Leader:** Ensure smooth running of the firm	Degree	Road, Rail
P6	Top	10 +	**Senior Trader:** Trading importing and exporting	Degree	Road, Rail, Sea
P7	Top	1-5	**Global IT Manager:** Looking after anything that touches technology	High School	Road, Rail, Sea

Table 3.1 shows that the majority (5/7) of the participants occupy top management positions at Twilight Zone. Two key participants were from middle management. The interviews were conducted with managers with different work experience. Most (4) of the interviews were conducted with managers with one-to-five years' experience; two had ten or more years' experience; while one interview was with someone with six-to-ten years' experience. The choice of managers at different levels and experience was to get balanced insights from all participants. The first senior manager questioned manages Twilight Zone's transport portfolio, moving all grains from pick-up to destination. His major responsibility is to supply merchandise to the correct clients at the right time, per contract. The first senior manager also manages 3PL transporters and awards contracts based on competitive pricing and capacity. The first senior manager evaluates performance and tailors commercial partnerships to the organisation's needs. The executive's second assistant logistics manager handles imports, exports, and local transportation from farmers to millers and crushers.

The third senior manager was a logistics manager who leads a logistics team and logistically executes all the international and local contracts, from cargo procurement to end-user delivery. The fourth and fifth middle managers ensure that Twilight Zone executes all local and import

contracts on schedule to ensure invoicing and contract completion. The fourth (wheat executive team leader) and fifth senior managers ensure everything is going well and identify any concerns so Twilight Zone can escalate and resolve them within the stipulated timeframe. The sixth senior manager ensures timely entity trading. The seventh senior manager is a head of information technology and reports to the CEO and CFO; and oversees any technological project or problem, locally and globally. The seventh senior manager's responsibility is mobile phones, networking, applications, databases, and hardware-software. The seventh senior manager co-ordinates management and technology for South Africa; the Isle of Man; Monaco; Peru; and Columbia. Table 3.1 reveals that most managers confirmed the company's transport of grains by road, rail, and sea. The table also shows that most individuals are suitably educated for their roles, making them key participants.

3.11 Data collection methods

Data is obtained from participants in a research process and in-depth interviews were used in this study as the data collection instrument (Creswell & Clark, 2020). For this study, in-depth, semi-structured interviews were used. This choice was based on the nature of the qualitative research design. In-depth interviews with experts in the industry were used to collect qualitative data. The primary data in this study was collected by interviewing of the sampled participants. The interviews were conducted, using a semi-structured interview guide. To gain adequate data for this research, secondary data was also collected. This was done by reviewing academic journals, textbooks, dissertations, theses, and articles. "Secondary sources, like academic journals, provide credible backup because they are peer reviewed. Therefore, there is an in-depth understanding of the literature relating to the ground-breaking aspects of the researcher's study" (Coldwell & Herbst, 2014). Subsequently, the recorded interviews were transcribed, and thematic analysis was used to identify themes and patterns. Secondary data was gathered and used in this study to provide a perspective on the road freight transport and logistics industry and on the concept of 3PL; and to provide insight into best service endeavours across the supply chain network.

3.12 Data analysis

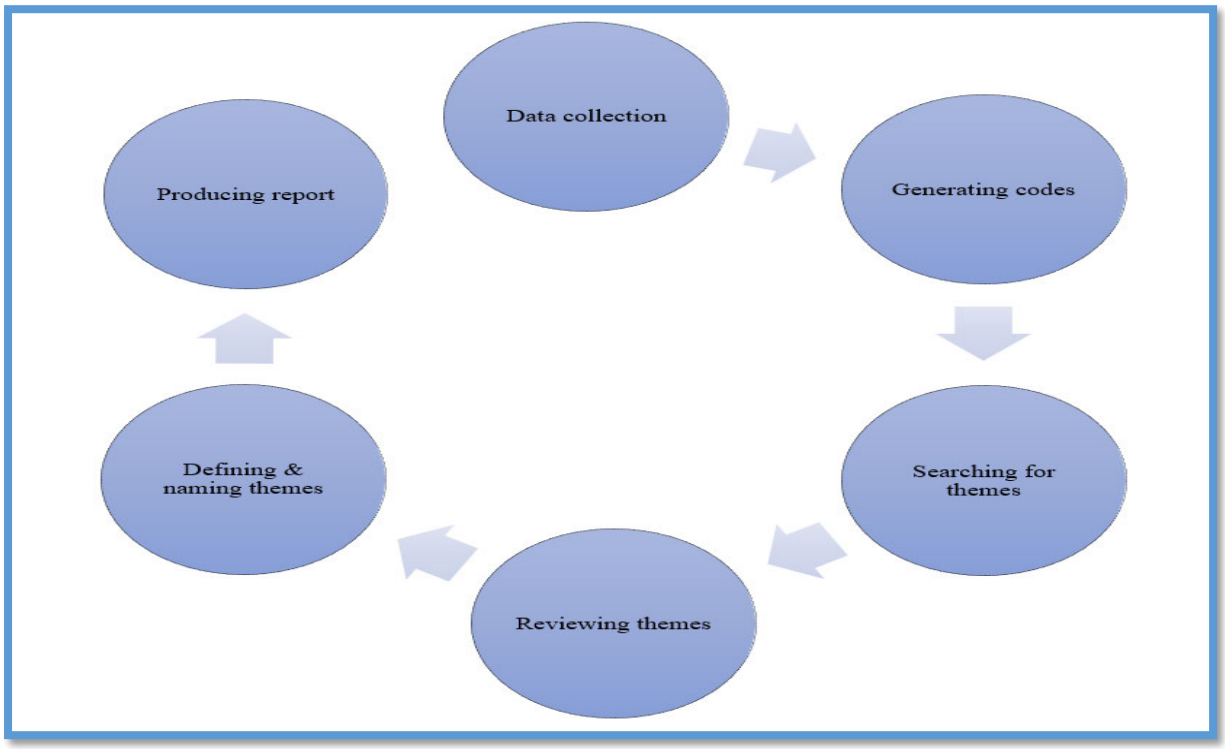
The motivation behind analysing data is to obtain insights that are practical and applicable. According to Nassaji (2015:132), data analysis is "the art or science of examining raw information to conclude that information". In understanding the need for data analysis, understanding the meaning of data is imperative. Data and information are often confused.

While these words are often used synonymously, their meanings are very different. According to Calzon (2022), data are all available statistics, opinions, facts, and predictions. Information, on the other hand, is interpreted, formatted, and organised data, which is usable for decision-making (Cant & Van Heerden, 2017). The primary data was analysed using thematic data analysis. The raw data was categorised into themes, patterns, trends, and relationships (Nowell, 2017). To analyse the data and convert it into meaningful, usable information, data reduction was used to ascertain what data from the research was relevant to the research questions and objectives. Thereafter, coding was undertaken. This early step in the data analysis process is defined as the process whereby data is formatted, sorted and classified (Calzon, 2022). Coding is used for content analysis by extracting keywords to identify patterns in the words and to interpret the meanings of these word patterns (Maguire & Delahunt, 2017). A general inductive approach to the interpretation of the qualitative evaluation data was used. An inductive approach was used to disentangle the unprocessed textual data into a concise, summary format; to establish a clear connection between the evaluation or research objectives and the summarised conclusions derived from the raw data; and to build a framework of the fundamental structure of the experiences or processes that were evident in the raw data. McCombes (2019:41) defined data analysis "as the act of condensing gathered data into a more manageable size while the researcher searches for patterns, employs statistical methods, and summarises the data". Frequency distribution may be used to obtain sufficient readable data. Castleberry and Nolen (2018) stated that, in qualitative research, data presentation is a procedure used to convert, modify and review information to arrive at certain conclusions in relation to a certain condition or problem. Various software programmes can be used to produce charts, tables, and graphs to present data. This enables the researcher to reach conclusions and answer the research questions.

Thematic analysis is a method of analysing qualitative data, such as interview transcripts, survey responses, or social media posts. It involves identifying and organising common themes or topics that emerge from the data and interpreting their meaning and significance in relation to the research question. The researcher used thematic analysis, and NVivo software, to create 'narrative references' and 'word trees' where interview information templates were uploaded. By extracting keywords, identifying patterns in the keywords, and understanding the meaning of these word patterns, coding can be utilised for content analysis (Maguire & Delahunt, 2017). This kind of thematic analysis is thus data-driven (Castleberry & Nolen, 2018). Six-phase thematic analysis is a method used to analyse the data collected from interviewees.

In Phase 1, the researcher studied the data to gain a deeper understanding of the data, then transcribed it, and used NVivo version 14 software to code it. Phase 2 generated initial codes. Phase 3 searched for themes; Phase 4 reviewed themes: Phase 5 defined and named themes, and Phase 6 produced a report. The data was analysed by the researcher with reference to the research objectives, the research questions and the literature, and a comprehensive, well-thought-out report was produced.

Figure 3.2: The Six Steps in Thematic Analysis



Source: *designed by Researcher*

3.13 Actual qualitative analysis

The researcher created simple queries to understand what was happening in the data (QSR, 2023). The interview transcripts were analysed based on defined themes and subthemes. In the transcribed text, query searching was conducted to find all instances of a word, phrase, or concept. According to QSR International (2019), a qualitative research software development company, text querying has three basic functions: Firstly, it enables the exploration of the use, context, and meaning of word(s). Secondly, it enables the automatic coding of words or phrases. Thirdly, searching for concepts enables the use of similar words. As a result, text querying finds and analyses all occurrences of a certain thing. Using querying of responses, the analysis developed insights into the strategic effects of 3PL partners on Twilight Zone; the

extent to which organisational collaboration enhances effective transportation management; and the effects of technological innovations on collaborative transportation systems in the grain industry. The analysis touched on every main theme while concurrently coming up with, and discussing, subthemes.

3.14 Data quality control

In-depth semi-structured interviews with seven participants served as the primary source of information for this study. To post precise information without missing or distorting important details, audio recordings were made, with consent from all the interviewees. A semi-structured interview guide was used to conduct thorough face-to-face interviews. The researcher provided a semi-structured interview guide that was based on research goals to guide the interviews, but with the flexibility to allow for more spontaneous and narrative responses from the participants. Two weeks before the interviews, contact with the participants was made to set up times and days that were convenient for all the parties. To facilitate the utilisation of numerous data collection methods, triangulation was also used in this study. Triangulation of procedures is employed to assist in verifying information from several sources, offer integrity and confirmation, and create a balance between two or more different types of surveys (Olsen, 2004). Interviews have the benefit of allowing participants to express their experiences and opinions on the subject in their own words. Semi-structured, in-person, interviews were carried out using a semi-structured interview guide to accomplish the objectives of this study. Lastly, authenticity was assured by voice recording the interviews and appreciating each participant's viewpoint.

Data quality control is the process of ensuring that the data-gathering instruments measure what they are supposed to measure, consistently (Vosloo, 2014). Qualitative research has been criticized for lacking the rigour and credibility associated with traditional quantitative research (Horsburgh, 2003; Dawadi, 2021). Trustworthiness is defined as dependability, credibility, transferability, and conformability. To ensure the trustworthiness of the data collected, the following measures were be employed: using transparent research procedures; making, research methods available for review and inspection; providing clear, rational reasoning (Du Plooy, Davis & Bezuidenhout, 2014). To ensure the trustworthiness of the data collected, and to ensure credibility, the following measures were be employed: The researcher used thematic analysis; a review of recent literature; and triangulation. Dependability is the "relationship between the methodology, methods, data, and findings Baumgart" (2021:538). This research

is dependable because the researcher applied procedures to treat the interview process with confidentiality. Confirmability is the ability of the participants to evaluate the integrity and quality of the research. An audit trail was established to ensure that the findings were sound and had been confirmed. Transferability is the degree to which findings are relevant and have implications for, and applications in, other populations and settings (Baumgart, 2021). Researchers should "provide sufficient details about the study setting and participant characteristics and compare findings to other studies conducted in different contexts or populations" (Baumgart, 2021:539). Credibility was ensured by reviewing the transcribed text and analysis of the data before writing up the report (Shen, 2019).

3.15 Ethical consideration

These principles were enforced while conducting the study to ensure that the participants were respected and protected from harm and that there was fairness in terms of how the research study was conducted (Bhandari, 2022). The researcher applied for ethical clearance with the ethics committee at the University of KwaZulu-Natal before any form of primary research was undertaken. Before the interviews were conducted, participants were provided with an informed consent form to complete and sign, agreeing that they would be participating of their own free will. Gatekeeper permission was applied for, granting the researcher permission to collect data from the participants. This was done before approaching the prospective participants. Any confidential information obtained from the research was kept confidential and the participants were assured of anonymity. This study followed all ethical guidelines, which ensured that the researcher conducted herself ethically. The Harvard reference style was used to cite all secondary sources.

3.16 Conclusion

Chapter Three has provided the justification for the study. This chapter focussed on the problem being addressed in the study, investigating the shortfalls in transport capacity in an upstream supply chain network in the grain industry. It also presented the aim of the study, the research questions, and the rationale for the study. The chapter included the background to the study and its significance, as well as the research methodology that the researcher used for the study. It provided an outline of the method used by the researcher to guide and navigate through the study. The chapter to follow presents the data obtained from the participants in this study.

CHAPTER FOUR
PRESENTATION OF RESULTS

4.1 Introduction

This study researched the transportation constraints of 3PL capacity in the grain industry, using Twilight Zone as a case study. The first objective was to explore the strategic influence of 3PL partners on an efficient and responsive transportation system at Twilight Zone. The second research objective was to explore how organisational collaboration enhances effective transportation management in the grain industry. The third objective was to examine the effects of technological innovations on collaborative transportation systems in the grain industry. As Creswell (2014) advised, qualitative analysis centres on an exploratory analysis of interviewees or text data. The current analysis was based on seven interviewees who responded qualitatively to questions posed in the interview guide. The analysis was performed using text querying of the data. In the study, NVivo version 14 was utilised to analyse the data using the information from text queries, which offered a flexible data exploration approach. The interview transcripts revealed four themes and subthemes, summarised in the table below:

Table 4.1: Themes emerging from the interviews

Themes	**Subthemes**
Theme 1: Capacity constraints	Pressure on road infrastructure
	Load shedding
	SARS slowness
	Strikes
	Congestion
	Production halts
	Theft and hijacking
Theme 2: Strategic effect of 3PL	Effectiveness
	Cost
	3PL
	Customer
Theme 3: Transport technologies	Tracking system
	Network
	Real-time

Theme 4: Organisational Effort	Organisational Structure
	Organisational strategy
	Organisational resources

4.2 Theme 1: Capacity Constraints

Table 4.2 presents the reasons for the capacity constraints affecting the supply of road freight transport to fulfil customer orders, as provided by the participants.

The use of the letter 'P' in the tables below refers reference to the participants. The number indicates which participant responded, as listed in Table 3.1.

Table 4.2: Constraints to fulfilling customer orders

P	**Participants' brief description of constraints:**	**Sub-themes generated**
1	*"Load shedding. Truck driver strikes and protests on the N3. Congestions, and production halts caused by slow SARS customs processing at borders. Durban Riots 2021, grain mills were stopped, leading to a shortage of bread".*	Load shedding Strikes Congestion Production halts SARS slowness Riots
2	*…"Poor road conditions, theft, hijacking, port and border congestions, load shedding".*	Poor roads Theft High jacking Congestion Load shedding
3	*… "road infrastructure is not built to withstand the large amount of volumes we have. All those factors of load shedding, corruption, strikes, and SARS systems have also contributed to constraints"*	Poor roads Load shedding Corruption Strikes SARS slowness

4	*…"bad SA road networks. Eskom load shedding. Shortages with drivers in the market and their periodic strikes that happen in our industry. SARS systems being down or slow."*	Poor roads Load shedding Shortage of drivers Strikes SARS slowness
5	*…"We do have shortages in terms of truck availability, and it also goes with cost as well. Regarding rail, it's a continuous battle to get Transnet to get enough rail wagons available for us."*	Shortage of trucks and rail wagons
6	*… "Road transport is the collapse of the rail transport system that put enormous pressure on road transport. With load shedding, loading on time and in the right quantities to get the export programme is difficult."*	Pressure on road transport Load shedding

Table 4.3 lists the seven common constraints which, the participants believed, negatively affect their ability to fulfil customer orders. These include the implications of loadshedding and disruptive industrial strikes. In addition, congestion on the roads as a result of switching from freight rail to road freight, as well as road works and deteriorating infrastructure all create bottlenecks on the production runs. Table 4.3 lists these problems, ranked in order of the impact they have.

Table 4.3: Narrative instances is response to constraints to fulfilling customer orders

Sub-theme	**References/Narrative Instances**
Pressure on road infrastructure due to rail failure	23
Load shedding	16
SARS slowness	4
Strikes	3
Congestion	2
Production halts	2
Theft and hijacking	1

Table 4.3 shows the constraints in ranked order. They include the pressure from poor roads; load shedding; slow SARS service; strikes; traffic congestion; production halts; theft, and hijacking. The results show that all the participants agreed that pressure on the roads and load shedding were two key constraints that affected delivery to customers.

i) Slow SARS service

The SARS customs system was also affecting the transport system as its system was often partially down. Participants 1, 3 and 4 indicated and agreed that "*The SARS customs system brought border overcrowding; vehicles were held for almost two weeks, and manufacturing facilities had no goods, halting output".*

ii) Strikes

Participants 1, 3 and 4 and indicated, and concurred, that truck driver strikes and demonstrations on the N3 in 2022 created severe backlogs. Participants added that *"The protests block roads, and trucks being burned negatively impacts road transporters ability to fulfil customer contract orders. This slowed the truck from Durban Port SABT to drop off maize for exports and import wheat for local clients".* The participants also alluded to the Durban riots of 2021, saying that *"It blocked all truck capacity carrying grains in and out of Durban, some mills in Durban which had no wheat for production, leaving Durban and adjacent towns short on bread".*

iii) The pressure on road infrastructure due to rail failure and cable theft

Table 4.4 presents the constraints on rail transportation and its consequent impact on road transportation.

Table 4.4: Constraints on rail transportation and impact on road transportation

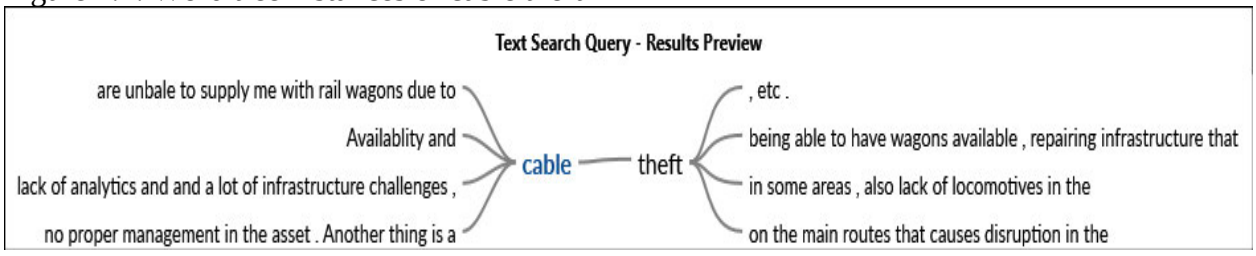
P	**Highlights of rail infrastructure constraints**	**Impact of rail infrastructure constraints on road capacity**
1	*..."the theft of rail infrastructure cables. Parts of the railway lines were washed away during the 2021 floods in Durban."*	Road freight transport was over-stretched by the grain industry, coal and minerals
2	*..."cable theft, shortage of locomotives, lack of skills in the industry, lack of analytics and infrastructure challenges."*	Road transport has increased immensely over the past few years, putting huge pressure on congestion and the port
3	*... "the lack of rail infrastructure, inability to deal with theft."*	As a result of the deterioration of roads all across South Africa – the Free State and north Mpumalanga, and other Mpumalanga areas, there are silos that are now inaccessible, especially when it rains, because of the amount of traffic the highways have to contend with. Our highways are permanently congested, with an increase in accidents and a shortage of qualified drivers; and employment of foreign drivers leads to xenophobia

4	*…"…Transnet cable theft in some areas, also lack of locomotives in the areas, sometimes the vegetation is overgrown over the railways, railways get washed away by heavy rains."*	This leads to an increased demand for trucks; pressure from the increase in tariffs; lives in danger; and congestion at the harbours; and the Komaatipoort border crossing was not built to handle this increase in trucks going through the border. It was built for a certain number of trucks, not the current number of trucks running through.
5	*…"cable theft, repairing infrastructure."*	With no rail, it costs almost double to secure road transport. This has affected costs and margins. No wagons are available, and they have to be secured at a much higher transport rate.
6	*…"at Transnet, there is no proper management of the asset. Cable theft on the main routes, strikes, political unrest, and road transport systems will also greatly affect the rail system."*	The huge impact on the demand and availability of road trucks; negative effect on the road infrastructure; an economic impact of repairing the roads.

The extracts in Table 4.4 clarify how constraints on the rail infrastructure have affected the supply and movement of rail wagons, which has impacted road capacity. The common reasons for the failure of the rail infrastructure were given by participants 1,2,3,4,5 and 6: *"the inability to deal with cable theft; washed-away railway lines by the 2021 floods in Durban; shortage of locomotives; lack of skills in the industry; lack of analytics and infrastructure challenges; the lack of rail infrastructure; vegetation is overgrown over the railways; lack of proper management in the asset at Transnet; political unrest; road transport system will have a big effect on the rail system as well".*

The above tables emphasised the participants' belief that the inability to deal with the theft of rail infrastructure led to constraints in rail capacity. To indicate how often theft was given as the main cause of capacity constraints, and the most dominant subtheme, the researcher summarised the references made to theft in the narrative instances and verbatim statements. The word tree in Figure 4.1 indicates the instances where the word 'theft' was quoted as a problem in the transport system.

Figure 4.1: Word tree instances of cable theft



According to the word in context – 'cable' – in Figure 4.1, there were many instances where participants would use the word to describe theft at Transnet, which is a 3PL partner to Twilight Zone. Some participants stated the following:

Table 4.5: The constraints from, and impact of, cable theft

P	Highlights of Cable Theft	Impact of Cable Theft
5	*..." lack of rail infrastructure that has been constraint, their inability to deal with theft both on the lines and theft of cable."*	Not enough grain commodity supplied to customers at the right time
4	*..."my experience on the desk Transnet have said to me that sometimes they are unable to supply me with rail wagons due to cable theft in some areas."*	Shortage in the supply to clients and mills stop production
2	*.. "a shortage and lack of skills in the industry , lack of analytics and a lot of infrastructure challenges , cable theft.."*	Increased operational costs, profitability, rising fuel prices are all challenges, as well as a lot of competition. Experienced people can negotiate the best rates, but definitely operational costs have increased over the years because of Transnet's poor performance; so road transport is very active and competitive at the moment
3	*..."Transnet cable theft in some areas, also lack of locomotives in the areas, sometimes the vegetation is overgrown over the railways, railways get washed away by heavy rains."*	This leads to an increased demand for trucks; pressure from the increase in tariffs; lives in danger; and congestion at the harbours; and the Komaatipoort border crossing was not built to handle this increase in trucks going through the border. It was built for a certain number of trucks, not the current number of trucks running through.
1	*..."The theft of rail infrastructure cables have caused a major decline of rail services and reliability*	Rail transport of grain to the port for export has declined by 70%. These consignments are now moved by road.

	especially over the past three years. Our maize exports that serviced 70% of exports , it now for this financial year dropped to mere 5% and the balance has been shifted to road."	
2	*..."At Transnet, there is no proper management of the asset. Cable theft on the main routes, strikes, political unrest, and road transport systems will also greatly affect the rail system.*	This has a huge impact on the demand and availability of road trucks, and a negative effect on the road infrastructure. There is an economic impact of repairing the roads.

As shown in Figure 4.2, the participants reported theft as a perennial reason for rail failure, and the authorities are not doing anything to curb the problem. The theft of rail infrastructure cables has resulted in a significant decrease in rail services and dependability, particularly over the last three years.

The issue of availability and cable theft has implications for the number of available wagons and the delay in restoring the infrastructure, which hinders their availability. Due to the absence of rail infrastructure, Twilight Zone is compelled to incur almost double the expenses to procure road transportation. This has significantly impacted their overall costs and profit margins. The unavailability of wagons has necessitated their use of other transportation services at much higher rates. The participants added that "*The lack of effective management within Transnet, the organisation responsible for overseeing rail system logistics in South Africa, has significant implications for the overall functioning of the infrastructure*". One additional factor contributing to disruptions in company operations is the occurrence of cable theft along major transportation routes.

Furthermore, the scarcity of experienced personnel in the locomotive sector has resulted in inefficiencies within South Africa's rail system. According to all participants quoted in Table 4.5, *"There is a perceived negative impact on the road infrastructure"*. This is particularly evident when examining the route to Richards Bay, which passes through various towns where the roads have incurred damage. Consequently, repairing these roads will have economic

implications. To address this issue, the road network must be extended significantly to facilitate the transportation of products to customers within South Africa, and to export markets.

Table 4.6 lists the factors that cause certain road transport-related constraint(s).

Table 4.6: Road transport-related constraint(s).

Road transport constraint(s)	Factors causing road constraints
Road infrastructure constraints	*…"caused by inaccessibility caused by floods. The collapse of the rail network, load shedding, and truck drivers' strikes. Slow SARS customs is not fully functional. Durban riots 2021. Floods in Durban in 2022 washed away an entrance point bridge…"*
Road infrastructure conditions, theft, hijacking, border congestion, port congestion	*…"load shedding and grain volumes caused congestion at ports with turnaround times making it difficult, policies, and waiting for certain documentation for border crossing and at ports…."*
Toll roads, unpaved roads, roads not being kept up to standard	*…"government resource constraint"*
Road infrastructure conditions, border congestion	*…"loads washed away by rain. The use of road instead of rail while transporting minerals has led damaged roads. Slow SARS systems and strikes …"*

Table 4.6, above, shows that road transport constraints are caused by the unavailability of rail transport, caused by the near-collapse of the railway network. The participants added that: *"The use of road instead of rail has led to damaged roads."* Other factors leading to the constraints in road transport in the grain industry at Twilight Zone were given as: "…*the flood in Durban 2021; riots/strikes; large volumes transported; load shedding; inefficient SARS customs service; and government resource constraint"*.

iv) The impact of transport market constraints on Twilight Zone's future business

Table 4.7 summarises the impact of the transport market constraints of short supply and road transport rates and their effect on the company, according to the Twilight Zone participants.

Table 4.7 Transport market constraints and their impact on the company's future business.

P	Transport market constraints	Transport market constraints impact on the company's future business.
1	*"Road freight transport market has been affected tremendously by the near collapse of the rail industry …."*	*"Road transport vehicles are in short supply, therefore transport market conditions, shortage of capacity and high transport rates."*
2	*"Road transport vehicles are in short supply. Therefore, transport market conditions, capacity shortage, and high transport rates."*	*"Costs will be shifted to the end user, and consumers could switch to alternate cheaper products."*
3	*"Volatile prices"*	*"Increased operational costs, profitability, rising fuel prices"*
4	*"Market unpredictability"*	*"Twilight Zone has to compete with feed mills closer to feed plants."*
5	*"High transport tariffs and lack of capacity in the market to handle the product that Twilight Zone wants to move."*	*"Because I work for an essential services company, we have not been hampered that much. And, any increased cost because we act as a middleman in the market, any increased cost or extra costs are transferred to the customer."*
6	*"Trucks taking too long to load. Rail is on the brink of collapse, and the road transport industry is now facing immense pressure to cater to all these contracts. Increasing fuel prices has also led the transporters to increase their rates to meet margins."*	*"Increased fuel tariffs are paying double the small profit margin. Unable to supply the mills fast enough."*

According to participant 5, as in Table 4.7, *"The road freight transport sector has seen a significant impact due to the near collapse of the rail industry"*. All the participants, 2,3,4,5 and 6, lament a shortage of road transport vehicles. Participant 1 stated "*Road freight transport*

market has been affected tremendously by the near collapse of the rail industry; therefore road transport vehicles are in short supply, coupled with the harvest season of grains and coal exports, freight rates are at an all-time high."

Participant 1 also said: *"The expenses associated with maize meal, wheat, and animal feeds are expected to be passed on to the end user, perhaps prompting customers to consider substituting these items with more affordable alternatives".*

Participant 4 stated that *"The market constraints in the Twilight Zone are characterised by unpredictability". This is due to certain routes that have traditionally been highly competitive and cost-effective but are no longer so due to road and rail freight scarcity. Consequently, this scarcity leads to an inflation of the final product, as larger products are transported within the logistics chain. Our current competition primarily stems from feed mills that are in closer proximity to feed plants. Historically, quality has consistently played a significant role in determining their preferred suppliers. However, location has recently become a more influential factor, as having cargo in close proximity helps minimise transportation costs and reduce overall overhead expenses.*

According to P3, *"The absence of a rail system has a detrimental impact". This is primarily because certain contracts requiring rail transportation incur additional costs and higher fuel tariffs. Consequently, the expenses associated with these contracts are twice as much as they should be, resulting in a minimal profit margin. Furthermore, the unavailability of an adequate number of trucks at favourable rates further exacerbates the market situation.*

Participants 1,2,3,5 and 6 are in agreement that the transport market has experienced an increase in transport rates.

4.3 Theme 2: The strategic effects of 3PL

3PL comes up eight times in transport, as indicated in Figure 4.5 To illustrate 3PL as the most dominant subtheme, the researcher summarised its references in the narration and verbatim statements

From the seven participants, key words were identified, and a theme was developed. Regarding the strategic effect of 3PL, the tables show that *effectiveness, cost, and customers are the three*

mentioned subthemes that define the strategic influence of 3PL. The sub-themes derived from the sustainable initiative theme are shown in Table 4.8.

Table 4.8: The strategic effect of 3PL on the transportation system

Main Theme	**Sub-themes**	**References/narrative instances**
Strategic influence of 3PL	Effectiveness	*P1…"manage the fleet and its resources. The firm can concentrate on its…"* *P6…"business profile that we have is making sure that we always find solutions for our clients and our own problems; for us to partner up with a strategic firm that already has a proven track record of being in the industry for a long time, innovative, and have an owner driven business, that would be strategic.."* . *P3…. "the route we looking into because, like I mentioned the restraints in the logistic system of South Africa is experiencing, road and rail transport and because our business model has changed, we now have to supply our own crushing plant with product which we are now reliable on getting the product there in time and as efficient as possible and there's definitely an opportunity to investigate and align our company in partnership with a logistics role…."* *P5…"Third-party logistics give us expertise , cost saving , risk mitigation, limits risk, and resource networking.* *Having different third parties definitely helps to build efficiency…. and it is not our core business."* *P2…." Their strategic influence first is that they concentrate on the firm's transport portfolio, so that we, Twilight Zone can focus on our primary line of business, that is trading."*

	Cost	P1… *"Investment costs are very high. We lack the skill to manage the fleet, time contracts and, most importantly, Twilight Zone's main core function is buying and selling of grains. The mills and animal feed lots."* P5… *"It is the cost, and it is not our core business*." *P6…. "a tremendous investment, money-wise, risk mitigation runs with it, skills shortage*." P7…*"*Our *transport rates are then subsided with a linked transport rate back to our pickup points. The synergy in the network is created and brings for all parties in the network: Twilight Zone, the transporter and our clients in a symbiotic value chain*."
	Customer	*P1… "3PL transporter's relationship extends beyond Twilight Zone and it include our customer…outbound to facilitate and consolidate the logistical stream".* *P5… "collaboration, improves communications, better operations, risk shortages, improves planning, congestions, improves profits, awareness and engagements is very important to work together for the effectiveness of transport…"* *P3: "It bridges the gap between customer and end supplier. Without that third party logistics we would not be able to be in business."* *P6…… "Third-party transporter's relationship extends beyond Twilight Zone, and it includes our customer…outbound to facilitate and consolidate the logistical stream.*"

i) Effectiveness

Participants 1, 2 and 5 confirmed that transport is not its core business and 3PL manages the transport fleet and transport resources, so that Twilight Zone can focus on its primary line of business.

Participants 1 and 6 agreed that investment costs for owning one's own fleet are high.

The verbatim statements, or most narrated examples, show that "3PL gives Twilight Zone expertise; saves costs; mitigates and limits risk; enables networking; and helps to build efficiency. Furthermore, third parties working with Twilight Zone are geared to manage the

fleet". The narration also showed that the 3PL transporter's relationship extends beyond Twilight Zone, and it "includes our customer outbound to facilitate and consolidate the logistical stream. The thirty-party logistics bridges the gap between the customer and the end supplier."

ii) Cost

Figure 4.4 clearly shows that participants consider *"3PL useful for cost savings when third parties are used by the company".* Figure 4.4 provides narrative examples to show that cost reduction is one motive for adopting 3PL. The participants said, *"there would be cost savings as investment. Costs are very high, and the company lacks the skill to manage the fleet and time contracts".* Participants 1, 3, 5 and 7 said that 3PL gives the firm expertise and saves on consulting fees. The participants also said there would be cost savings because concentrating on non-core business would be expensive. The participants agreed that: *"The product will be delivered on time and as efficiently as possible, and 3PL will maintain the effectiveness of transport as collaboration improves communications operations; mitigate risk shortages and improves planning and eases congestions and improve profits; and also, awareness and engagement are very important to work together for the success of transport".*

iii) Customer

Participants 1, 3, 5 and 6 noted that 3PL collaboration closes the gap between the "*firm and customer, improves profits, and facilitates better communication and provides effectiveness of transport."*

To show narrative instances where 'the customer' was the most dominant subtheme, the researcher summarised the references in the narration and verbatim statements, as in Figure 4.3, which shows that participants consider "*3PL useful for customer relationship management when third parties engage with loading and offloading points."*

4.4 Theme 3: Transport technologies

The participants were asked to comment on the transport technologies which were improving efficiency in the Twilight Zone's transport business and its strategic partnerships with third parties. They shared their perspectives on the implications of the Fourth Industrial Revolution's advances in the transportation sector for organisational efficiency in transportation and 3PL transportation. A textual search query regarding the effect of technology on the grain industry,

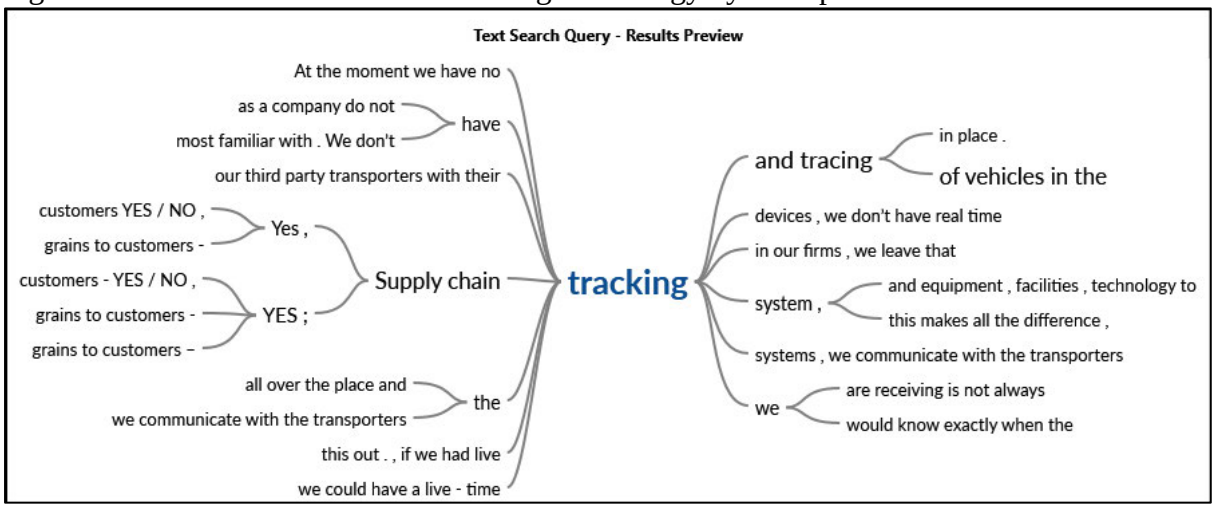
showed that tracking systems, networks, and real-time emerged as the most common words. The sub-themes developed from the transport technologies theme are shown in Table 4.9.

Table 4.9: Transport technologies theme

Main Theme	Sub-themes	References/narrative instances
Technological innovations	Tracking System	15
	Network	5
	Real-time	10

To show that, in the narration, 'tracking technology' was the most dominant subtheme, the researcher summarised the references to tracking technology in the narration and verbatim statements. The word tree in Figure 4.6 shows the instances in the narration where the tracking system was noted as being necessary for the transport system.

Figure 4.7: Word tree instances of tracking technology by third parties.



i) Tracking system

According to the number of words used in the context of 'tracking', there were many instances when participants used the word to describe that Twilight Zone was not using a tracking system to curb inefficiency, instead relying on a 3PL transporter. Some of the participants commented as follows:

P2: "We, as a company, do not have tracking systems; we communicate with the transporters, the tracking system and equipment, facilities, and technology to run it effectively' It's a booking system and booking email."

P3: "Most of our transporters use bid track; and c-track is what I am most familiar with. We don't have tracking in our firms. We leave that to the experts with the 3PL transporters to supply that information."

P4: "We rely on our 3PL transporters with their tracking devices; we don't have real-time updates."

P5: "Currently, we have no tracking and tracing in place."

P6: "I think if we could have a live-time tracking system, this would make all the difference. It saves communication time waiting for third parties, and is also not reliable, and when weekends come. We need to arrange with the terminal and know exactly where those trucks are for preplanning."

Participants 1, 2, 3, 4 and 5 all agreed that the firm does not have a tracking system, which would assist with locating truck.

The discussion above shows that Twilight Zone knows about the tracking system, but it is implemented is done by 3PL transporters who have embraced the tracking technology.

According to the sentiments expressed by the participants in the word tree shown in Figure 4.7, one can infer that the participants would say something relevant about the words 'supply chain tracking'. Most participants said 'yes' that Twilight Zone has no supply chain visibility for the co-ordination and planning of delivery of grains to customers; or for supply chain tracking and tracing of vehicles in the supply chain network.

ii) Supply chain network

Figure 4.8 shows the positive responses to the words 'supply chain visibility'. Participants 1, 2, 3, 4 and 5, all agreed and answered *'yes'* to the question: "W*ill technology enhance supply chain visibility of the co-ordination and planning of grains in the supply chain network?"*

iii) Real-Time

According to the sentiments expressed by those who responded on the relevance of technological innovations in the transportation of grains by Twilight Zone, each participant was likely to mention something connected to the words 'real-time'. In other words, this word is a subtheme that explores what most of the participants, employees working for Twilight Zone, would say about the need for technology to maintain real-time management. In this

context, the word ‘real-time’ was mentioned relevantly in four out of ten references. To show the narrative instances of ‘real-time’ as an important subtheme, the relevant references were summarised as follows.

4.5 Theme 4: Organisational effort

Concentrating on organisational structure, strategy, and resources that assist in improving Twilight Zone’s overall efficiency is one of the most efficient methods to establish the sustainability of removing the constraints of the operation. Participants were asked what resources, structure, and strategy they believed the organisation could use to facilitate sustainable operations in the grain industry.

Table 4.10: Organisational resources, structure and strategy

Subthemes	**Narrative Statement(s)**	**Summary of organisational efforts**
Organisational Structure	*P7: “The company's short-term plan is to restructure and align human capital, place the right resources in the right places, and ensure all the departments are sufficiently buffered with strong skills, training, and a proper succession planning structure…”* *P1: “*Our *structure helps to manage risks, management systems, and controls to be in place to make the business successful, future success, and sustainability.”* *P6: “We are busy with a restructuring phase right now, where we have Twilight Zone corporation down to trading; where we are looking at the six main pillars of how we are looking at streamlining, innovation, innovation, collaboration, all that to bringing in line so that we bring in all the best practices from all the different divisions that we have and bring into one so that we all have one way of working together into one; so that we all have a standard way of working in a hope*	Restructuring, streamlining, innovating, collaboration, and best practices. Risk management framework, management systems, and controls.

	that, that is the best practice currently that we can employ that will keep us through for the future; marketing intelligence and then obviously customer satisfaction at the end of the day."	
Organisational strategy	*P7: "We provide high-quality products that exceed customer expectations. We have developed a strong customer service strategy that ensures all customers are happy with their experiences and the service levels we provide. Focusing on quality and customer service is crucial for our business legacy. We apply offensive, defensive, cost-leadership, predatory pricing, and differentiation strategies."* *P1: "The market is very competitive; innovation, doing something different than your competitors, understanding the market, and then focusing on customer services."* *P5: " It is basically to provide innovative solutions to our clients, to deliver the goods at the right place, time, and price."*	Customer service strategy and customer satisfaction. Quality and customer service. Strategies: offensive strategy, defensive, cost leadership, predatory pricing, differentiation strategies and, innovative solutions, timely delivery of products
Organisational resources	*P1: "The company plan, short-term, is to restructure and align human capital."* *Place the right resources in the right places, and ensure all the departments are sufficiently buffered with strong skills, training and a proper succession planning structure."* *"We have highly skilled, qualified staff to run with the transport operations by ensuring a smooth operations flow, pre-empting truck shortages, and supplying truck position updates through the supply chain. We have resources that oversee new projects with the capacity and expertise to assist. We are exploring deeper into*	We employ skilled, innovative, and qualified personnel to utilize resources for expansion and adaptation in the African markets and Asia.

	Africa's markets with soybeans, soybean meal, and maize in far-east Asia. " *P2: "Yes, I believe so, and we have innovative people who understand the markets and add value to the company. Before penetrating new markets, we studied at the moment we don't have enough resources, but that is something we can adapt to very quickly. If there are new markets, we are flexible for quick turnaround time..."* *P5: "Yes... the company is sufficiently equipped with sufficient human skill set to improve logistical objectives."*	

Table 4.10 shows that Twilight Zone is restructuring in terms of organisational structure. The company is currently restructuring from Twilight Zone corporation to trading, looking at the six main pillars of streamlining, innovation, collaboration, and bringing all the best practices from the divisions into one to all work together. In short, the firm's goal is to reorganise and align human capital, position the appropriate resources in the right locations, and cushion all areas with strong skills, training, and succession planning. In terms of resources, most of the participants believe that: *"Twilight Zone has sufficient resources to ensure the company's smooth operations*".

4.6 Chapter Summary

This study used qualitative analysis. In the analysis, subthemes were developed for each primary theme. The choice of managers from different levels and with varying experience was to get balanced insights from all informants. The analysis shows that most of the key informants were sufficiently educated for their roles, making them key informants. Twilight Zone is currently in the process of dismantling current departmental structures and introducing a coadjutant configuration, positioning Twilight Zone strategically to penetrate new and existing markets, on both the domestic and international fronts.

CHAPTER FIVE
DISCUSSION OF RESULTS

5.1 Introduction

This chapter highlights and discusses the key findings from the literature review and the qualitative research, drawing conceptual parallels, and the data quality control. The intention of this study was to establish the transportation constraints for 3PL capacity in the grain industry at Twilight Zone, to identify the transportation constraints, to establish the impact of the constraints and to identify possible solutions to counter capacity shortages and non-fulfilment of customers' orders, thereby promoting logistical efficiency and maximising revenue within Twilight Zone. This is supported by an assertion from Ralston, Schwieterman, Bell and Ellram (2023), who stated that supply chain competition overlaps with competition between individual companies, and that only when the supply chain achieves high levels of competitiveness can the company envision its long-term sustainability in the market. The results presented in Chapter Four will be discussed in relation to the framework of the study and measured against the research objectives set out in Chapter One. The focus on the concept of transportation constraints that have hampered productivity in the value chain of Twilight Zone has been achieved. The verifiable, conclusive findings of this study provide valuable insight for future research.

Research Objective One

Determine the strategic influence of third-party logistics partners on an efficient and responsive transportation system in the grain industry.

The 3PL partners' contributions to Twilight Zone include expertise; cost savings; mitigation of risks; risk limitation; networking enabling; and helping to build efficiency. According to Yadav, Garg and Luthra, (2020) 3PL companies play an important role in the transportation industry.These results are in line with the notion that 3PL is the activity of outsourcing activities related to logistics and distribution. 3PL, therefore, describes businesses that provide one, or many, of a variety of logistics-related services, giving Twilight Zone freedom to invest and exploit its capital in its core business functions. Jere and Ngidi (2020) argued that using transport technology facilitates enhanced efficiency within the transport system, primarily via tracking and monitoring devices. Transportation costs are often a significant portion of logistics expenses. Transportation costs can vary depending on the industry and specific supply chain requirements, but they are rarely the smallest cost. Other factors, such as inventory holding

costs, warehousing expenses, and administrative expenses, can also contribute significantly to logistics costs.

While many transportation and logistics providers are called 3PL providers, the term ‘3PL’ does not necessarily imply that the seller and buyer have no responsibility for transportation and logistics functions. The term ‘3PL’ typically refers to an external entity facilitating or providing specific services within the supply chain, such as transportation companies, warehousing companies, or customs brokers. This main theme was developed from the responses to the question that enquired about the strategic influence of 3PL partners on the efficient and responsive transportation system in Twilight Zone; the reason for the firm not owning its own fleet; the sustainable competitiveness of 3PL; the government regulation of 3PLs; and performance measurement of 3PLs. The intention was to obtain the perspectives of the Twilight Zone's personnel regarding their observation of the strategic influence of 3PL, the reason for 3PL, and the sustainable advantage of 3PL. In summary, frequently outsourced logistics activities like transportation, warehousing, and distribution are often handed over to 3PL experts to achieve cost savings and improve efficiency. However, less frequently outsourced activities, such as inventory management, demand forecasting, and network design, are typically retained in-house to maintain strategic control over critical aspects of the supply chain. The decision to outsource or keep these functions in-house depends on factors like the company's industry, size, complexity, and strategic priorities. The results are in line with the notion that 3PL is the activity of outsourcing activities related to logistics and distribution. The 3PL partners offer logistics services and support some, or all, aspects of a business’s shipping operations, managing all aspects of moving goods from manufacturers and distributors to the end customer (Goswami, De, Habibi & Daultani, 2020). 3PL, therefore, describes businesses that provide one or many of a variety of logistics-related services. Types of services would include public warehousing; contract warehousing; transportation management; distribution management; and freight consolidation. The outsourced provider manages all, or a significant part, of an organisation's logistics requirements and performs transportation, locating, and sometimes product consolidation activities. As such, 3PL companies play an important role in the transportation industry. This is required in today's business environment, where the responsibility for transport-related activities can be transferred to some other company, while a manufacturing company focuses on its core business. The results in cost savings and effectiveness align with the fact that outsourcing logistics services to a 3PL partner can drive cost savings, allow access to cutting-edge technologies in logistics, and improve scalability and

flexibility. Furthermore, 3PL saves money and promotes effectiveness as there is no need to invest in a warehouse, land, transportation, training, staffing or technology. Outsourcing warehousing services allows companies to use space as needed without the fixed costs of owning and maintaining storage facilities. This is particularly beneficial when demand varies yearly, or businesses want to expand into new markets without making huge upfront investments. As such, participants acknowledge that they would not be in business without 3PL acting as a go-between in the process. Firms may also outsource their logistical activities to 3PL partners in an effort to increase capacity, productivity, efficiency and profitability (Ali, 2023).

Research Objective Two

Examine the extent organisational collaboration manages effective transportation in the grain industry.

The results have shown that participants consider 3PL somewhat useful in customer relationship management. The results showed positive narrative instances that cost reduction was one motive for adopting 3PL, allowing Twilight Zone to focus its capital resources on the fundamentals of its core business model, which is the purchase and sale of grains. Thus, frequently outsourced logistics activities, like transportation, are often handed over to 3PL experts for to save costs and improve efficiency. Akhtar (2022) indicated that outsourcing to 3PL service providers (LSP) helps the companies to reduce costs, and improve performance, sustainability, customer satisfaction, and profitability. However, less frequently outsourced activities, such as inventory management, demand forecasting and network design, are typically retained in-house to maintain strategic control over critical aspects of the supply chain. Therefore, the decision to outsource or keep these functions in-house depends on factors like the company's industry, size, complexity, and strategic priorities. The organisation is, therefore, trying to develop a framework to handle risks, management systems and controls, to ensure economic success and sustainability.

Regarding organisational strategy, Twilight Zone uses several techniques, since it operates in a competitive market in the grain industry and must comprehend the market and concentrate on customer service to satisfy customers. Twilight Zone, in its business, prioritises quality and customer service. Twilight Zone uses offensive, defensive, cost leadership, predatory pricing, and differentiation strategies to fulfil its customer service strategy. It provides innovative solutions to deliver grain industry goods at the right place, time, and price and, consolidates

functions far above its abilities. According to Yadav, Garg and Luthra, (2020), a 3PL company plays an important role in the transportation industry. It saves time for the company, allowing the 3PL company to use its core expertise in transportation and logistics.

Research Objective Three

Establish the influence of technological innovations on better collaborative transportation systems in the grain industry.

The results show that Twilight Zone is not doing anything about information technology tracking systems to curb inefficiency but is rather relying on their 3PL transport partners' communications. Studies have shown that embracing IT promotes a company's growth in the market (Agyabeng-Mensah, 2019). According to the sentiments expressed by the participants, one can infer that they would say something relevant in response to the words 'supply chain tracking'. The supply chain network is better explained by supply chain tracking and tracking of vehicles in the supply chain network. Tan (2020) highlighted 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. Agyabeng-Mensah (2020) asserted that technological developments enhance a firm's ability to respond to customer demand, thus generating increased sales and improved profitability This suggests that the role of technology is best explained by the existence of supply chain networks that benefit Twilight Zone. The narrative instances show that Twilight Zone would like a real-time system. However, it has not been implemented, as the participants would embrace the concept, but have not implemented it. Sutherland (2019) concurred, and noted that South Africa has a significant skills shortage due to failings in its education system, limiting the supply of managers, researchers, and workers required for the Fourth Industrial Revolution. Outsourcing logistics services to a 3PL provider can allow access to cutting-edge logistical technologies, thereby improving customer satisfaction by giving a superior client experience. Normally, customers expect next-day or same-day transportation as a standard. Utilising a 3PL partner, therefore, allows Twilight Zone to offer quick delivery, regardless of where the request is being sent. The narrative instances show that Twilight Zone would like a real-time system. Therefore the objective, which was to assess the influence of technological innovations on better collaborative transportation systems in the grain industry, has been answered here. From the participants, it is clear that the organisation is not implementing much technology in its transport system, by they are exposed to what their 3PL partners are implementing in terms of the tracking system and other real-time

systems and technology. In other words, the supply chain network visibility is better explained by the supply chain tracking and tracing of vehicles in the supply chain network. The 3PLs normally have state-of-the-art technologies which specialize in the transport and logistics area. A 3PL has an ultimate and customised approach to every complex logistics problem. This enhances the efficiency of the parent company by doing the job better and re-engineering of the distribution network (Yadav, 2020). This suggests that the role of technology is best explained by the existence of supply chain networks that benefit and support Twilight Zone. The implication is that the organisation (Twilight Zone) supports the creation of technological innovations to manage its fleet of vehicles. This means the organisation has shown much interest in managing the supply chain using transport technology. The finding, 'creating a supply chain' aligns with those researchers who posited a positive relationship between technological innovation and improvement in the efficient supply chain. The participants believed that linking supply chain networks and technologies would affect the delivery of goods locally and globally. Global trade has deemed digitization imperative for thriving supply chains through automation, artificial intelligence, digitised information flow and enhanced tracking systems (El Baz, Laguir & Stekelorum, 2019).

5.2 Data Quality Control

Vancauwenbergh (2021) stated 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 & Ishtiaq, 2021). Table 5.1 sets out the trustworthiness criteria of the study, namely, credibility, dependability, confirmability and transferability. Data quality control criteria were applied and achieved in this study, as noted in the last column in Table 5.1.

Table 5.1: Data quality control criteria

Criteria	Aim	Researcher applied Data control criteria
Credibility	Establish confidence in the study's ability to capture what the research	In-depth interviews of seven key participants were conducted and recorded; the data was transcribed

	aimed to study, and that the results are true, credible, and believable.	for accurate interpretation by experts using NVivo version 14 who coded and categorised it.
Dependability	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 the seven participants, for the voice recordings of the interviews, and with confirmation of confidentiality. Permission was obtained to record the interviews and the participants were informed that they could withdraw from the study at any time should they feel uncomfortable. Experts employed NVivo version 14 who coded and categorised it.
Confirmability	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 seven participants selected for this research had the expertise, experience and knowledge necessary to answer the questions truthfully and accurately.
Transferability	Extend the degree to which the results can be applied in other situations or generalised to other contexts or settings.	The seven participants' demographic details and the research setting were detailed so that the results can be applied to similar settings.

Source : Alqahtania (2021)

"Triangulation is an effective approach for validating data by combining information from two or more sources" (Fusch, Fusch & Ness, 2018:20). Different viewpoints from the logistics senior management and middle management of Twilight Zone's participants, confirmed each other's statements. On each theme, all the participants were in agreement about the transportation constraints that exist in their grain trading organisation, enhancing the validity of the findings, and thereby achieving triangulation.

5.3 Saturation

Guest (2020), as cited in Morgan (2002), found that data saturation is achieved during the first five or six interviews, and that very little new information is obtained as the twentieth interview is conducted. Therefore, the sample of seven (7) participants ensured that data saturation was achieved. The researcher determined that data saturation was reached with seven participants who shared comparable backgrounds and competencies in Twilight Zone's logistics, trading and IT departments. The point of data saturation was reached with the fourth participant who had covered all aspects of the, and when subsequent interviews yielded little new information (subsequent participants gave the same answers to the questions posed).

5.4 Significance of the study's findings

The study identified the transportation constraints of 3PL transport in the grain industry, with four key themes captured under four constructs: Theme 1: Capacity constraints; Theme 2: Strategic effect of 3PL; Theme 3: Transport technologies and Theme 4: Organisational effort. The four pillars provided the cornerstone of the investigation and effectively highlighted the problems and opportunities. The study clearly indicated that, with the available technology that exists in the logistical environment, tracking integration will strengthen logistical operations and capabilities. Information technology tracking systems with 3PL road freight transporters and TFR on-line systems will streamline and provide real-time information on trucks and rail wagons in supply chain network circulation, and this information will assist immensely with making more informed decisions on a day-to-day basis, which will circumvent stock shortages. This finding is supported by Kurpjuweit et al. (2021), who reported that blockchain improved visibility to offer a tracking and tracing utility of the extended supply chain. Zelbst et al. (2019) examined the role of cloud-based collaborative planning systems in enabling end-to-end supply chain visibility in the supply chain network for material movements and current and projected inventory levels. Global trade has deemed digitization imperative for thriving supply chains through automation, artificial intelligence, digitised information flow, and enhanced tracking systems (El Baz, Laguir & Stekelorum, 2019).

The main transportation capacity constraints noted in this study are the road infrastructure; load shedding; strikes/disruptions; frequent SARS customs systems downtime; congestion on the roads due to the collapse of TFR's system; cable theft and truck hijackings. This suggests that government has little control over crime; the maintenance of the road infrastructure; SOC Transnet's poor management; or SOC Eskom's inability to provide a consistent supply of

electricity. The findings of this research also contribute to the existing body of knowledge. Modipa (2022) evaluated the impact of cable theft on the free flow of traffic in South Africa. The research also drew on global findings on the impact of cable theft on the free flow of traffic to formulate steps to counteract the problem. The results show that participants believed the collapse of the rail transport system is the main reason for the huge pressure on road transport. This is why market transport rates have reached unprecedented levels. The prevailing circumstances in the transport business include a scarcity of available capacity and increased transportation charges. Additionally, it should be noted that the rail sector is now facing a critical situation with potential collapse. Consequently, the road transport industry is now under significant pressure to accommodate the market demands of these contracts. The fuel price escalation has prompted carriers to raise their fees to maintain profit margins. The delivery of goods to clients has been affected by road infrastructure degradation caused by too many trucks.

The grain industry's dilemma is that clients have developed their business models for rail freight delivery and receiving, but now they must utilise road transport. Road transport cannot compete with rail transport because its infrastructure cannot handle very large volumes. The participants also believed that load shedding has hampered the Twilight Zone's supply chain. Due to a lack of electricity, trucks would be delayed at warehouse loading locations. Eskom's performance, which causes load shedding, also prevents silos from loading. Load shedding, particularly when loading trucks on land to transport commodities to ports for export, makes it hard to load on time and in the proper amount to export the product.

The results show seven common constraints that affect the fulfilment of customer orders: the pressure on poor roads; load shedding; SARS's systems not being fully functional, so that the slowness of customs clearing processes has caused bottlenecks at borders; strikes/riots; congestion; production halt; and lastly, theft and hijacking. The results show that pressure on the roads and load shedding were key constraints affecting customer delivery. In the long term, this will not be sustainable for road transport, since good infrastructure is a pre-requisite for the transportation of goods. The results also show that participants believed the collapse of the rail transport system is the main reason for the pressure on road transport. This has significantly impacted maize exports and has accounted for a significant portion of total exports being transported by road. This, in turn, has led to higher transport rates and has negatively impacted Twilight Zone's profit margin. If these market conditions persist, Twilight Zone could,

potentially, limit its trading activities to the domestic market. The absence of adequate rail infrastructure has posed significant limitations, caused, in part, by instances of theft along the railway lines, and the theft of cables. Similarly, truck cargo theft remains a prevalent issue, exacerbated by ineffective policing in these areas. Even when policing is present, their capacity to effectively combat criminal activities is insufficient. Consequently, criminals maintain a dominant position, instilling fear among law enforcement agencies and occasionally private enterprises, thereby hindering confrontation of these challenges. Furthermore, the results show that the inability to deal with theft of rail infrastructure has led to constraints in rail capacity.

The participants also believed that trucks were delayed at warehouse loading locations due to a lack of electricity. The participants reported theft as a perennial problem, and the authorities are not doing anything to curb the problem. The results show that road transport constraints are caused by inaccessibility, caused by the collapse of the rail network; Transnet's use of road transport instead of rail; floods; riots/strikes; the large volumes being transported; load shedding; an inefficient SARS customs service; and government resource constraints. According to the participants, the road freight transport sector has been significantly impacted by the near collapse of the rail industry. Consequently, the participants noted the shortage of road transport vehicles and market constraints characterized by unpredictability. This finding is supported by a study conducted by Munsanje (2021), who noted that the inability of Transnet to perform in recent years, due to failing infrastructure, has put a severe strain on the road freight industry, with both capacity and infrastructural constraints placing an increased demand on the road infrastructure. Thus, the expenses associated with these contracts are twice as much as they should be, resulting in a very small profit margin. Furthermore, the unavailability of an adequate number of trucks at favourable rates further exacerbates the market situation, resulting in higher demand in the road freight market, driving up road transport rates.

In terms of organisational structure, Twilight Zone is restructuring. Twilight Zone uses several techniques in the grain industry since it operates in a competitive market and has to comprehend the market and concentrate on customer service to satisfy customers. Twilight Zone, in its business, prioritizes quality and customer service. Twilight Zone uses offensive, defensive, cost leadership, predatory pricing, and differentiation strategies to implement its customer service strategy. It provides innovative solutions to deliver grain industry goods at the right place, time, and price. Most participants believe that Twilight Zone has sufficient resources to ensure the company's smooth operations. Structure is a valuable tool in achieving co-

ordination, as it specifies reporting relationships (who reports to whom); delineates formal communication channels; and describes how the separate actions of individuals are linked together (Parthasarthy & Sethi, 2018). Based on the above discussion, for Twilight Zone to deliver its third-party logistical plans, the strategy and the organisation structure must be woven together seamlessly. Consequently, the results imply that sustainable transportation organisations should combine structure, strategy, and resources. These results are in line with those of Chakma, Dhir, Ongsakul, Sakka and Ahmed (2022), who said resources include the funding, people, materials, and technology needed to produce, distribute, measure, and optimise company activities (Chakma, Dhir, Ongsakul, Sakka & Ahmed, 2022). Thus, a firm should always set a budget for human and financial resources to fuel a company's operations and investments in new markets (Xu & Kim, 2022). The participants believed that there are sufficient human resources who are skilled and innovative to ensure smooth operations at Twilight Zone. Human resources are a company's workers who create its commodities and services. The experience and knowledge of Twilight Zone's personnel enable the organisation to build healthy client relationships by providing professional and respectful customer service. Consequently, the results imply that sustainable transportation organisations should combine structure, strategy, and resources.

5.5 Summary of Chapter and Conclusion

This chapter analysed and discussed the results from Chapter 4 of the study, which focussed on the transportation challenges in the road and rail freight market and their impact on the business. It also identified the potential advantages of adopting technologies with 3PL transporters to improve supply chain visibility and performance in Twilight Zone's network. Findings also proposed a 3PL score-card system to evaluate and enhance the service quality of each service provider. The chapter also acknowledged the role of government parastatals in the current road freight crisis in the South African transport market. Drawing on the analysis and outcomes of this study, the final chapter offers a summary of the main conclusions and suggests implications for practice and future research.

CHAPTER SIX
CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter summarises the main contributions and implications of this study, which examined the transportation capacity challenges faced by 3PL partners in the grain industry and their effects on firm performance and customer satisfaction. The study also explored possible solutions to overcome these challenges and enhance supply chain visibility. Based on the research objectives, this chapter presents the key findings, recommendations, limitations, and delimitations of the study, and concludes with a brief overview of the main points. The final part of this chapter will discuss recommendations for how to leverage the full potential of the road and rail freight industry.

6.2 Summary of Findings from the Literature Review

Authors have emphasised that logistical performance demands having the right product at the right place at the right time. Measures must be put in place to guide the process to ensure logistical excellence for optimum supply chain throughput efficiency. Distribution involves the logistics side of the supply chain, which is the physical transportation of goods. Kain and Verma (2018) defined logistics as the planning involved in the co-ordination of goods and services from inception to the end customer. Martins (2020) stated that 'operations' refers to the activities and processes used in the warehouse, which play a vital role in supply chain efficiency. Logistics includes the strategic co-ordination and management of many operations that influence the timely and cost-effective delivery of the correct product to its intended destination (Rushton, Croucher & Baker, 2022). Distribution involves the logistics side of the supply chain, which is the physical transportation of goods

6.3 Summary of findings from the Main Study

The study found that the non-existence of rail support for all Twilight Zone's grain operations places extreme pressure on road freight transportation systems. The inadequate rail freight transport system has placed the grain industry in a very difficult position. The road freight market is now characterised by high demand, high transportation rates, and a shortage of 3PL road capacity; and a negative financial and operational impact on the grain industry has ensued. If the railways become fully functional, this will greatly ease the current pressures that exist in the 3PL road transport sector. Road transport rates will decrease; road infrastructure will not be damaged to the extent that it currently is; fewer fatalities will occur on the roads; instances

of theft and hijackings will decline; and the grain industry will enjoy the benefits of both modes functioning in a synergetic transport structure.

Another important finding is Twilight Zone's inability to trace and trace vehicles on both rail and road, which has contributed to the inefficient flow of communications to customers due to a lack of IT integration. It was noted that exogenous factors such as load shedding; bottleneck congestions; road and rail infrastructural challenges; cable theft; hijacking; high road tolls; and non-functional SARS systems have rendered the grain industry an enormous disservice in terms of logistical capabilities. These findings are supported of the literature, which links efficiencies in the supply chain with the delivery of grains to the right place at the right time.

6.4 Recommendations from Research Findings

Twilight Zone must consider contingency planning by exploring each constraint individually, and as identified in the data analysis. Applying the theory of constraints as outlined by Cox and Boyd (2020), a constraint is described as a limitation or restriction. The five steps of the theory of constraint are: identifying the constraint; exploiting the constraint; subordinating everything to the constraint; elevating the constraint; and repeating by finding the next constraint. The research investigated and addressed the different problems and hindrances that influence the road and rail freight sectors in South Africa in the transport of cargo. Some of these factors are outside Twilight Zone's jurisdiction. The next section will present the possible solutions to tackle these challenges.

- ✓ The failure of Transnet freight rail management to combat inefficiency and lack of rolling stock and locomotives, and shortages of staff and drivers: The Minister of Public Enterprises, Pravin Gordhan, must investigate the experience and qualifications of the staff and conduct suitable competency and managerial testing. Monthly assessments of rail turnover and targets should be gauged at the highest level, since the economy relies heavily on freight rail as the transportation backbone of the South African grain industry.
- ✓ Congestion at loading and offloading points was noted as a transportation constraint, due to the lack of electricity from hours of loadshedding. The Public Minister of Public Enterprises, Pravin Gordhan, and the Minister of Electricity, Kgosientsho Ramokgopa, need to address and resolve the energy crises. The government should assist with setting up a solar funding scheme to aid all businesses to ensure operational sustainability and

business continuity, to prevent the collapse of the South African economy. Loss of turnover could easily lead to staff retrenchments and increase the already high rate of unemployment in South Africa.

- ✓ Cable theft is a major contributor to loss of rail turnover. Therefore, the Minister of Police, Bheki Cele, must investigate the syndicates operating within organised crime, to bring these criminals to justice; as well as implementing other measures to combat and deter such activities, to ensure the survival of the South Africa railway system. South Africa needs to enjoy the benefits of larger storage and haulages units at lower per unit transport cost.
- ✓ Truck hijackings were mentioned by the participants, forcing the road freight transporters to increase security measures, which adds to their total haulage costs and are ultimately for the end-consumer to bear. SAPS must devise strategies to keep the roads free from criminal activities, such as patrols on the highways and an increased police presence.
- ✓ Road infrastructure deterioration is ever increasing, due to a large portion of the grain ear-marked for rail transportation being moved by road freight, which is unable to cope with increased demands. The lack of maintenance of paved roads, and bridges washed away which have not been rebuilt, pose major problems for road freight transporters. The Department of Transport should consider consolidating road maintenance under one national authority; and the maintenance of farming and rural roads should be a top priority (Khuzwayo, 2018).
- ✓ The road freight industry rates were, in the past, characterised by price wars, due to a lack of regulation in the industry (Khuzwayo, 2018). However, in the current market, the opposite applies. 3PL transporters are in a prime position to dictate prices due to a lack of capacity to sustain transport logistics operations in South Africa. This has led to decreased profit margins for firms; or the end-consumer having to absorb these costs which are included in product prices. The Minister of Transport, Lydia Sindiswa Chikunga, must step in and apply guidelines for pricing structures.
- ✓ Slow SARS procedures have also contributed to congestion and slow turnaround of trucks at border posts. The competence of customs officials should be tested, and IT system upgrades should be done regularly, thereby minimizing systems breakdowns for extended periods of time. Regular training should be implemented to ensure that customs staff are fully fledged operators who can ensure the easy flow of trucks through SA borders.

- ✓ The integration and implementation of IT systems in Twilight Zone's operations will enhance its visibility and assist with making informed decisions, preventing stock-out situations.
- ✓ A score-card system for 3PLs must be implemented to rate them according to their service levels.

6.5 Recommendations for Future Studies

The study examined the underlying obstacles to 3PL transportation capacity in the grain industry while transporting cargo from farmers to silo warehouse; and silo warehouses to clients' mills (manufacturing points) and ports for export. This study only explored the road and rail freight challenges from the demand(user)-side perspective of logistics. Therefore, the following recommendations for future research are proposed.

- ✓ A future research direction could be to investigate the rail freight challenges from the perspective of TFR, which provides rail wagon capacity in the grain industry. This study could help to confirm or contradict the findings of TFR.
- ✓ The researcher conducted a qualitative study to explore the challenges faced by the participants. The study revealed several challenges that hindered the participants' performance. The researchers suggests that future quantitative studies could help to measure the impact of these challenges and prioritise them for implementing corrective actions.
- ✓ A future research direction could be to investigate the road freight challenges from the perspective of 3PL partners throughout South Africa, who provide truck capacity in the grain industry. This study could help to confirm or contradict the findings of the transport companies.
- ✓ The government's role in addressing the road and rail freight challenges, as outlined in the recommendations from the research findings, is a key aspect in the current situation. Thus, a future study on how the government influences the road and rail freight sector could enhance the understanding of the issue.
- ✓ The study examined the effects of the road freight challenges on the demand side in one grain trading firm. A further research opportunity could be to explore the impact from the logistics demand side, by interviewing other grain grading companies about their experiences.

6.6 Limitation and delimitations of the study

Research is not flawless, and therefore it can be affected by various forms of research bias that may arise at any stage of the research process. Three limitations were in this study. The first limitation of this study is that the Twilight Zone employees who participated in the interviews were extremely pressed for time, due to the demanding nature of their work portfolios. The second limitation was the effect of power outages, which reduced the time available for the researcher to conduct the study. Poor Wi-Fi and internet connections also disrupted the progress throughout the study. The third limitation is that qualitative research relies on the researcher's interpretive and subjective views, which may entail intuitive choices that could introduce bias. The researcher examined different kinds of research bias and their prevention, and thus adopted a neutral stance during the process to guarantee the research's quality.

6.7 Conclusion

The research accomplished its mandate by reporting on the research questions presented in Chapter One. Based on the findings, the researcher offered recommendations for the 3PL freight industry in Chapter Five. On completion of the research, and after performing an in-depth analysis of the data, it was determined that this study had successfully achieved the research objectives, highlighting key issues, with a focus on the capacity constraints that exist in the transportation systems in the grain industry. It was found that major constraints in the transportation sector have negatively the grain industry, which is a large contributor to the South African economy. The constraints have placed immense pressure on the road freight sector and cost inputs across domestic and global economies; therefore government invention is required. Various studies have shown that there is a strong correlation between logistics performance and a country's economic development (Hayaloglu, 2015). Higher profitability margins are generated from better customer satisfaction and overall supply chain efficiency, ultimately leading to a better functioning South African economy. South Africa currently registers a high unemployment rate of 32.60% (Stats SA, 2023), which contributes to social ills, such as the crime, poor standards of living and poverty, that plague South Africa. South Africa's economy cannot afford a downturn in growth, and therefore government must intervene to curb the failures that persist in the freight transportation sector to ensure upliftment and a better quality of life. Twilight Zone must heed the findings and implement the suggestions and recommendations as indicated by the researcher. All the findings of this research are supported by the literature presented; therefore, the recommendations may be implemented. This study adopted a well-rounded approach to examine a comprehensive range of challenges and make recommendations to alleviate the transportation constraints for third-

party logistics capacity in the grain industry. The findings are corroborated in the literature review, indicating the success of the research.

"To accept good advice is but to increase one's own ability." - Johann Wolfgang von Goethe

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APPENDICES

Appendix A: Interview Guide

Section1: DEMOGRAPHIC QUESTIONS:

What is your current position in the organization- please only answer if you feel comfortable to share:

Lower Management	Middle Management	Top Management

- How long have you been working in your current position?

1-5 years	6 - 10 years	10 + years

- Briefly describe your current role in the organization

- What is your highest level of education – please only answer if you feel comfortable to share:

High School /Matric	Diploma/Degree	Honours/Masters

Section 2: ENVIRONMENT

1. What modes of transport does your firm utilise?

Road	Rail	Air	Sea	Pipeline	Intermodal

2. Please identify constraints on the supply of road freight transport to fulfill the customer orders?

3. What rail infrastructure places constraints on the supply and movement of rail wagons through the supply chain?

4. Based on answers in question (3), what impact has this had road capacity in the transport market?

5. What Road infrastructure places constraints on the movement of grains through the supply chain?

6. What factors have impacted the turn-around of road trucks in the Supply chain network?

7. What are the current transport market conditions in the road freight industry?

8. How have these conditions impacted the company's future business?

Section 3: TECHNOLOGY & SUPPLY CHAIN VISIBILITY

1. Do you have sufficient information to track & trace the movement of road trucks?

2. Please advise which IT tracking applications you currently use for transport operations module?

Cargowise	MyCarrier	Bidtrack	Datatim	Pointer

3. Do you think the introduction of integrated technology i.e. real-time tracking of rail and road will enhance logistical operational flow?

4. What are the possibilities of integrating third-party rail transport management systems ie. rail on-line (ROL) with the firms to track rail trucks in-transit?

5. Do you think the integration of information systems with third-party logistics can enhance the following?

- Supply Chain visibility of the coordination and planning of grains to customers

  YES/NO
- Supply chain tracking and tracing of vehicles in the supply chain network

  YES/NO

Section 4: THIRD-PARTY LOGISTICS

1. What is the strategic influence of third-party logistics partners for the efficient and responsive transportation system in Twilight Zone?

2. To what extent does organisational collaboration enhance effective transportation management in the grain industry?

3. What is the main reason for the firm not owning its fleet?

4. Do you think third-party logistics partnership is strategically aligned to ensure the firm has a sustainable competitive edge?

5. Has government regulation in terms of BEE affected sourcing of third-party transport?

6. Does the company have a score-card system that assess third-party performances?

Section 5: ORGANISATIONAL STRUCTURE

1. How does the organisational structure align with sustainability for the company?

2.What is the organisational strategy to obtain competitive advantage?

3. Do you think the company is sufficiently equipped with sufficient human skill set to improve logistical objectives?

4. Does the organisation have sufficient resources to penetrate new markets?

Appendix B: NVivo DATA ANALYSIS FIGURES

Figure 4.2: Reference instances of cable theft

<Files\\3PL> - § 6 references coded [0.01% Coverage]

Reference 1 - 100.00% Coverage

The theft of rail infrastructure cables have caused a major decline of rail services and reliability especially over the past 3 years, our maize exports that serviced 70% of exports , it now for this financial year dropped to mere 5% and the balance has been shifted to road. Parts of the railway lines were washed away during 2021 floods in Durban that as well hampered the movement of cargo to the port. Proper Management heads to spearhead Transnet freight rail to provide proactive strategies to ensure effective and efficient rail services.

Reference 2 - 100.00% Coverage

Shortage of locomotives, a shortage and lack of skills in the industry, lack of analytics and a lot of infrastructure challenges, cable theft, etc.

Reference 3 - 100.00% Coverage

The lack of rail infrastructure that has been constraint, their inability to deal with theft both on the lines and theft of cables, then you have your theft of cargo from trucks there are no policing for these areas and wherever there is policing they are not geared to deal with the criminals, the criminals have the upper-hand and our police force and sometimes even private companies are too afraid to tackle the problems head on.

Reference 4 - 100.00% Coverage

From my experience on the desk Transnet have said to me that sometimes they are unable to supply me with rail wagons due to cable theft in some areas , also lack of locomotives in the areas, sometimes the vegetation is overgrown over the railways , and also in some rural areas the railways get washed away due to heavy rains.

Reference 5 - 100.00% Coverage

Availability and cable theft being able to have wagons available, repairing infrastructure that contributes to not having wagons available.

Reference 6 - 100.00% Coverage

Just within Transnet to manage the rail system logistics in South Africa has a major effect, there is just no proper management in the asset. Another thing is a cable theft on the main routes that causes disruption in the business flow also I think the shortage of skilled workers in the locomotives had the effect of inefficiency in the rail system in SA, again strikes, political unrest as with the road transport system it will have a big effect on the rail system as well.

Figure 4.3: Reference instances of customer

<Files\\3PL> - § 4 references coded [0.01% Coverage]

Reference 1 - 100.00% Coverage

Their strategic influence first is that they concentrate on Seaboard's transport portfolio, so that we, Seaboard can focus on our primary line of business that is trading and **customer**-relationship management. Our third parties are geared to manage the fleet and are hands on with the loading and offloading points,

Reference 2 - 100.00% Coverage

Third-party transporter's relationship extends beyond Seaboard and it include our **customer** outbound to facilitate and consolidate the logistical stream. Our transport rates are then subsided with a linked transport rate back to our pickup points, the synergy in the network is created and brings for all parties in the network; Seaboard, the transporter and Seaboard's clients in a symbiotic value chain.

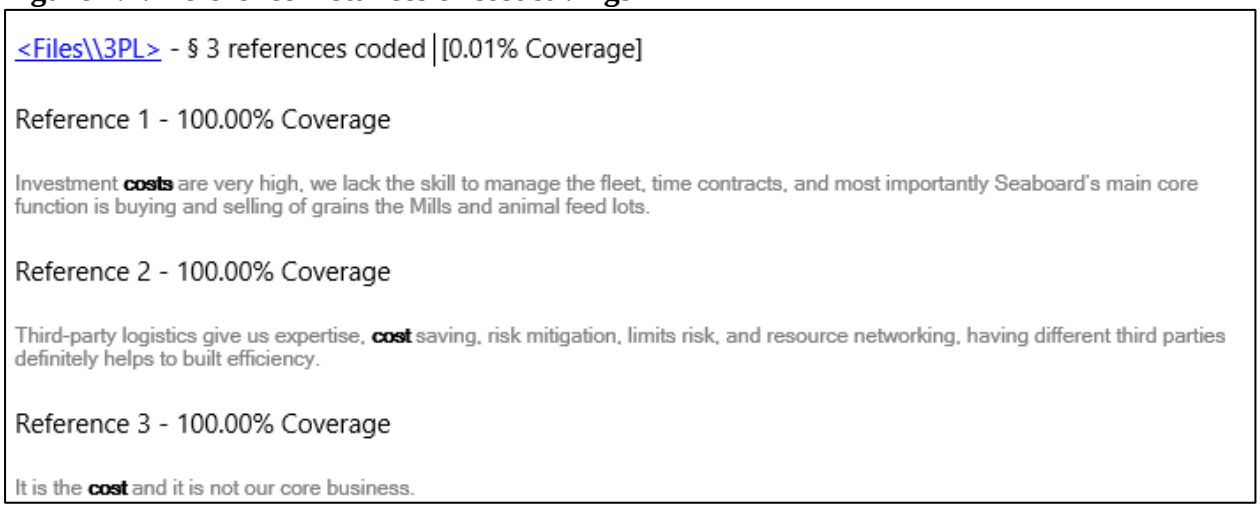
Reference 3 - 100.00% Coverage

It bridges the gap between **customer** and end supplier without that third party logistics we would not be able to be in business.

Reference 4 - 100.00% Coverage

Yes and No, yes it has because if we want to compete in greater scheme of things and have a high score It would mean we would mean have to focus on businesses that have 51% black economic owner in it but we have found historically found that that it is either "window dressing" or that companies that trying to get the business is actually on paper black empowerment, but they sub contract to anyone else down the line, so it is no real contribution towards promoting the black economic empowerment in that instance ., and for us at the end of the day although it is to help the programme go forward our first priority is to make sure that our **customers**' needs are fed and therefore it doesn't really focus or play a role in our decision making of whether we fix transporter on either A or B.

Figure 4.4: Reference instances of cost savings



<Files\\3PL> - § 3 references coded [0.01% Coverage]

Reference 1 - 100.00% Coverage

Investment **costs** are very high, we lack the skill to manage the fleet, time contracts, and most importantly Seaboard's main core function is buying and selling of grains the Mills and animal feed lots.

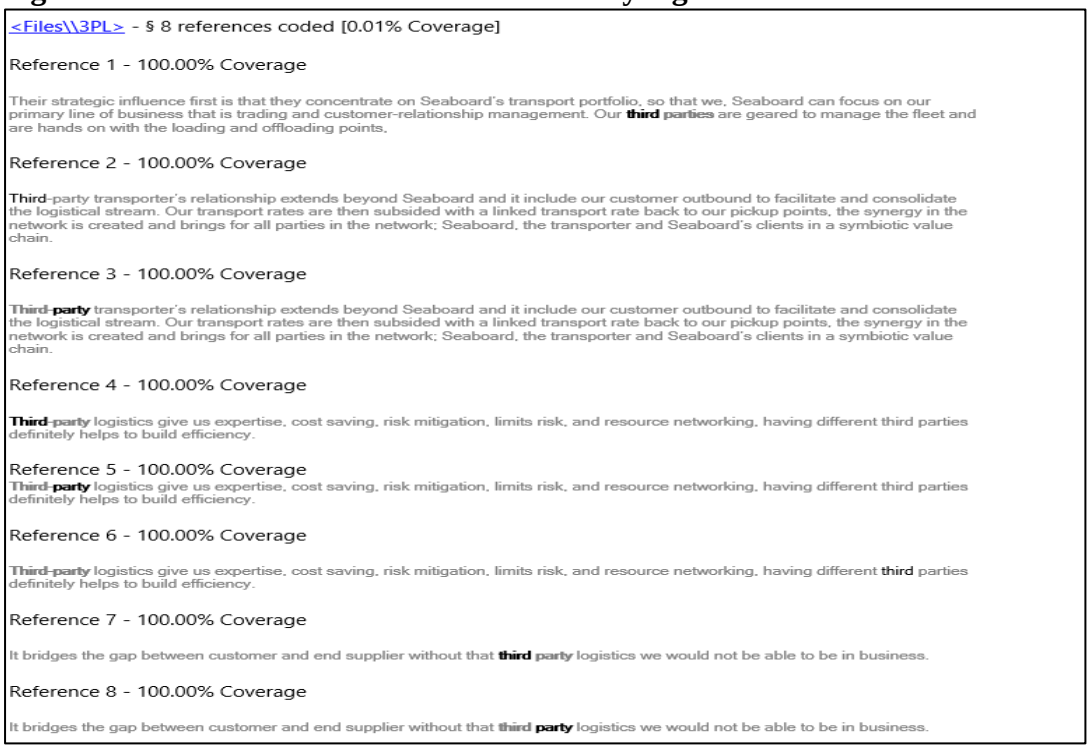
Reference 2 - 100.00% Coverage

Third-party logistics give us expertise, **cost** saving, risk mitigation, limits risk, and resource networking, having different third parties definitely helps to built efficiency.

Reference 3 - 100.00% Coverage

It is the **cost** and it is not our core business.

Figure 4.5: Reference instances of Third-Party logistics



<Files\\3PL> - § 8 references coded [0.01% Coverage]

Reference 1 - 100.00% Coverage

Their strategic influence first is that they concentrate on Seaboard's transport portfolio, so that we, Seaboard can focus on our primary line of business that is trading and customer-relationship management. Our **third parties** are geared to manage the fleet and are hands on with the loading and offloading points.

Reference 2 - 100.00% Coverage

Third-party transporter's relationship extends beyond Seaboard and it include our customer outbound to facilitate and consolidate the logistical stream. Our transport rates are then subsided with a linked transport rate back to our pickup points, the synergy in the network is created and brings for all parties in the network; Seaboard, the transporter and Seaboard's clients in a symbiotic value chain.

Reference 3 - 100.00% Coverage

Third-party transporter's relationship extends beyond Seaboard and it include our customer outbound to facilitate and consolidate the logistical stream. Our transport rates are then subsided with a linked transport rate back to our pickup points, the synergy in the network is created and brings for all parties in the network; Seaboard, the transporter and Seaboard's clients in a symbiotic value chain.

Reference 4 - 100.00% Coverage

Third-party logistics give us expertise, cost saving, risk mitigation, limits risk, and resource networking, having different third parties definitely helps to build efficiency.

Reference 5 - 100.00% Coverage

Third-party logistics give us expertise, cost saving, risk mitigation, limits risk, and resource networking, having different third parties definitely helps to build efficiency.

Reference 6 - 100.00% Coverage

Third-party logistics give us expertise, cost saving, risk mitigation, limits risk, and resource networking, having different **third** parties definitely helps to build efficiency.

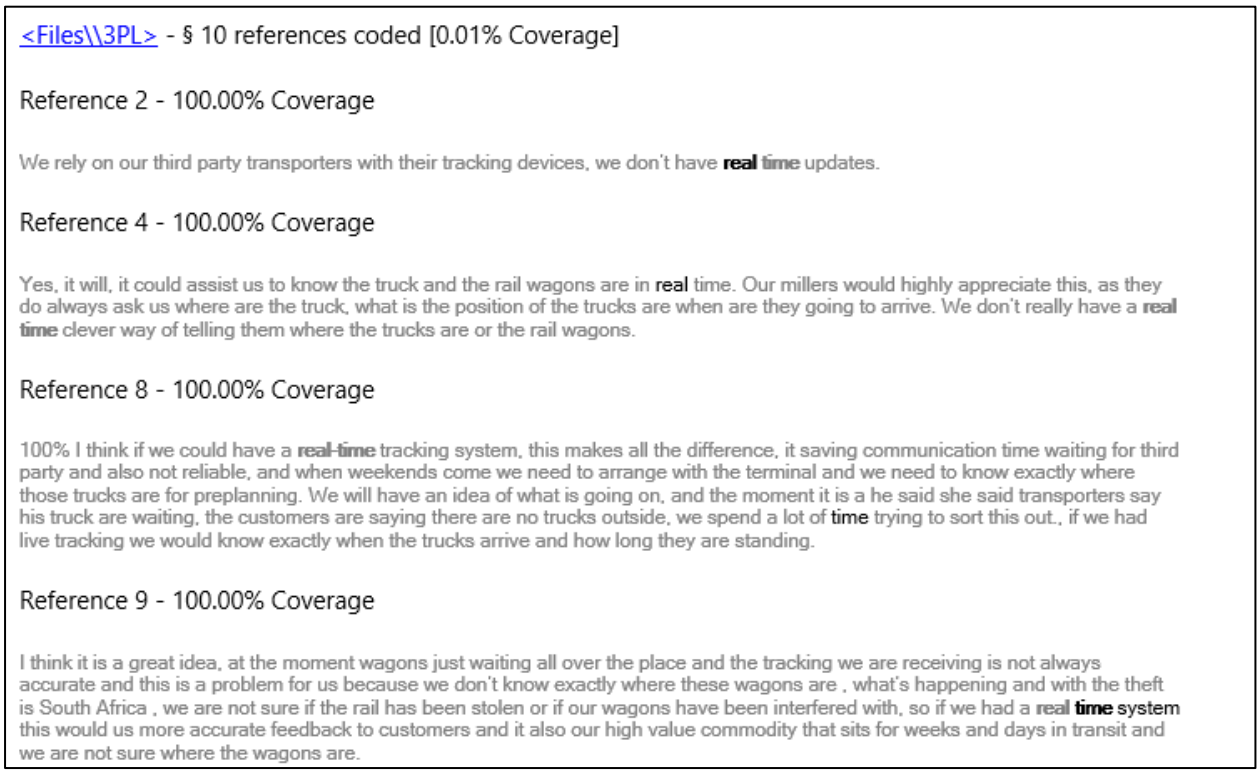
Reference 7 - 100.00% Coverage

It bridges the gap between customer and end supplier without that **third party** logistics we would not be able to be in business.

Reference 8 - 100.00% Coverage

It bridges the gap between customer and end supplier without that **third party** logistics we would not be able to be in business.

Figure 4.7: Narrative Instances of real-time transport system



<Files\\3PL> - § 10 references coded [0.01% Coverage]

Reference 2 - 100.00% Coverage

We rely on our third party transporters with their tracking devices, we don't have **real time** updates.

Reference 4 - 100.00% Coverage

Yes, it will, it could assist us to know the truck and the rail wagons are in **real** time. Our millers would highly appreciate this, as they do always ask us where are the truck, what is the position of the trucks are when are they going to arrive. We don't really have a **real time** clever way of telling them where the trucks are or the rail wagons.

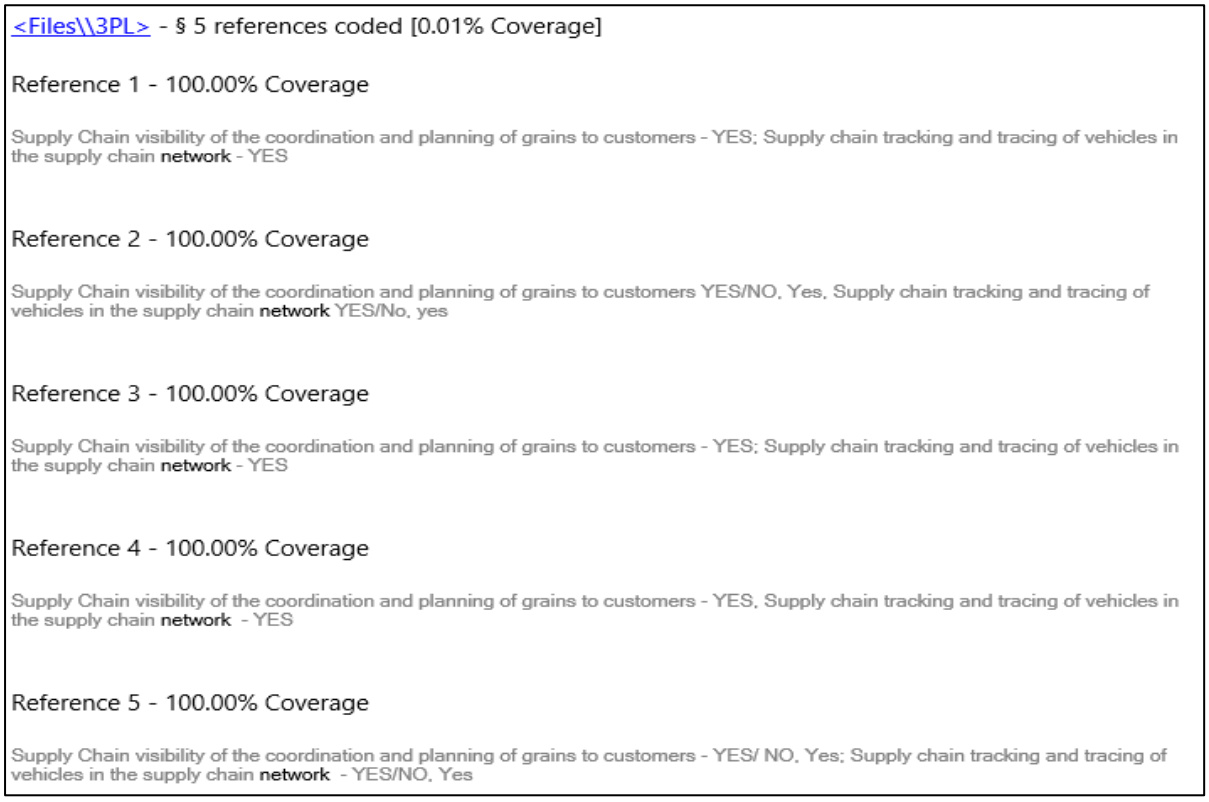
Reference 8 - 100.00% Coverage

100% I think if we could have a **real-time** tracking system, this makes all the difference, it saving communication time waiting for third party and also not reliable, and when weekends come we need to arrange with the terminal and we need to know exactly where those trucks are for preplanning. We will have an idea of what is going on, and the moment it is a he said she said transporters say his truck are waiting, the customers are saying there are no trucks outside, we spend a lot of **time** trying to sort this out., if we had live tracking we would know exactly when the trucks arrive and how long they are standing.

Reference 9 - 100.00% Coverage

I think it is a great idea, at the moment wagons just waiting all over the place and the tracking we are receiving is not always accurate and this is a problem for us because we don't know exactly where these wagons are , what's happening and with the theft is South Africa , we are not sure if the rail has been stolen or if our wagons have been interfered with, so if we had a **real time** system this would us more accurate feedback to customers and it also our high value commodity that sits for weeks and days in transit and we are not sure where the wagons are.

Figure 4.8: Reference instances of supply chain network



<Files\\3PL> - § 5 references coded [0.01% Coverage]

Reference 1 - 100.00% Coverage

Supply Chain visibility of the coordination and planning of grains to customers - YES; Supply chain tracking and tracing of vehicles in the supply chain **network** - YES

Reference 2 - 100.00% Coverage

Supply Chain visibility of the coordination and planning of grains to customers YES/NO, Yes, Supply chain tracking and tracing of vehicles in the supply chain **network** YES/No, yes

Reference 3 - 100.00% Coverage

Supply Chain visibility of the coordination and planning of grains to customers - YES; Supply chain tracking and tracing of vehicles in the supply chain **network** - YES

Reference 4 - 100.00% Coverage

Supply Chain visibility of the coordination and planning of grains to customers - YES, Supply chain tracking and tracing of vehicles in the supply chain **network** - YES

Reference 5 - 100.00% Coverage

Supply Chain visibility of the coordination and planning of grains to customers - YES/ NO, Yes; Supply chain tracking and tracing of vehicles in the supply chain **network** - YES/NO, Yes

Appendix C: Ethical Clearance Letter

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

30 July 2023

Simone Raquel Maclou (961085472)
School Of Man Info Tech & Gov
Westville Campus

Dear SR Maclou,

Protocol reference number: HSSREC/00005774/2023
Project title: Transportation constraints for third-party logistics capacity in the grain industry: A case of Twilight Zone
Degree: Masters

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 22 June 2023 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 30 July 2024.
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.

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

Yours sincerely,

[redacted]

Professor Dipane Hlalele (Chair)

/dd

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

Appendix D: English Editor's Report

ETHEL ROSS

English language editing and proofreading

13 March 2024

To whomever it may concern:

This letter serves to confirm that I worked as the proofreader and language editor on Simone Raquel Maclou's Master's thesis:

Transportation constraints for third-party logistics capacity in the grain industry: a case of Twilight Zone

In no way did I change the content.

Yours faithfully

[redacted]

Ethel Ross (BA Hons; H Dip Ed)

Email: clanross1@icon.co.za Tel: 083 954 5412

Appendix E: Informed Consent Letter

UKZN HUMANITIES AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE (HSSREC)

APPLICATION FOR ETHICS APPROVAL
For research with human participants

INFORMED CONSENT RESOURCE TEMPLATE

Note to researchers: Notwithstanding the need for scientific and legal accuracy, every effort should be made to produce a consent document that is as linguistically clear and simple as possible, without omitting vital details as outlined below. Certified translated versions will be required once the original version is approved. There are specific circumstances where witnessed verbal consent might be acceptable, and circumstances where individual informed consent may be waived by HSSREC.

Information Sheet and Consent to Participate in Research

Date: 14-06-2022

Greetings: (Good morning and thank you for availing yourself of this interview).

My name is Ms Simone Raquel Maclou from (Provide information about the researcher (name, department/institution and various contact numbers and email addresses)
Name: Simone Raquel
Surname: Maclou
Student number: 961085472
Email address 961085472@stu.ukzn.ac.za
Contact number: 0718847095
From the School of Information Technology, Governance, and Management, University of KwaZulu-Natal (UKZN).

You are being invited to consider participating in a study that involves research (interview). The aim and purpose of this research is to (**explore transportation constraints for third-party logistics capacity in the grain industry: a case of Twilight Zone**). The study is expected to enrol (seven subjects to be interviewed from various departments namely the logistics department, that is; logistics manager, assistant logistics manager, transport manager, and two logistics co-ordination team leaders; and in the trading department, a senior trader (procurement) will be interviewed and lastly in Information Technology department, the IT manager will be interviewed). It will involve the following procedures (). The duration of your participation if you choose to enrol and remain in the study is expected to be (30 minutes per participant). The study is funded by (is funded by the University).

The study may involve the following risks and/or discomforts (does not involve any risk to the participants). We hope that the study will create the following benefits (the study will bring transformation into the gran industry). The researcher must disclose in full any appropriate

alternative procedures and treatment etc. that may serve as possible alternate options to study participation.

If the research could potentially involve risk, explain in full if compensation exists for this risk, what medical and/or psychosocial interventions are available as treatment, and where additional information can be obtained.

This study has been ethically reviewed and approved by the UKZN Humanities and Social Sciences Research Ethics Committee (**HSSRES/00005774/2023**).

In the event of any problems or concerns/questions you may contact the researcher at (provide contact details) or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details are as follows:

Supervisor; Dr T.P Mbhele
Email address: Mbhelet@ukzn.ac.za
Contact details: 0312607524
Ethics Committee Administrator: M.Snyman
Email address: Snymanm@ukzn.ac.za
Contact details: 0312604557
Administrator: A. Pearce
Email address: Pearce2@ukzn.ac.za
Contact details: 0312608162

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

State clearly that participation in this research is voluntary (and that participants may withdraw participation at any point), and that in the event of refusal/withdrawal of participation, the participants will not incur penalty or loss of treatment or other benefit to which they are normally entitled. Describe the potential consequences to the participant for withdrawal from the study and the procedure/s required from the participants for orderly withdrawal. Under what circumstances will the researcher terminate the participant from the study?

State clearly if any costs might be incurred by participants because of participation in the study. If there are incentives or reimbursements for participation in the study, state how much and why they will be given.

Describe in detail the steps that will be taken to protect confidentiality of personal/clinical information, and the limits of confidentiality if applicable. Describe the fate of the data and stored samples.

Participation in this interview is voluntary and your name will not be disclosed. There is no
The risk attached to participation in this study. All responses will be of immense importance to the
The success of this study. The study was approved by the University of KwaZulu-Natal higher.
Degree committee. You have a right to withdraw from this interview at any time, should you?
Wish to do so.

CONSENT (Edit as required)

I (Simone Maclou) have been informed about the study entitled **Transportation constraints for third-party logistics capacity in the grain industry: a case of Twilight Zone** by Simone Maclou, 961085472

I understand the purpose and procedures of the study (add these again if appropriate).

I have been allowed to answer 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 to which I usually am entitled.

I have been informed about any available compensation or medical treatment if injury occurs to me because 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 (provide details).

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:

Supervisor; Dr.T.P Mbhele
Email address: Mbhelet@ukzn.ac.za
Contact details: 0312607524
Ethics Committee Administrator: M.Snyman
Email address: Snymanm@ukzn.ac.za
Contact details:0312604557
Administrator: A. Pearce
Email address: Pearce2@ukzn.ac.za
Contact details:0312608162

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