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DECLARATION

I, Wendy Mulite, declare that this thesis represents my original work. Throughout my period of registered study, I have not used the content of this document for any other academic award or qualification, nor have I submitted any part of it for another award. This thesis is the product of my independent research, and all sources from other authors have been properly acknowledged.

Date: 28/06/25

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DEDICATION

This research is first and foremost dedicated to Almighty God, whose unwavering love and boundless grace made this work possible. I also dedicate it to my beloved children for their endless encouragement and steadfast support throughout this journey. May God bless each of you.

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ABBREVIATIONS

3PL	*Third-Party Logistics*
AGL	*African Global Logistics*
C.I	*Confidence Interval*
EDI	*Electronic Data Interchange*
KPIs	*Key performance Indicators*
KPMG	*Klynveld Peat Marwick Goerdeler*
LMIS	*Logistics Management Information Systems*
MSL	*Medical Stores Limited*
SDP	*Service Delivery Point*
SLAs	*Service Level Agreement*
UNICEF	*United Nations Children's Fund*
USAID	*United States Agency for International Development*
ZAMRA	*Zambia Medicines Regulatory Authority*
ZAMMSA	*Zambia Medicines & Medical Supplies Agency*

ABSTRACT

This study investigates the effectiveness of third-party logistics (3PL) in enhancing last-mile delivery of essential medicines within Zambia's public health supply chain. Using a structured questionnaire, data were collected from 109 respondents across ZAMMSA, 3PL providers, and high-volume health facilities. The analysis focused on key performance areas including delivery timeliness, accuracy, fleet condition, communication, responsiveness, and the perceived impact on medicine availability and patient outcomes. Descriptive statistics and chi-square tests were employed to identify significant relationships between operational and perceptual variables.

The findings reveal that 3PL integration has led to notable improvements in medicine availability, emergency delivery success, and overall satisfaction with logistics services. Strong associations were observed between satisfaction, communication, and responsiveness, as well as between fleet condition and medicine availability. The study concludes that 3PL services play a critical role in strengthening healthcare logistics and offers practical recommendations for enhancing performance, including investment in infrastructure, performance-based contracting, and data-driven decision-making. Limitations and directions for future research are also discussed.

CHAPTER ONE
INTRODUCTION

1. Introduction

Most essential and non-essential services for both public and private institutions are being outsourced from third party logistics (3PL) providers. Raw material, logistics and distribution management particularly, have generally been comprehensively studied. However, there is a need to further study the effectiveness of the 3PL services in improving the last-mile distribution of essential medicines in Zambia's public health supply chain. Third-Party Logistics (3PL) involves delegating supply chain and logistics operations to specialized external companies. These providers offer a range of services such as freight transportation, storage solutions, stock control, order processing, and shipping coordination. By utilizing their advanced systems and industry knowledge, 3PL firms enable companies to enhance operational efficiency, cut expenses, and optimize their supply chains (Armstrong & Associates, 2023). This study analyses the effectiveness of the third-Party's involvement in Zambia's public health essential medicine distribution. The capacity and customer satisfaction aspects of 3PL are to be used as variables and will be evaluated in terms of efficiency and effectiveness.

This chapter presents the following sections: Background of the study; problem statement; main and specific objectives; study questions; motivation to study; Limitation; and thesis outline.

1.1 Background to study

In Zambia, ensuring the delivery of essential medicines to the last mile, particularly within the public health system, continues to face significant obstacles due to inadequate infrastructure, logistical challenges, and limited resources. Initially, the government managed medicine distribution through Medical Stores Limited (MSL), an entity established to handle the nationwide storage and delivery of health commodities. However, by the early 2000s, it became clear that MSL lacked the logistical capacity to provide timely and reliable deliveries, especially to remote and hard-to-reach areas (Yadav, 2015).

To overcome these challenges, Zambia began engaging third-party logistics (3PL) providers to enhance the efficiency of its public health supply chain. With backing from development partners such as USAID, the Global Fund, and UNICEF, initial pilot projects were launched to test the viability of 3PL integration. These pilots revealed that 3PL providers could deliver superior performance, including more reliable deliveries, fewer stockouts, and better access to remote areas, compared to traditional government-led systems (UNICEF, 2020). Encouraged

by these outcomes, the country gradually adopted a new logistics strategy that involved outsourcing Transportation function—particularly last-mile distribution—to private logistics firms.

The formal adoption of third-party logistics in Zambia's public health supply chain was institutionalized in 2020 with the transformation of Medical Stores Limited into the Zambia Medicines and Medical Supplies Agency (ZAMMSA). As the national agency responsible for the procurement, storage, and distribution of essential medicines, ZAMMSA was established under a revised operational model that prioritizes efficiency, innovation, and collaboration with the private sector. In line with this mandate, ZAMMSA regularly engages 3PL providers through competitive procurement processes to handle warehousing (off site warehouses), transportation, and last-mile distribution. These partnerships are governed by service-level agreements (SLAs) and performance-based contracts to ensure accountability, responsiveness, and improved service delivery (ZAMMSA, 2021)

The adoption of third-party logistics (3PL) in Zambia's health sector reflects a broader global trend that promotes public-private partnerships to harness private-sector capabilities, infrastructure, and technological innovation in public health supply chains. This integration has enabled ZAMMSA to expand its distribution capacity, particularly during critical periods such as the COVID-19 pandemic, and to improve the availability of essential medicines across all provinces. This strategic shift underscores the growing recognition that efficient supply chain management is fundamental to achieving key health system objectives, including universal health coverage and equitable access to medical commodities (Foster et al., 2017).

However, in Zambia's public health supply chain, there is limited empirical evidence assessing the Effectiveness of Third-Party Logistics (3PL) in Enhancing Last-Mile Essential Medicine Distribution in Zambia's Public Health Supply Chain.

1.2 Statement of the Problem

Despite substantial investments in Zambia's public health supply chain, challenges persist in ensuring consistent availability of essential medicines at the last mile. According to the Zambia Medicines Regulatory Authority (ZAMRA, 2022), over one-third of public health facilities reported stockouts of at least one essential medicine within a three-month period, with rural areas being most affected. These stockouts are attributed to systemic inefficiencies such as inaccurate demand forecasting, delayed deliveries, and inadequate transport and storage infrastructure (Ministry of Health Zambia, 2021).

In response, the Zambian government, through the Zambia Medicines and Medical Supplies Agency (ZAMMSA), introduced Third-Party Logistics (3PL) providers to manage the warehousing and last-mile distribution of health commodities. The goal was to leverage private-sector logistics expertise to improve delivery performance. However, performance evaluations have shown mixed outcomes. For instance, while the USAID Global Health Supply Chain Program (2020) reported improvements in delivery lead times in selected districts, ZAMMSA's internal audits revealed that key performance indicators such as order fulfilment rates, delivery timeliness, and stock accuracy, often fell short of national targets.

Specifically, ZAMMSA's 2021 performance reports indicated that order fulfilment rates by 3PLs ranged between 68 and 82 orders of every 100, failing short of the target of 90 orders. Additionally, delivery lead times varied significantly, with some districts experiencing delays of 5 to 10 days beyond scheduled delivery windows. Stock accuracy at 3PL-managed warehouses was inconsistent, with error rates ranging from 8 to 15 errors per 100 stock items across provinces. Moreover, a study by Mwape et al. (2023) highlighted the absence of a standardized performance measurement framework for 3PL providers. Indicators such as transport reliability, on-time delivery rates, and inventory reconciliation accuracy were inconsistently reported, making it difficult to evaluate and compare provider performance across regions. The rising prevalence of non-communicable diseases and threats like antimicrobial resistance highlight the urgent need for a robust last-mile public health supply chain. Without data-driven insights into the impact of 3PL interventions, decisions risk being based on anecdotal evidence. A systematic evaluation of 3PL effectiveness in Zambia is essential to improve delivery capacity, stock availability, and service quality under ZAMMSA (Vasiliauskas & Navickienė2023).

Therefore, this study is significant because there has been little research regarding the Effectiveness of Third-Party Logistics (3PL) in Enhancing Last-Mile Essential Medicine Distribution in Zambia's Public Health Supply Chain with a focus on ZAMMSA and this is a research gap that this current study sought to address.

1.3 Justification for the Study

Third-party logistics (3PL) and their performance are pivotal to the efficiency of any organization's operations, particularly within public health systems. This study is significant as it evaluates the effectiveness and capacity of 3PL providers in Zambia's public health supply chain, specifically in ensuring the delivery of essential medicines to the last mile. Given the limited research on this topic in Zambia, the study fills a critical knowledge gap by assessing

how well 3PL services function in reaching underserved communities. Its findings are expected to contribute to improved healthcare outcomes by ensuring a consistent supply of essential medicines, preventing stockouts, and reinforcing sustainable logistics practices. Additionally, the research offers empirical insights that can guide policy and support evidence-based decisions in Zambia's public health sector.

1.4 Research Aim

The aim of this study is to evaluate the effectiveness of Third-Party Logistics (3PL) on the last mile distribution of essential medicines in Zambia's public health supply chain. To achieve this aim, the researcher identified four variables as independent variables to test for the effectiveness of the public health supply chain. These variables enabled the researcher to break down the main aim of the study into four specific objectives as stated below:

1.5 Research Objectives

i. To evaluate the efficiency of 3PLin last-mile distribution of essential medicines at ZAMMSA
ii. To assess the logistical capacity of 3PL providers at ZAMMSA
iii. To determine the level of customer satisfaction with 3PL services at ZAMMSA
iv. To examine the impact of 3PL integration on essential medicine availability at ZAMMSA.

1.6 Research Questions

i. What is the efficiency of 3PL in the last-mile distribution of essential medicines at ZAMMSA?
ii. What is the logistical capacity of 3PL providers contracted by ZAMMSA?
iii. What is the level of customer satisfaction with 3PL services among health facility staff at ZAMMSA?
iv. What impact has the integration of 3PL providers had on the availability of essential medicines at health facilities at ZAMMSA?

1.7 Research Scope

The study will be limited to ZAMMSA staff members, 3PL providers at ZAMMSA and selected high volume public health facilities because these are the ones that receive medicines directly from ZAMMSA central warehouse and regional hubs. This study is limited to public

health facilities and private facilities are out of the scope. ZAMMSA was selected because it is the only government agency authorized to distribute medicines, either using their fleet or outsourced. This study has also been selected because not so much research has been conducted in Zambia, especially where the assessment of the effectiveness of 3PL in the last mile distribution of essential medicines in Zambia's public health supply chain is concerned.

1.8 Research Contributions

This study will contribute to the academic discourse on supply chain management by contributing on a focused scrutiny of last-mile distribution in the public health sector using the 3PL providers. The study intends to aid logistics experts, decision makers, and scholars in developing more robust, cost-effective, and customer-centric distribution approaches. Given the current path of international business and urbanization, insights from this research are anticipated to be opportune and practically appreciated.

1.9 Research Design

According to Kothari (2005), a research design outlines the framework for collecting, measuring, and analysing data in a systematic manner. Creswell (2014) further defines research design as a structured plan that guides the research process, encompassing quantitative, qualitative, and mixed-method approaches. Quantitative research involves the collection of numerical data to quantify variables and analyse relationships (Cooper et al., 2007), while qualitative research focuses on non-numerical data, often through narrative or case study formats (Creswell, 2014).

Given the nature of this study, which seeks to describe and evaluate the effectiveness of third-party logistics (3PL) in the last-mile essential medicine distribution, a descriptive research design is most appropriate. Descriptive research is used to systematically describe a situation, problem, or phenomenon without manipulating variables (Babbie, 2010). This study will adopt a case study approach within a quantitative framework, allowing for the collection of structured data from a defined population. Due to time constraints and the need for focused analysis, a mixed-methods approach will not be employed.

1.10 Research approach and method

The research approach serves as the foundational framework that determines how a study is structured, how data is collected, and how findings are interpreted. It establishes a clear connection between theoretical concepts and empirical investigation, ensuring that the study remains methodologically sound and logically coherent (Bryman & Bell, 2015). According to

Saunders et al. (2016), research approaches can be broadly categorized into deductive and inductive methods, each serving distinct purposes. The deductive approach, as described by Robson (2002), follows a structured, hypothesis-driven process where researchers test pre-existing theories by quantitatively analyzing measurable variables. This method is particularly useful for studies aiming to validate or refute established assumptions, as it relies on statistical generalization to draw broad conclusions (Saunders et al., 2009). In contrast, the inductive approach is exploratory, beginning with raw data and observations rather than a predefined hypothesis, ultimately generating new theories from empirical findings (Saunders et al., 2016). For this study, a quantitative methodology will be employed, aligning with the deductive approach to systematically assess the impact of third-party logistics (3PL) on Zambia's health supply chain. This structured methodology ensures that the research yields reliable, generalizable insights into the efficiency and effectiveness of 3PL in medicine distribution.

The choice of a deductive approach for this study is driven by the need to empirically evaluate the role of 3PL in optimizing Zambia's medical supply chain, using measurable performance indicators. By adopting this method, the research will test existing theories on logistics efficiency, cost reduction, and supply chain reliability, applying them to the Zambian context. Quantitative data, such as delivery times, inventory accuracy, and transportation costs, will be collected and analyzed to determine whether 3PL partnerships enhance last-mile distribution. This approach allows for objective comparisons and statistical validation, ensuring that findings are not only relevant but also replicable in similar settings. Unlike the inductive method, which is more suited for exploratory or theory-building research, the deductive approach provides a rigorous, hypothesis-testing framework that aligns with the study's goal of assessing tangible outcomes. Furthermore, this methodology facilitates the identification of correlations between 3PL adoption and improvements in supply chain performance, offering actionable recommendations for policymakers. By grounding the research in a deductive framework, the study ensures that conclusions are evidence-based, scalable, and applicable to real-world logistical challenges in Zambia's healthcare system.

1.11 Data collection and analysis techniques

The study will employ an electronic questionnaire developed through Google Forms; a platform selected for its user-friendly interface, widespread accessibility, and efficiency in online survey administration (Wright, 2005). This tool enables seamless distribution to respondents while ensuring real-time data capture, minimizing manual entry errors and

enhancing response accuracy. The questionnaire will be designed with structured, closed-ended questions to facilitate quantitative analysis, incorporating Likert scales, multiple-choice options, and demographic inquiries. Once responses are collected, the raw data will undergo cleaning to remove incomplete or inconsistent entries, ensuring dataset reliability. Microsoft Excel will then be utilized for data organization and preliminary analysis, leveraging its computational capabilities to sort, filter, and categorize responses (McFedries, 2010). This software also supports descriptive statistics, allowing for the calculation of key metrics such as response frequencies and central tendencies. The systematic approach to data collection and processing ensures methodological rigor, laying a strong foundation for subsequent statistical evaluation.

The study will adopt quantitative methods to examine relationships between variables, employing statistical techniques to identify patterns and correlations within the dataset (Creswell, 2014). Numerical summaries, including frequencies, percentages, means, and standard deviations, will be computed to provide a comprehensive overview of respondent trends and distributions. These metrics will be synthesized into tabular formats for clarity, enabling straightforward comparisons across different survey segments. Additionally, graphical representations—such as bar charts, pie graphs, and histograms—will be generated to visually communicate findings, enhancing interpretability (Babbie, 2010). The analysed data will then be contextualized within the study's research questions, facilitating evidence-based conclusions about the examined phenomena. By integrating statistical rigor with intuitive visualization, the study ensures that results are both analytically sound and accessible to diverse audiences. This methodological approach strengthens the validity of the research while providing actionable insights aligned with the study's objectives.

1.12 Layout of the Study

The thesis will consist of five chapters. Chapter one provides an introduction. The chapter stipulates the problem and an outline of the problem statement. The chapter further offers data about the detailed objectives which are vital for the researcher to achieve the main objective of the study. Chapter two articulates the literature review focusing on specific thematic areas of the study. Chapter three describes the nature of the study and the employed research design, the sampled population and the selected sampling method, and research tools to be used in the study. Chapter four contains data analysis and presentation of findings. Chapter five is a concluding chapter of the thesis. It has conclusion and provides commendations based on the acknowledged gaps from the main findings.

1.13 Summary of the Chapter

Chapter one provided the introduction and gave a background to the study. The statement of the problem was highlighted, and the justification of the study was given. This enabled the development of the research aim, which was further broken down into specific objectives of the study, after which research questions were outlined based on the same objectives. The research scope, research contributions, research design, approach and method, data collection and analysis techniques and how the entire study is organized were also critically reviewed.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This section presents a review of associated literature to the research study. It hence highlights the empirical analysis of academic work in line with the set study objectives. It starts with the review of the public health supply chain, the notion of third-party logistics, last mile distribution in the health supply chain, efficiency and effectiveness measures of third-party logistics, customer satisfaction and the impact of third-party logistics on Stock availability. Additionally, it takes an empirical assessment of the study objectives.

2.1 Public Health Supply Chain

In public health supply chains, essential medical commodities are systematically classified into two primary categories: medicines (including vaccines and therapeutic drugs) and medical consumables (such as syringes, gloves, and sterilization equipment) (WHO, 2022). These products are typically transported in large quantities from manufacturing facilities to centralized warehouses, which serve as primary distribution hubs before onward delivery to service delivery points (SDPs) like clinics and hospitals (Smyth, 2017). Central warehouses play a crucial logistical role by receiving, sorting, and dispatching supplies according to requisition orders generated by regional health facilities and sub-national storage hubs (USAID, 2021). Given their proximity to patients, SDPs provide the most reliable consumption data, which is critical for accurate demand forecasting, supply planning, and quantification to prevent shortages or overstocking (MSH, 2020). Key data inputs for these processes include real-time inventory levels, stock adjustments, and expiry date tracking, ensuring efficient resource allocation (Gavi, 2023). Additionally, reverse logistics mechanisms enable the return of unused, expired, or excess commodities to central warehouses, minimizing waste and optimizing stock redistribution (Singh et al., 2023). This end-to-end coordination strengthens supply chain resilience, particularly in low-resource settings where logistical gaps can disrupt healthcare access (World Bank, 2022).

In public health supply chains, both central warehouses and health facilities are responsible for forecasting and quantification, initiating orders based on anticipated needs. These forecasts typically rely on historical consumption data from service delivery points (SDPs), but are vulnerable to the bullwhip effect, which can result in overstocking and wastage. To maintain service continuity and respond to unexpected demand, facilities often hold large inventories. This

multi-tier inventory system contributes significantly to operational costs, with inventory holding and labour expenses accounting for a substantial portion of total supply chain spending (Subramanian, 2021). This situation requires perfection to enable information within each health facility and warehouse to be transmitted proficiently to enable cost reduction through concerted management in the public health supply chain (Symth, 2017)

2.2 The Notion of Third-Party Logistics

Third-party logistics (3PL) represents a strategic business model where organizations outsource their logistics operations to external service providers, encompassing transportation, warehousing, and distribution functions (Murphy & Wood, 2008). This practice, often termed contract logistics, frequently leads to misconceptions in supply chain management, as its scope varies widely across industries and organizational needs (Rushton et al., 2022). While Murphy and Wood (2008) emphasize that 3PL lacks a universal definition, most interpretations agree it involves any logistics activity performed by an external partner rather than in-house teams (Waters, 2010). A critical characteristic of 3PL arrangements is their long-term contractual nature, distinguishing them from short-term freight or warehousing services (Armstrong, 2011). Such partnerships typically require collaborative planning, shared performance metrics, and integrated IT systems to ensure seamless operations (Christopher, 2022). Researchers further highlight that 3PL relationships extend beyond transactional services, evolving into strategic alliances that enhance supply chain flexibility and cost efficiency (Lieb & Bentz, 2020). This long-term orientation fosters trust and innovation, enabling vendors to customize solutions that align with the client's business objectives (Sink & Langley, 2023).

Public health supply chain management is not merely a financial concern; it is a critical determinant of clinical effectiveness and patient outcomes. The reliability and speed of supply chains directly influence the availability of essential medical supplies, diagnostics, and pharmaceuticals, which are foundational to timely and accurate treatment (Singh & Parida 2022). For instance, disruptions in clinical laboratory supply chains can delay diagnostic testing, thereby compromise patient care and increasing operational costs (Mitra te.al.,2024). Moreover, the healthcare sector operates under a unique set of values that often diverge from conventional business philosophies. Unlike typical commercial enterprises focused on profit maximization, healthcare systems prioritize patient welfare, equity, and public accountability. This divergence necessitates a specialized approach to supply chain management that integrates logistical efficiency with ethical and clinical priorities. As Iannone et al. (2013) emphasize, healthcare

logistics must be designed with these distinct principles in mind to ensure both operational sustainability and improved health outcomes (Singh & Parida 2022).

2.2.1 Zambia's Third-Party Logistics

Research in global health supply chains identifies two predominant delivery models commonly implemented in low- and middle-income countries (LMICs), including Zambia (Yadav, 2011). The first system employs regional hubs as intermediate distribution tiers, functioning as strategic cross-docking stations where bulk shipments are disaggregated for order fulfilment to individual healthcare facilities (Saraste, 2013). These hubs streamline logistics by handling picking, packing, and last-mile distribution, thereby reducing administrative burdens on district-level staff who would otherwise manage deliveries to service delivery points (SDPs) (WHO, 2020). The second model utilizes a two-tier system, bypassing intermediate hubs to enable direct delivery from central medical stores (CMS) to SDPs, enhancing speed for high-priority commodities (USAID, 2011). Both systems aim to optimize supply chain responsiveness, ensuring medications reach end-users efficiently critical in resource-constrained settings (Schopperle, 2013). The choice between models depends on factors like geographic coverage, infrastructure quality, and commodity urgency, with hybrid approaches emerging to balance cost and coverage (MSH, 2022). Ultimately, these frameworks prioritize proximity-based accessibility, aligning with the World Health Organization's (WHO) goal of getting medicines as close as possible to those in need (Global Fund, 2023).

2.2.2 Public Health Supply Chain Outsourcing

According to Perri et al., (2023) Zambia's public health supply chain has combined the use of 3PL to manage and streamline distribution and logistics functions. The Zambia Medicines and Medical Supplies Agency (ZAMMSA) has outsourced part of its distribution functions to private 3PL providers. These 3PL providers offer specific logistic, warehousing, and inventory management services, enabling the distribution of medicines and medical supplies between the central warehouse and regional hubs, including last-mile delivery to health facilities around the country.

Gallien, et al. (2021) highlight that Zambia can significantly enhance its public health supply chain efficiency by utilizing the expertise and resources of third-party logistics (3PL) vendors. By partnering with 3PL providers, the country can optimize delivery routes, ensuring timely and cost-effective distribution of medical supplies. Improved inventory management practices, facilitated by 3PLs, can reduce wastage and ensure the availability of essential health products.

This collaboration can lead to substantial cost savings for the health system, allowing funds to be redirected to other critical areas. Furthermore, 3PLs can address specific challenges, such as transporting temperature-sensitive cold chain products, which require specialized handling and storage. Their logistical expertise also enables them to navigate remote and hard-to-reach areas, ensuring equitable access to healthcare supplies. Overall, leveraging 3PL services can transform Zambia's health supply chain into a more resilient and efficient system.

Heydari et al. (2020) emphasize that public-private partnerships (PPPs) can further strengthen supply chain performance by harnessing the private sector's proficiency. PPPs bring together the public sector's regulatory oversight and the private sector's innovation, technology, and operational efficiency. Such collaborations can streamline procurement processes, reduce delays, and improve the overall reliability of the supply chain. By involving private entities, governments can access advanced logistics solutions and cutting-edge technologies that may otherwise be unavailable. PPPs also foster accountability and transparency, ensuring resources are used effectively. Additionally, these partnerships can enhance capacity-building initiatives, training local stakeholders to manage supply chains more effectively. Ultimately, PPPs create a sustainable framework for improving healthcare delivery, particularly in resource-limited settings like Zambia.

2.3 Last Mile Distribution in the Health Supply Chain

Last-mile distribution represents the pivotal final phase of the public health supply chain, ensuring that essential medicines and medical supplies are delivered efficiently and reliably from central warehouses to end users, including healthcare facilities and patients (WHO, 2022). This stage is fundamental to healthcare delivery, as it directly influences medication availability, treatment adherence, and ultimately, patient health outcomes (John & Khemani, 2023). However, last-mile logistics encounter persistent systemic and geographical barriers, particularly in low- and middle-income countries (LMICs) like Zambia, where inadequate infrastructure, fragmented transportation networks, and logistical inefficiencies can disrupt the timely supply of life-saving commodities (USAID, 2023). These challenges are exacerbated in rural and hard-to-reach regions, where poor road conditions and long distances between distribution hubs and healthcare facilities increase the risk of stockouts, delays**,** and supply chain breakdowns (Mwanaumo et al., 2023).

To address these complexities, innovative logistics technologies are being deployed to optimize last-mile distribution. Advanced tools such as Dispatch Optimizer software, a dynamic routing system enhance supply chain efficiency by automating delivery scheduling, minimizing transit

times, and reducing fuel costs (Tiwari & Sharma, 2023). These systems enable real-time adjustments to delivery routes based on traffic conditions, weather disruptions, and urgent demand surges, ensuring that medical supplies reach their destinations without unnecessary delays (Global Fund, 2023). Transportation remains a core component of last-mile logistics, with countries like Zambia, South Africa, Zimbabwe, and Nigeria utilizing a mix of delivery methods—including motorcycles, bicycles, boats, and refrigerated trucks—to navigate diverse terrains and infrastructural limitations (Mwanaumo et al., 2023).

Emerging cutting-edge technologies, such as unmanned aerial vehicles (drones) and Logistics Management Information Systems (LMIS), are poised to transform last-mile distribution by improving speed, accuracy, and reliability, particularly in remote and underserved areas (Gates Foundation, 2023). Drones, for example, have been successfully piloted in Malawi and Rwanda to deliver blood products and vaccines to isolated clinics, significantly reducing delivery times compared to traditional road transport (UNICEF, 2022). Meanwhile, LMIS platforms provide end-to-end supply chain visibility, allowing health officials to monitor stock levels, predict shortages, and streamline replenishment processes (John & Khemani, 2023). When integrated effectively, these innovations can mitigate logistical bottlenecks, enhance supply chain resilience, and ensure equitable access to essential medicines, even in the most challenging environments (World Bank, 2023).

2.4 Efficiency and Effectiveness Measures of Third-Party Logistics

Efficiency in logistics refers to the optimal use of resources to achieve maximum output, while effectiveness is about achieving the right outcomes or goals. Though distinct, these concepts are interrelated and essential in evaluating healthcare performance. A health facility is considered effective when it meets the needs of its clients through timely and appropriate service delivery. Efficiency, on the other hand, is demonstrated when administrators maximize output from existing resources—for example, by reducing patient bed days or increasing the number of consultations per day. Performance measurement in logistics is crucial for identifying areas of improvement. A recent systematic review identified 64 key performance indicators (KPIs) for hospital supply chains, categorized into financial, managerial, and clinical dimensions, which help assess both efficiency and effectiveness in healthcare logistics (Fallahnezhad et al., 2024).

Moreover, organizations that fail to measure logistics performance often lack structured performance planning, which hinders their ability to take corrective actions and maintain control over critical operations. The value of performance metrics lies not just in their collection, but in

their application to enhance logistics processes in ways that are meaningful to end users. As healthcare logistics becomes increasingly central to service delivery, organizations are shifting from reactive, tactical models to more strategic and resilient supply chain frameworks (KPMG, 2023). Logistics management in public health is a specialized discipline that significantly influences the success or failure of healthcare delivery. Quality in this context is defined not only by adherence to standards but also by the overall experience and satisfaction of the patient, encompassing both technical accuracy and emotional perception (Wicks et al., 2009)

2.5 Customer satisfaction in the Public Health Supply Chain

Customer service in logistics is defined by an organization's ability to meet client expectations in four key areas: timeliness, reliability, communication, and accessibility. These dimensions are essential for ensuring customer satisfaction and long-term loyalty. Timeliness refers to minimizing order cycle times, which helps reduce inventory pressure and improve responsiveness. Reliability encompasses consistent order fulfilment, safe and complete deliveries, and predictable service levels. Communication involves maintaining clear, timely, and effective exchanges between service providers and clients. In today's digital environment, this includes leveraging tools like Electronic Data Interchange (EDI) and shared data platforms to streamline information flow and reduce inefficiencies in verbal or manual communication processes (Ciechomski, 2024; Maersk, 2023).

Accessibility, the final pillar of customer service, focuses on how easily customers can interact with and receive support from logistics providers. This includes user-friendly systems, responsive service teams, and flexible service options tailored to diverse customer needs. Research shows that companies that prioritize customer-centric logistics strategies—such as integrated logistics systems—are better positioned to enhance customer satisfaction and operational performance. These systems improve delivery accuracy, simplify interactions, and ensure that customer needs are met efficiently and consistently (Maersk, 2023). Ultimately, customer satisfaction remains a critical determinant of long-term business success, and logistics plays a central role in shaping that experience.

2.6 The Impact of Third-Party Logistics on Stock Availability

Third-party logistics (3PL) service providers have progressively become a key element of health commodity distribution approaches in low- and middle-income countries. Their engagement intends to address constant challenges in the accessibility of medicines and medical supplies, specifically at SDP level. The effectiveness of 3PL in improving stock availability is substantial

but situational-dependent, with both progressive impacts and possible risks linked with their incorporation into national supply chains (Yadav, 2015).

Effective management of inventory stock levels is a fundamental component of supply chain coordination, enabling businesses to balance product availability with cost efficiency (Chopra & Meindl, 2022). Third-Party Logistics (3PL) providers contribute significantly by implementing sophisticated logistics solutions, integrating cutting-edge technologies, and enhancing demand prediction accuracy (Waters & Rinsler, 2023). Their expertise helps align inventory with market demand while reducing holding costs and preventing stockouts (Christopher, 2022). This coordination ensures smoother operations across procurement, warehousing, and distribution networks (Lysons & Farrington, 2023). By leveraging data analytics and automation, 3PLs optimize stock levels in real-time, improving supply chain responsiveness (Sople, 2023). The following analysis explores the relationship between inventory control and supply chain synchronization, emphasizing 3PLs' strategic role (Rushton et al., 2022). Proper inventory management ultimately enhances customer satisfaction and operational profitability (Grant et al., 2023).

One of the major impacts of 3PL providers is the increase of delivery consistency and timeliness. These specialised organizations often outdo public sector logistics entities in terms of operational proficiency. Outsourcing supply distribution specialized companies resulted in decreased stockout rates and superior order fulfilment in several countries. Comparable results are reiterated by (Solomon et.al, 2023), which noted that third-party service providers participated in improving the last-mile delivery performance, especially in inaccessible and underserved areas

2.7 Technology Integration in 3PL Logistics Management

Third-party logistics (3PL) providers play a pivotal role in modern supply chain optimization by deploying advanced logistics management systems, which significantly enhance inventory visibility, demand forecasting accuracy, and responsiveness to market fluctuations (Aronovich et al., 2010). These systems integrate real-time data analytics, IoT-enabled tracking, and AI-driven demand sensing, allowing businesses to monitor stock levels dynamically across multiple warehouses and distribution channels (Christopher, 2022). By leveraging automated alerts and predictive analytics, 3PLs help eliminate supply chain blind spots—a major contributor to overstocking, stockouts, and inefficiencies (Waters & Rinsler, 2023). For instance, **cl**oud-based inventory platforms provide stakeholders with instantaneous updates on shipment statuses, warehouse capacities, and order fulfilment rates, ensuring proactive replenishment

decisions (Lyson's & Farrington, 2023). Furthermore, performance dashboards track key metrics such as order cycle times, fill rates, and lead time variability, enabling continuous improvement in logistics operations (Rushton et al., 2022). Such technological capabilities not only reduce human error but also mitigate risks associated with delays, supplier disruptions, or sudden demand spikes (Sople, 2023). Consequently, businesses partnering with 3PLs experience higher service levels, lower carrying costs, and improved customer satisfaction—key drivers of competitive advantage in today's volatile markets (Grant et al., 2023).

The integration of third-party logistics (3PL) providers into public health supply chains offers significant potential for improving overall system efficiency by allowing ministries of health and healthcare workers to concentrate on their primary clinical responsibilities rather than logistical operations (Yadav, 2015). This strategic outsourcing becomes particularly transformative when supported by robust contract management frameworks and rigorous performance monitoring systems, especially in resource-constrained settings where in-house logistics expertise may be limited (WHO, 2020). The implementation of performance-based contracting mechanisms, including clearly defined service-level agreements (SLAs), creates strong incentives for 3PL providers to maintain high service standards and accountability throughout the supply chain (Global Fund, 2016). These contractual arrangements typically specify key performance indicators (KPIs) such as delivery timelines, stock accuracy rates, and emergency response capabilities, which are regularly assessed to ensure compliance (USAID, 2021). In low-resource environments, where public health systems often struggle with infrastructure limitations and workforce shortages, 3PL partnerships can provide access to specialized logistics expertise, advanced technology systems, and established distribution networks that would otherwise be unavailable (MSH, 2022). However, the success of such collaborations depends heavily on the government's capacity to effectively manage contracts, monitor performance, and enforce accountability measures throughout the partnership duration (Sanders et al., 2023). When properly implemented, these outsourcing arrangements can lead to improved medicine availability, reduced stockouts, and more efficient use of limited public health resources, ultimately contributing to better health outcomes (World Bank, 2022).

2.8 Challenges Associated with 3PL Dependence in Public Health Supply Chain

While third-party logistics (3PL) providers offer significant advantages, **o**ver-reliance on external partners introduces operational risks, particularly when contracts lack robust oversight mechanisms or fail to align with public health priorities (Vledder et al., 2019). Poorly managed 3PL partnerships can exacerbate stockouts if providers misinterpret demand signals, mishandle

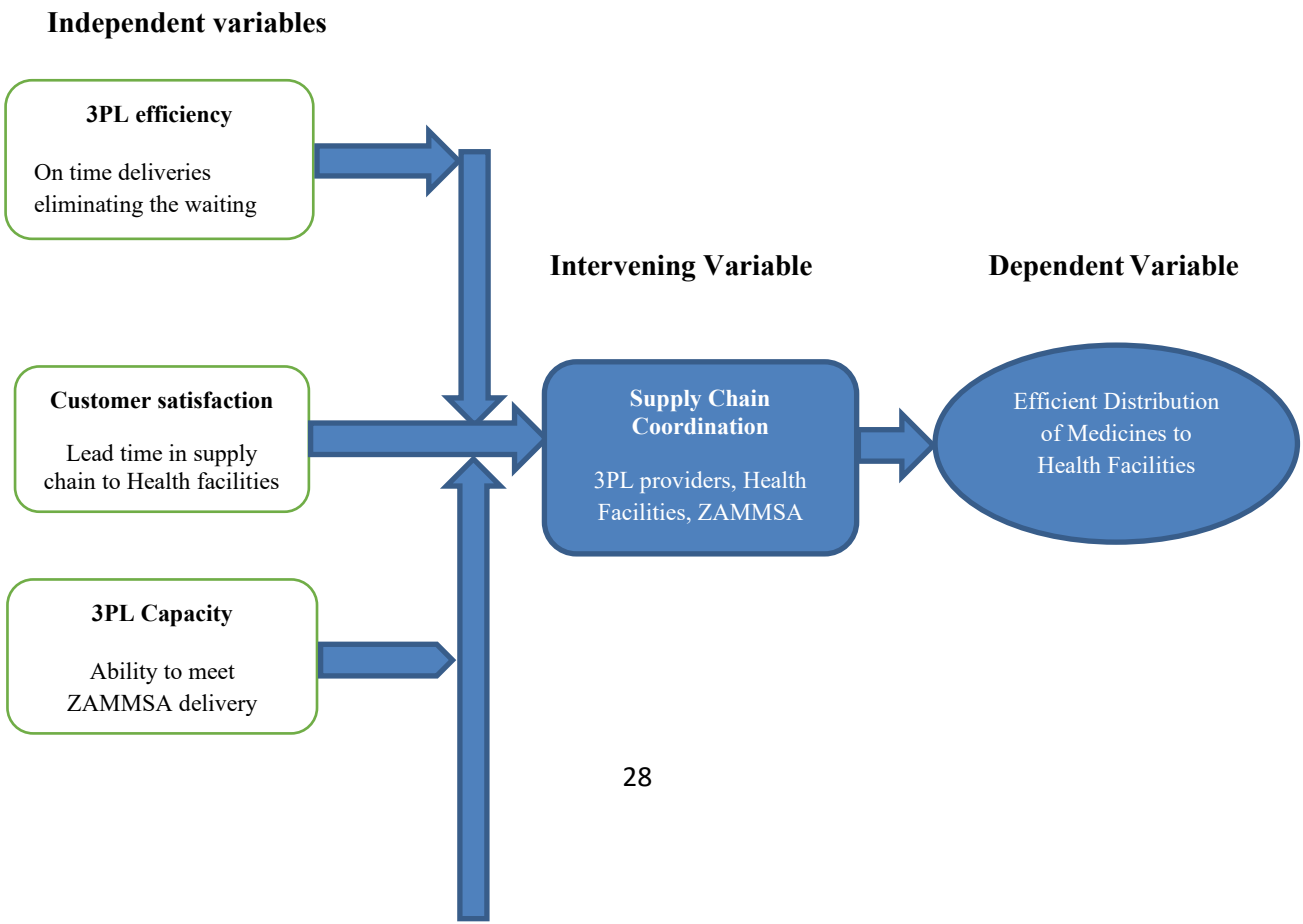
inventory, or prioritize commercial clients over public health facilities (WHO, 2021). For example, miscommunication between 3PLs, warehouses, and service delivery points (SDPs) may lead to mismatched delivery timelines, where urgent medical orders are delayed due to inflexible routing schedules or inadequate cold chain management (MSH, 2022). A critical challenge identified in low-resource settings is the lack of integration between 3PL tracking systems and national health management information systems (HMIS), creating data silos that obscure real-time stock visibility (Global Fund, 2020). Vledder et al. (2019) documented cases where advanced 3PL networks still failed to prevent stockouts because their digital platforms could not "talk" to government health databases, leading to unreported shortages or expired medicines languishing in transit hubs. Additionally, contractual ambiguities—such as unclear penalty clauses for missed deliveries—may reduce accountability, allowing 3PLs to deprioritize public health shipments during peak commercial demand (USAID, 2023). To mitigate these risks, governments must invest in interoperable technology, joint performance reviews, and contingency plans to ensure 3PLs complement—rather than disrupt—essential medicine supply chains (World Bank, 2022).

A significant limitation in utilizing third-party logistics (3PL) for public health supply chains emerges from the geographical coverage limitations and service scope restrictions inherent in many outsourcing contracts (Chandani et al., 2014). When 3PL providers are either not contractually obligated or adequately incentivized to service remote, rural, or conflict-affected regions, these areas frequently experience persistent stockouts and medicine shortages (WHO, 2021). This creates a paradoxical situation where logistics outsourcing, intended to improve efficiency, may instead exacerbate existing health inequities by prioritizing easily accessible urban centres over hard-to-reach populations (Global Fund, 2022). Chandani et al. (2014) emphasize that without deliberate equity-focused contracting mechanisms and context-adapted delivery strategies, 3PL partnerships risk reinforcing a two-tier health system where marginalized communities face systematically worse access to essential medicines. The challenge is particularly acute in countries with vast geographical areas, poor road infrastructure, or security challenges, where commercial logistics providers may deem operations unprofitable (USAID, 2023). To address this, some governments have implemented geographic coverage mandates, tiered pricing models, or public-private hybrid delivery systems to ensure universal access (MSH, 2022). These approaches recognize that 3PL contracts must be carefully designed with equity benchmarks and inclusive performance indicators that go beyond traditional cost-efficiency metrics to include measures of accessibility for vulnerable populations (World Bank, 2023).

2.9 Conceptual Framework

The conceptual framework presented in figure 2.9 below, illustrates how the variables of objectives of the study are linked. The independent variables of the research include the reduced stockouts of medicines, 3PL efficiency, 3PL Capacity and customer satisfaction at SDP. The dependent variable of the study is the efficient distribution of the medicine to the health facilities.

3PL Efficiency: Third-party logistics (3PL) efficiency refers to the operational effectiveness with which external logistics providers execute core supply chain functions, including warehousing, transportation, and order fulfilment, to enhance overall supply chain performance (Sremac et al., 2018). This efficiency is not merely about speed or cost reduction but encompasses a holistic optimization of resources, processes, and technologies to deliver seamless logistics services. Efficient 3PL operations ensure that goods are stored, handled, and transported in a manner that minimizes waste, maximizes accuracy, and meets service-level agreements (SLAs) with clients (Rushton et al., 2022). The growing complexity of global supply chains has made 3PL efficiency a critical success factor for businesses seeking to maintain competitiveness, particularly in sectors like e-commerce, healthcare, and manufacturing where timely delivery and inventory accuracy are paramount (Christopher, 2023).



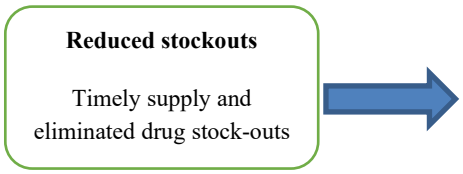


Figure 2: Conceptual Framework - Source: Author's Construction, (2025).

Stockouts are defined as the complete absence of essential medicines at a storage location or service delivery point for at least one day. Stock availability is vital for maintaining consistent healthcare services. Ensuring the timely delivery of essential medicines plays a significant role in preventing such shortages (Olaniran et al., 2022). 3PL providers, due to their specialized expertise in distribution, are generally well-equipped to deliver medicines efficiently across health facilities while aligning with ZAMMSA's supply schedules. This capability enhances the overall efficiency of medicine distribution. Additionally, customer satisfaction in 3PL services is a key indicator of logistics success, influenced by factors such as delivery speed, reliability, communication, and cost-effectiveness. Supply chain coordination captures how well various components of the supply chain such as 3PL providers, health facilities, ZAMMSA work together. This variable mediates the relationship between the independent variables and the dependant variable. The use of 3PL firms has been shown to reduce lead times in the supply chain, thereby improving service delivery to end users (Chen & Qi, 2016). Collectively, these independent variables; stockout reduction, 3PL capacity, customer satisfaction and the intervening variable, supply chain coordination, significantly influence the dependent variable, which is the efficient distribution of medicines to health facilities.

2.10 Theoretical Review

A theoretical framework serves as the foundational blueprint for academic research, functioning as both a navigational guide and conceptual boundary for scholarly investigation (Grant & Osanloo, 2014). This critical research component performs three essential functions that Fulton and Krainovich-Miller (2010) liken to an architect's blueprint or cartographer's map: First, it systematically organizes existing theories, concepts, and empirical evidence into a coherent structure that contextualizes the study within broader academic discourse. Second, it establishes clear parameters that prevent researchers from deviating into theoretically unsupported territory while still allowing for intellectual exploration within defined boundaries. Third, the framework serves as an analytical lens through which data can be interpreted, ensuring findings contribute meaningfully to theoretical advancement rather than merely presenting disconnected observations (Creswell & Poth, 2018).

The selection and application of an appropriate theoretical framework requires researchers to engage in rigorous conceptual work before empirical investigation begins. As Grant and Osanloo (2014) emphasize, this involves carefully mapping how key theories relate to the research questions, identifying relevant constructs and variables, and articulating testable propositions that bridge abstract theory with concrete investigation. The framework's guidance becomes particularly crucial during data analysis, where it helps researchers avoid common pitfalls such as theoretical inconsistency or conceptual drift - situations where interpretations gradually become disconnected from the original theoretical foundations (Ravitch & Riggan, 2017).

Moreover, a well-constructed theoretical framework performs vital scholarly functions that extend beyond the immediate study. It positions new research within existing academic conversations, demonstrates the researcher's command of relevant literature, and provides a structured approach for knowledge development (Maxwell, 2013). By tethering empirical work to established theories, the framework ensures research contributes to cumulative knowledge building rather than existing in isolation. This theoretical anchoring is what ultimately enables scholarly work to transition from mere observation to meaningful intellectual contribution (Boote & Beile, 2005).

2.10.1 Systems Theory

Developed by biologist Ludwig von Bertalanffy in the 1940s, Systems Theory revolutionized the understanding of complex structures by conceptualizing them as integrated wholes rather than isolated parts. According to von Bertalanffy (1968), a system is defined as a collection of interdependent components that interact dynamically to achieve a common objective. This perspective shifts focus from individual elements to their relationships, feedback loops, and emergent properties—highlighting how changes in one component can ripple through the entire system. Systems Theory has since been applied across disciplines, from ecology to management, due to its versatility in modeling interconnected processes (Checkland, 1999). In supply chain management, this theory helps decode how logistics networks function as unified ecosystems, where efficiency depends on the seamless coordination of procurement, storage, transportation, and distribution.

In this study, Systems Theory serves as an analytical framework for examining Zambia's public health supply chain, particularly the integration of third-party logistics (3PL) providers in last-mile medicine delivery. The supply chain is a dynamic **sys**tem comprising multiple stakeholders—such as the Zambia Medicines and Medical Supplies Agency (ZAMMSA), transporters, healthcare facilities, and regulatory bodies—each playing a critical role in

ensuring medicine availability. Systems Theory underscores that inefficiencies (e.g., stockouts or delays) often arise not from isolated failures but from weak linkages between components, such as poor communication between ZAMMSA and 3PLs or inadequate feedback mechanisms from service delivery points (SDPs) (Meadows, 2008). For instance, if a 3PL fails to align delivery schedules with healthcare facility demand patterns, the entire system suffers, leading to medication shortages in remote clinics. By adopting a systems lens, policymakers can identify leverage points (e.g., real-time data sharing or performance-based contracts) to enhance coordination and resilience.

A Systems Theory approach reveals that 3PLs act as intermediary subsystems within Zambia's supply chain, bridging gaps between central medical stores and last-mile distributors. Their effectiveness hinges on integration with other components: Information Flow: 3PLs must synchronize inventory data with ZAMMSA's Health Management Information Systems (HMIS) to prevent stock discrepancies (Vledder et al., 2019).Feedback Loops: Regular performance reviews with SDPs ensure adaptive responses to demand fluctuations (Global Fund, 2022).Interdependence: 3PLs rely on public infrastructure (e.g., roads) and policies (e.g., import regulations), illustrating how external factors influence system performance (World Bank, 2023).

Without this holistic alignment, 3PLs risk becoming disruptive rather than catalytic, exacerbating inequities in medicine access (Chandani et al., 2014). Systems Theory thus advocates for contract designs that incentivize 3PLs to serve hard-to-reach areas and technology investments to strengthen connectivity across the supply chain (USAID, 2023).

2.10.2 Contingency Theory

Contingency Theory, developed by Fred Fiedler (1964), argues that there is no universal "best" way to manage or organize systems. Instead, the effectiveness of any strategy depends on how well it aligns with the unique conditions of a given situation. This theory challenges the idea of a one-size-fits-all approach, emphasizing that different circumstances require tailored solutions. In the context of Zambia's last-mile distribution, this means that logistics strategies must be adaptable to factors such as challenging terrain, varying infrastructure quality, and uneven resource distribution. For example, rural areas with poor road networks may require different delivery methods compared to urban centers with better connectivity. By applying Contingency Theory, this research can assess how flexible 3PL operations can be customized

to overcome location-specific challenges. Ultimately, this approach ensures that supply chain solutions are both practical and effective in diverse settings.

The relevance of Contingency Theory to this study lies in its ability to explain why certain logistics strategies succeed in some regions of Zambia but fail in others. Factors such as seasonal weather disruptions, fuel availability, and local workforce capabilities all play a role in determining the most efficient distribution approach. For instance, during the rainy season, alternative transport methods like drones or boats may be more effective than traditional road deliveries. Additionally, partnerships with local community-based organizations could improve last-mile reach in remote areas where formal logistics networks are weak. By analyzing these situational variables, the study can identify which adaptive strategies—such as decentralized warehousing or dynamic route planning—yield the best results. This theoretical framework thus provides a structured way to evaluate how 3PL providers can optimize their operations in Zambia's complex and varied logistical landscape. The findings could inform policymakers and supply chain managers on how to implement context-sensitive solutions for improved healthcare distribution.

2.11 Gaps in Literature

Despite the growing adoption of third-party logistics (3PL) in public health systems, there remains a significant gap in empirical research evaluating their effectiveness in low- and middle-income countries like Zambia. Most existing studies focus on commercial logistics or high-income settings, offering limited insight into how 3PL interventions impact last-mile delivery of essential medicines in resource limited environments (Boysen te.al.,2021). Additionally, there is a lack of context-specific data on key performance indicators such as delivery timeliness, stock availability, and user satisfaction within the public health sector (Vasiliauskas & Navickienė, 2023). Furthermore, while technological innovations like route optimization and logistics management systems are increasingly integrated into 3PL operations, their role in enhancing public health service delivery in rural and underserved areas remains underexplored (Boysen te.al.,2021). These gaps underscore the need for a systematic, evidence-based evaluation of 3PL effectiveness in Zambia's public health supply chain to inform policy and improve healthcare access.

2.12 Chapter Summary

Chapter two begins with an introduction to the chapter and introduced the concept of the public health supply chain, it then explores the notion of third-party logistics (3PL). This is followed by a discussion on the efficiency and effectiveness measures of third-party logistics. The chapter then addresses customer satisfaction in public health supply chain and the impact of 3PL on stock availability. The chapter further explores technology integration in 3PL logistics management, challenges associated with 3PL dependence in public health supply chain. In the last three sections, the chapter illustrated and discussed the conceptual framework, the theoretical framework and concluded with the gaps in the literature.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter discusses the methodology that was used to achieve the study objectives. This research is a case study designed to evaluate the effectiveness of 3PL in Enhancing Last-Mile Essential Medicine Distribution in Zambia's Public Health Supply Chain. It involved a set of processes and procedures that were undertaken to achieve the study objectives. It highlights the techniques used to analyze the quantitative data collected from the field. The data was produced and analyzed to give meaning to the study's specific aim.

3.1 Research Approach

The research approach outlines the methodology used to structure and interpret annotations and other forms of evidence within a study. It is essential for researchers to understand how theory and research are interconnected, as emphasized by Bryman and Bell (2015). Saunders et al. (2016) identify two main types of research approaches: the deductive and inductive.

3.1.1 Inductive approach

Inductive research, also known as inductive reasoning, involves using observations to develop hypotheses that are later tested in the research process. It involves observing patterns and formulating explanations or theories by generating a series of hypotheses. Researchers can modify their technique without being constrained by preconceived hypotheses or theories. The inductive approach does not require the development of hypotheses but begins with the development of research questions and goals and objectives (Azungah, 2018). It is a scientific methodology that involves systematic execution of experiments and careful observation of phenomena to develop hypotheses supported by empirical evidence. The inductive approach is distinguished by its dependence on empirical evidence, commitment to the scientific method, and the development of theories.

3.1.2 Deductive Approach

According to Casala et al. (2021), the deductive research approach entails developing a hypothesis based on a thorough analysis of the body of existing literature and then evaluating it through empirical studies. Conversely, inductive research comprises developing a new hypothesis based on current data (Streefkerk, 2023). Deductive researchers begin with a

strong social theory and go from a general to a specific level of analysis, testing the theory's implications through evidence. This method, which is frequently associated with scientific investigation, was used in this study to use statistical techniques to clarify the relationship between independent and dependent variables (Casula et al., 2021). The deductive and inductive methods are complimentary even if they could seem different. Because deductive and inductive methods can improve the explanation of results, researchers may deliberately plan their investigations to include both components (DeCarlo, 2018). Sometimes, when investigating, researchers may decide to use a single technique at first, but as they work, they find that using a different strategy can improve the clarity of their results. The study has adopted a quantitative research method utilizing the deductive approach.

3.2 Research paradigm

The concept of "research paradigms" refers to frameworks for understanding and investigating social phenomena, shaping how researchers perceive reality, interpret data, and develop knowledge (Creswell & Poth, 2018). This study is grounded in a post-positivist philosophical approach, acknowledging that while an objective reality exists, researchers can only partially understand it due to practical limitations within Zambia's public health distribution system (Creswell & Creswell, 2018). For this study, a quantitative methodology will be adopted, indicating that a deductive approach will guide the study, allowing the researcher to draw general conclusions about the effectiveness of third-party logistics (3PL) on Zambia's health supply chain. (Saunders et al., 2019). This research focuses on a case study, evaluating the efficiency of ZAMMSAs third party logistics providers.

3.3 Strategy Justification

This research utilizes a case study methodology to assess the performance of Third-Party Logistics (3PL) providers in Zambia's last-mile pharmaceutical distribution network. The case study approach was selected for its ability to facilitate a detailed evaluation of 3PL operations within Zambia's public health supply chain focusing on ZAMMSA, providing contextual insights that broader survey methods might overlook (Yin, 2018). The investigation employs a quantitative method framework that incorporates quantitative assessment of operational metrices to gauge 3PL efficiency (WHO, 2020)., The case study design offers three distinct advantages: it permits direct comparison of service delivery between different geographic regions; reveals practical constraints within the public health supply chain (Saunders et al., 2019); and generates actionable policy insights for optimizing Zambia's medical distribution framework (USAID, 2021). This

comprehensive approach ensures a rigorous evaluation of 3PL contributions to healthcare logistics while accounting for Zambia's unique operational environment.

3.4 Time Horizon

The time horizon refers to the specific period allocated for conducting a research study, encompassing all stages from data collection to analysis and reporting (Saunders et al., 2019). For this study, the time horizon spans six months, from January to June 2025, providing a structured timeframe to achieve the research objectives. This duration was chosen to balance thoroughness with practicality, ensuring that the study remains feasible while delivering meaningful insights. However, the research faced time constraint**s**, which limited the depth of data collection and analysis, a common challenge in academic research (Bryman, 2015). Additionally, reliance on academic sources further compounded these constraints, as accessing peer-reviewed literature, conducting systematic reviews, and synthesizing findings can be time-intensive. Despite these limitations, the six-month period was carefully planned to maximize efficiency, prioritizing key research activities such as literature review, data gathering, and preliminary analysis. The structured timeline ensures that the study remains focused and manageable within the given academic and logistical constraints. Ultimately, the defined time horizon allows for a systematic examination of the research problem while acknowledging the inherent challenges of time-

3.5 Population Size

The study population is an aggregate or totality of all subjects, objects or members that conform to a designated set of specifications (Polit and Hungler, 2012). The target population usually has varying characteristics, and it is also known as the theoretical population. A research population is generally a large collection of individuals or objects that is the focus of a scientific query (Denscombe, 2012). It is for the benefit of the population that research is done. The target population will consist of 98 ZAMMSA distribution staff, 51 3PL staff at African Global Logistics and 39 staff at Ciltax Logistics and 12 selected high volume health facilities, giving a total population of 200 people.

3.6 Sample Size

In deciding the size of the sample to be used, the researcher considered the time and financial constraints and believes that the calculated sample size is a fair representation of the stakeholders for the population under study. To determine the sample size for this research, the ‘Slovin’s Formula’ was employed., which is designated by the formula:

$$n = \frac{N}{1+N(e^2)}$$

$$n = \frac{200}{1+200(0.05^2)}$$

$$n = \frac{200}{1.5} = 133.33$$

$$n = 133$$

The researcher assumed 95% Confidence Interval (C.I) with a 5% level of tolerable error would be used for this research work hence 133.33, giving us a random sample of 133 questionnaires.
Therefore, sample size (n) n = 133

Where: n = the desired sample size
N = Total population
e = Tolerable error = 0.05
1 = constant

3.7 Sampling Techniques

Sampling involves selecting a representative subset of individuals from a larger population to enable researchers to draw conclusions and generalize findings (Saunders et al., 2019). In market research, this method is widely used to obtain valuable insights without the need to survey every individual in the target population (Bryman & Bell, 2015). A sample, therefore, is a defined group drawn from the population to participate in a study, and sampling methods are broadly categorized into probability and non-probability techniques. Probability sampling ensures that every individual has a known chance of selection, while non-probability sampling does not offer this guarantee (Bryman & Bell, 2015). This methodological approach is both cost-effective and timesaving, making it essential in research design (Creswell & Creswell, 2018). Furthermore, contemporary survey platforms incorporate these sampling strategies to improve data reliability and operational efficiency (Kumar, 2019).

In this study, a stratified purposive sampling technique was employed, segmenting the target population into four distinct groups: ZAMMSA Distribution Team (49%), Africa Global Logistics (25%), CilTax Logistics Team (20%), and high-volume facility staff (6%). Structured data collection tools were administered to Warehousing and Distribution Officers, Regional Hub Managers, Health Facility Staff, and Assistant Logistics Officers. The sampling frame consisted of 200 employees, systematically organized into the predefined strata. From this frame, 133 participants were selected using simple random sampling to ensure equal selection probability across all groups (Creswell & Creswell, 2018).

3.8 Data Collection Methods & Instruments

Data is normally divided into two parts: primary and secondary sources. Primary source is the original material, which was created at the time of study. It is a unique source of information about the topic. On the other hand, secondary sources are the original materials that are already in existence (Rabianski, 2003). This research will be based on both primary and secondary sources. Primary data originated by the researcher for the purpose of the study being undertaken. It mainly includes data that has been recorded by the researcher for the first time to their knowledge.

In this study, primary data will be collected using structured electronic questionnaires. The questionnaires will be designed to draw out the respondent's way of dealings when it comes to the pharmaceutical supply chain and 3PL involvement. The questionnaire employed a mixed 5-point Likert scale with the different Likert types on different sections of the questionnaire. The variation in scales was intentional, clearly labelled, and aligned with the research objectives (Jamieson, 2004). The researcher will deliver the electronic Google questionnaires through email to the selected respondents and explain the objective and importance of the research to Zambia Medical Supplies Agency and the public health facilities in general. The data collection instruments will enable the researcher to collect answers for the research questions about the subjects.

3.9 Data Analysis

Data generated will be coded in a Computer Software Microsoft Excel 365 and will be analyzed using descriptive statistics. After collecting, data will be cleaned up and analysed using relevant statistical methods such as mean, mode, average and frequency to answer requestion questions of the study. While Gray (2016) identifies two primary data analysis approaches, content analysis and grounded theory, this research employed quantitative methods using structured questionnaires. The questionnaire design protected respondent anonymity by excluding personal identifiers, thereby ensuring participant confidentiality and promoting honest, unbiased responses. This approach not only safeguarded respondents' privacy but also enhanced the reliability of the collected data.

3.10 Reliability

Reliability refers to the consistency of data collection methods in producing stable and repeatable results (Saunders et al., 2015). It indicates the degree to which a measurement tool is free from random errors (Pallant, 2016) and whether it yields consistent outcomes upon repeated application. The accuracy of data often hinges on well-structured discussions and interview guides, which help minimize interviewer biases by providing participants with a comprehensive list of topics before administering survey questionnaires.

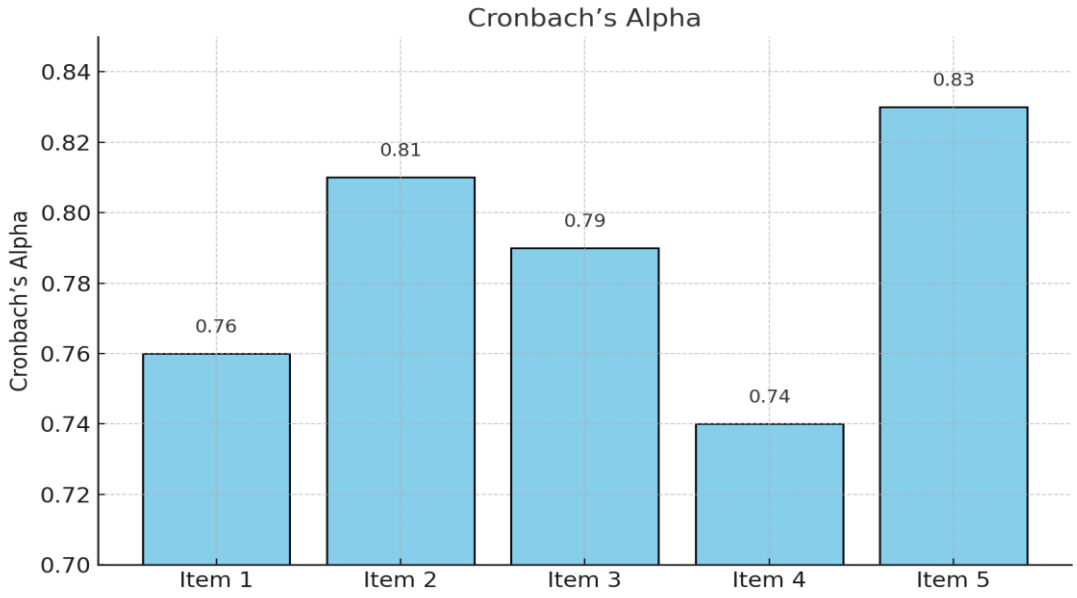


Figure 2 - Cronbach's Alpha: Source (George & Mallery2003)

A well-designed questionnaire is a crucial instrument in survey research, as it ensures a logical and systematic approach to achieving desired research objectives (Bryman & Bell, 2015). Cronbach's Alpha (α) is a statistical measure used to assess the internal consistency or reliability of a set of items in a scale or questionnaire. It evaluates how well the individual items correlate with the total scale score, thereby indicating the degree to which they measure the same underlying construct (Tavakol & Dennick, 2011). In the bar chart presented, we observe the values of Cronbach's Alpha when each of the five items in the scale is removed one at a time. The values range from 0.74 to 0.83, with Item 5 yielding the highest Cronbach's Alpha (0.83) if deleted, and Item 4 the lowest (0.74). Given this framework, the study seeks to determine whether Third Party Logistics (3PL) plays a significant role in enhancing last-mile essential medicine distribution within Zambia's public health supply chain**.**

3.11 Validity

Validity refers to the degree to which a research instrument accurately measures the specific constructs it is intended to assess (Easterby-Smith, Thorpe, & Lowe, 2015). To ensure validity, the researcher conducted a pilot study, distributing multiple questionnaires to a randomly selected sample of respondents within the target organization (ZAMMSA). Validity involves evaluating whether the research conclusions genuinely reflect the observed findings and determining the accuracy of the results. It also examines whether a causal relationship exists between the variables under study. However, external factors (such as historical influences) can compromise the validity of data, affecting its reliability for research purposes.

3.12 Research Ethics

3.12.1 Accessibility

The researcher ensured that all participants had equitable access to information about the study. Prior to participation, individuals were provided with clear, accessible explanations of the study's academic purpose, the voluntary nature of their involvement, and the benefits to both the institution and the broader academic community. This approach aligns with ethical research standards that emphasize informed consent and transparency (American Psychological Association [APA], 2020). Participants were also informed of their right to withdraw at any stage without any consequences, ensuring autonomy and respect for their decisions.

3.12.2 Conduct

Throughout the study, the researcher adhered strictly to ethical guidelines to protect the integrity of the research and the rights of participants. Confidentiality and anonymity were maintained rigorously, especially given the sensitive and competitive nature of organizational data. Informed consent was obtained in writing, and participants were assured that their responses would be used solely for scholarly purposes. No coercion or harm was involved, and all interactions were guided by principles of respect, voluntary participation, and data protection (Resnik, 2020). The study's ethical conduct was designed to uphold trust and safeguard the dignity of all respondents.

3.13 Chapter Summary

The scope of this chapter's analysis included a detailed assessment of the research techniques that will be applied in the current study. This section provides a comprehensive explanation of the study's design, the demographic group being studied, the sample selection methodology, the data collection tools, the evaluation of the tools' validity and reliability, and the data analysis technique.

CHAPTER FOUR

FINDINGS AND ANALYSIS

1. Introduction

This chapter outlines the study's results regarding the assessment 3PL in improving last-mile delivery of essential medicines within Zambia's public health supply chain. The findings will be defined and examined, with the author acknowledging that the collected data accurately represents the real-world conditions at the targeted entities, which are ZAMMSA, AGL, CILTAX, and selected high-volume health facilities. The analysis is grounded in the research objectives, which focused on evaluating 3PL's efficiency in last-mile medicine distribution at ZAMMSA and assessing how 3PL integration influences the availability of essential medicines.

4.1 Analysis and Findings

4.1.1 Demographic Information

The study surveyed a total 133 participants involved in the supply chain and logistics of essential medicines, of which 109 responded, representing 82%.

Question	Most Common Response	Frequency
Gender	Male	59 out of 109
Organization	ZAMMSA	60
Role	Warehouse/Inventory Staff	16
Years in Role	More than 6 years	23
Province	Lusaka	55

Table 1: Summary Descriptive Statistics of Demographics

Nearly half of respondents are based in Lusaka, with males making up ~58% of respondents and ZAMMSA was the most represented organization (~56%).

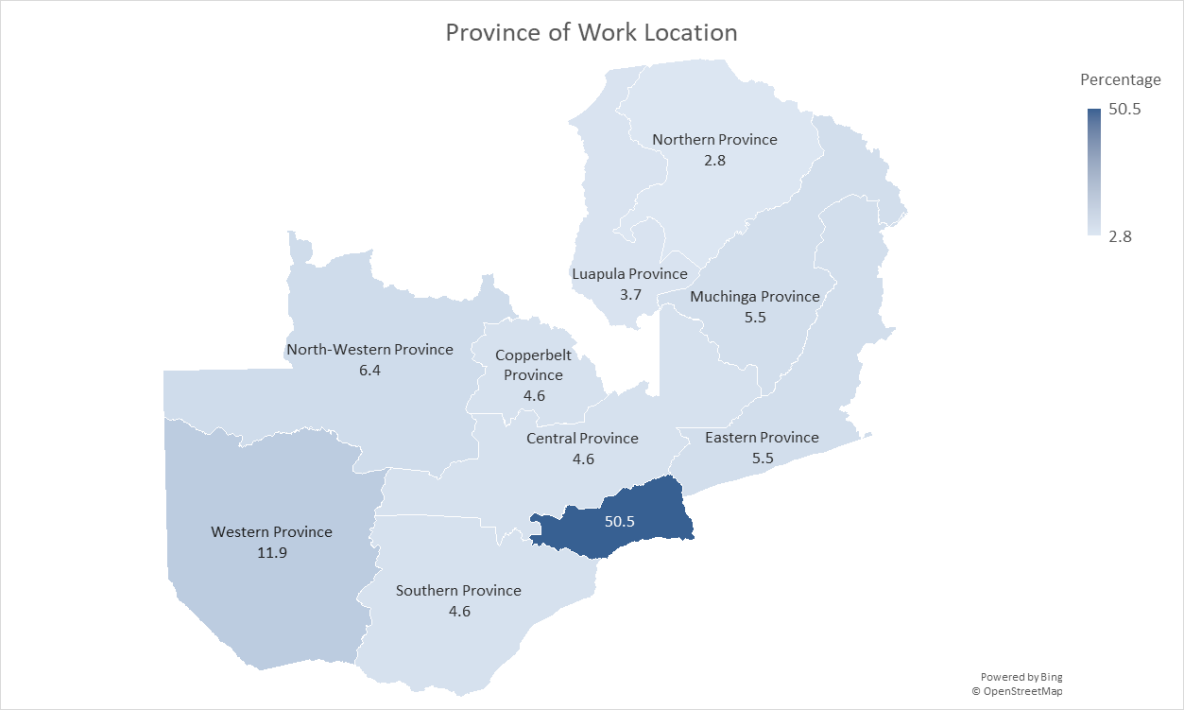


Figure 3 :Province of work location

The role of Warehouse/Inventory Staff accounted for ~28% of participants and years in role for more than 6 years with a frequency of 23, indicates a highly experienced workforce.

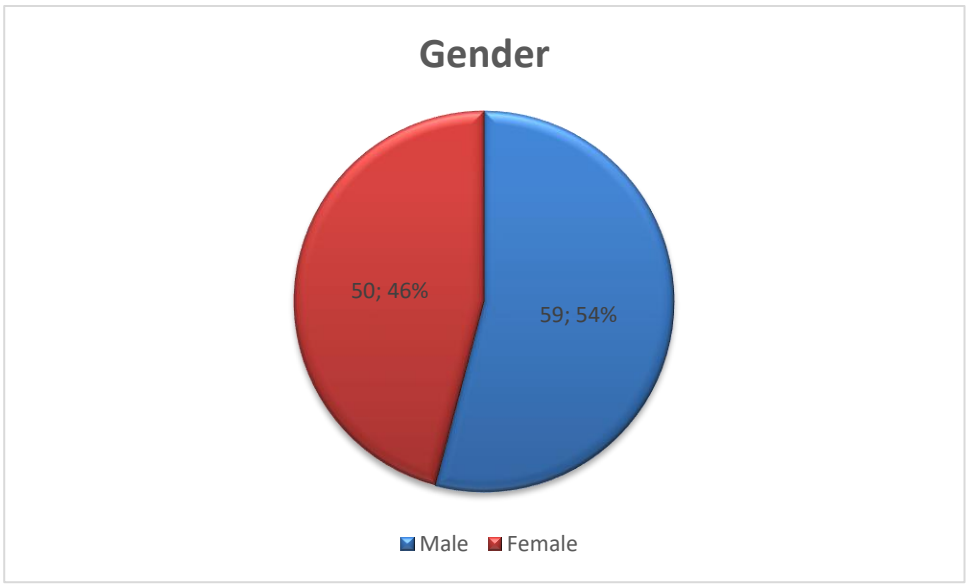


Figure 4: Gendar of respondents

The gender distribution was relatively balanced, with 59 males and 50 females, representing 54% and 46% of participants respectively.

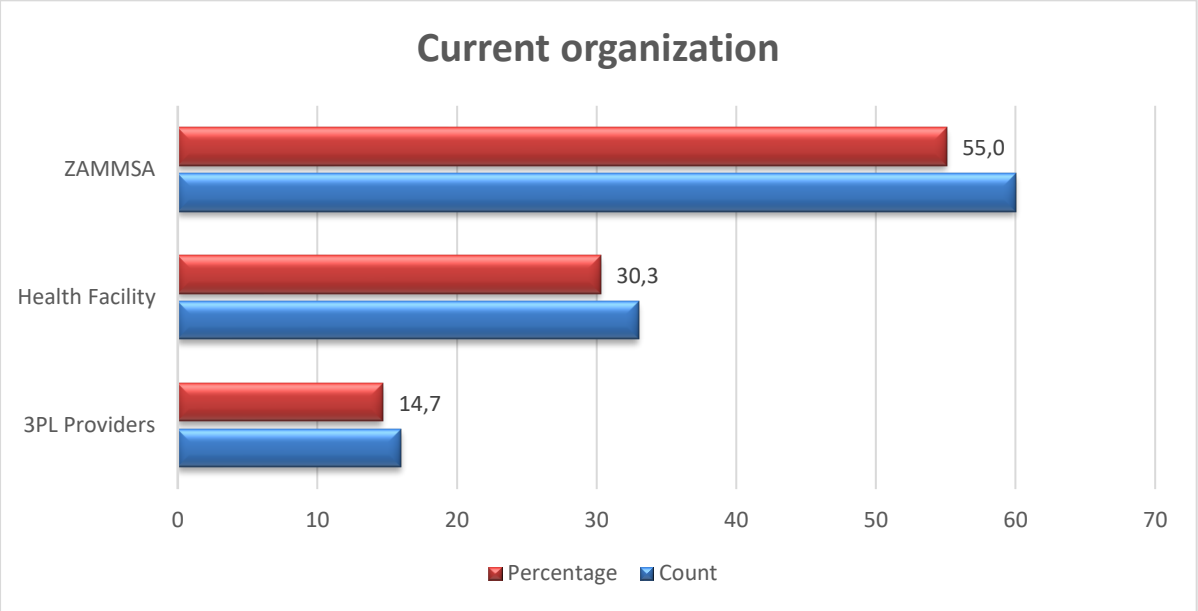


Figure 5:Current Organization

In terms of professional roles, the majority were Warehouse/Inventory Staff (26.6%) and Supervisors/Managers (25.7%), followed by Pharmacists, Logistics Officers and Nurses.

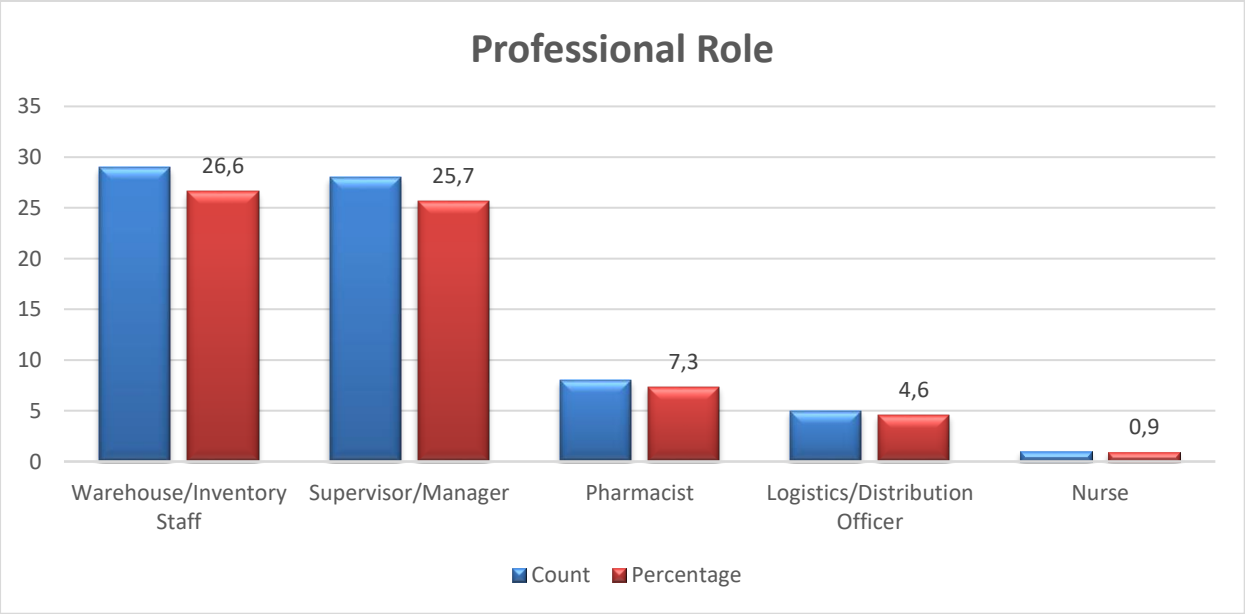


Figure 6 :Professional Role of respondents

Regarding experience, 40.4% of respondents had more than six years in their current role, indicating a mature and experienced workforce.

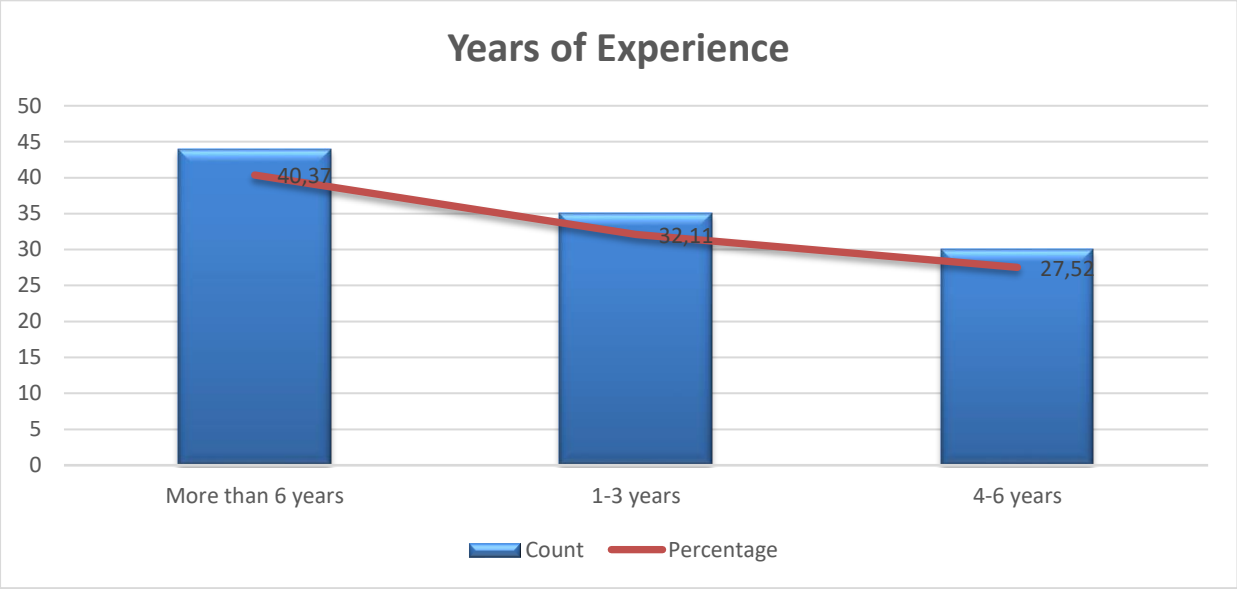


Figure 7 : Respondent Years of Experience

The table below summarizes the descriptive statistics for 12 key questions from the study questionnaire. Each section includes the question text, number of responses, number of unique responses, the most common response, and its frequency.

4.1.2 Efficiency of 3PL in Last-Mile Distribution

Regarding the on-time delivery of essential medicines most respondents (40), representing 36.7% of the respondents, indicated that medicines are always delivered on time, while only 2, representing 1.8 % indicated that delivery of essential medicines on time is rare. Other respondents, never (15) – 13.8%, Often (32) - 29.4%, sometimes (20) – 18.3% make up the rest of the percent.

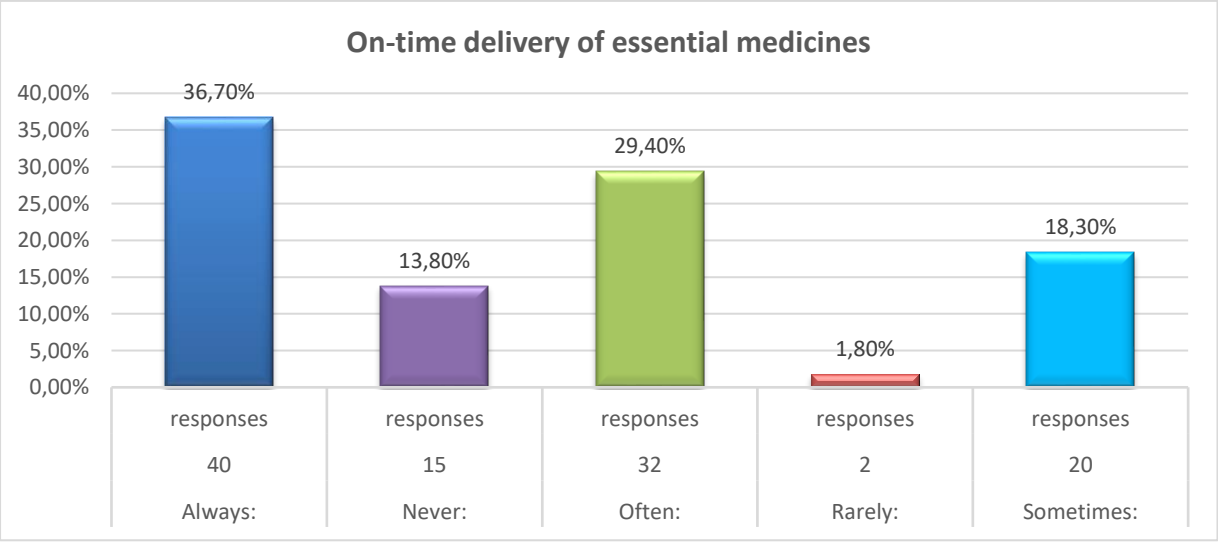


Figure 8: On-time delivery of essential medicines

Statistic	Value
Mean	~3.65
Median	4.0
Mode	Always
Standard Deviation	~1.24

For on time delivery, on a scale of "Never" = 1 and "Always" = 5, the average response is between "Sometimes" and "Often", leaning toward "Often". The middle response is "Often", indicating that at least half of respondents chose "Often" or "Always". Always is the most frequent response, chosen by 40 respondents (36.7%). The standard deviation indicates moderate variability in responses—some respondents experience less consistent delivery.

Table 2: Summary statistics - On-time Delivery of Essential Medicines

On the accuracy of deliveries in terms of correct items and quantities, 20 respondents, representing 18.3% indicated that this was excellence, 33 fair - 30.3%, Good - 53 (48.6%) and only 3 indicated that this was poor, representing 2.8% of respondents.

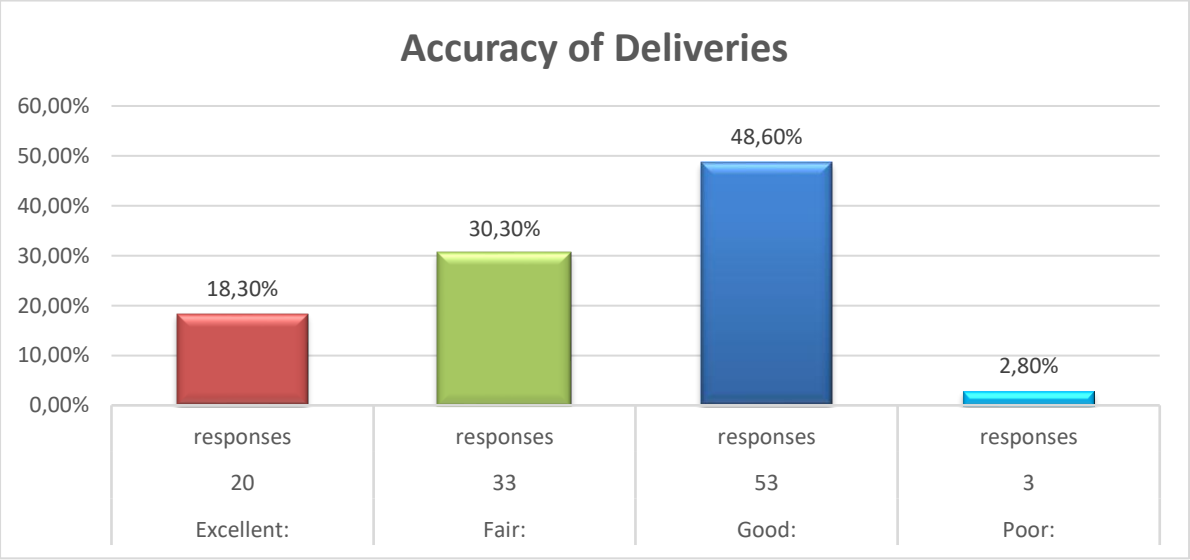


Figure 9: Accuracy of Deliveries

Statistic	Value
Mean	~2.96
Median	3.0
Mode	Good
Standard Deviation	~0.78

On a scale where "Poor" = 1 and "Excellent" = 5, the average is close to "Good". The median response is "Good", showing that at least half of respondents rated accuracy as "Good" or "Excellent". The most frequent response, selected by 53 respondents (48.6%). The standard deviation indicates relatively low variability as most respondents agreed on the quality of delivery accuracy.

Table 3: Accuracy of Deliveries (Correct Items and Quantities)

With respect to frequency of stockouts due to delivery delays, 6 respondents indicated that this was always the case (5.7%), 10 said they never experienced delays (9.4%), Often - 10 (18.8%), Rarely - 60 (56.6%) and the other respondents (20), representing 18.9% indicated that this only happens sometimes.

Count	%
60	56.6%
20	18.9%
10	18.8%
6	5.7%
Grand Total	100%

Figure 10 : frequency of stockouts due to delivery delays

Statistic	Value
Mean	~2.99
Median	3.0
Mode	Good
Standard Deviation	~1.18

On a scale where "Never" = 1 and "Always" = 5, the average is close to "Sometimes". The middle response is "Sometimes", suggesting a balanced distribution of experiences. Rarely is the most common response, chosen by 60 respondents (56.6%). The standard deviation Shows moderate variability—some facilities experience stockouts more frequently than others.

Table 5: Frequency of Stockouts Due to Delivery Delays

4.1.3 Logistical Capacity of 3PL Providers

Regarding whether 3PL providers have sufficient transport capacity to meet delivery demands, nearly half of the respondents (48.6%) agreed, while 18.3% strongly agreed, indicating a generally positive perception. However, 28.4% remained neutral, and a small minority disagreed (2.8%) or strongly disagreed (1.8%).

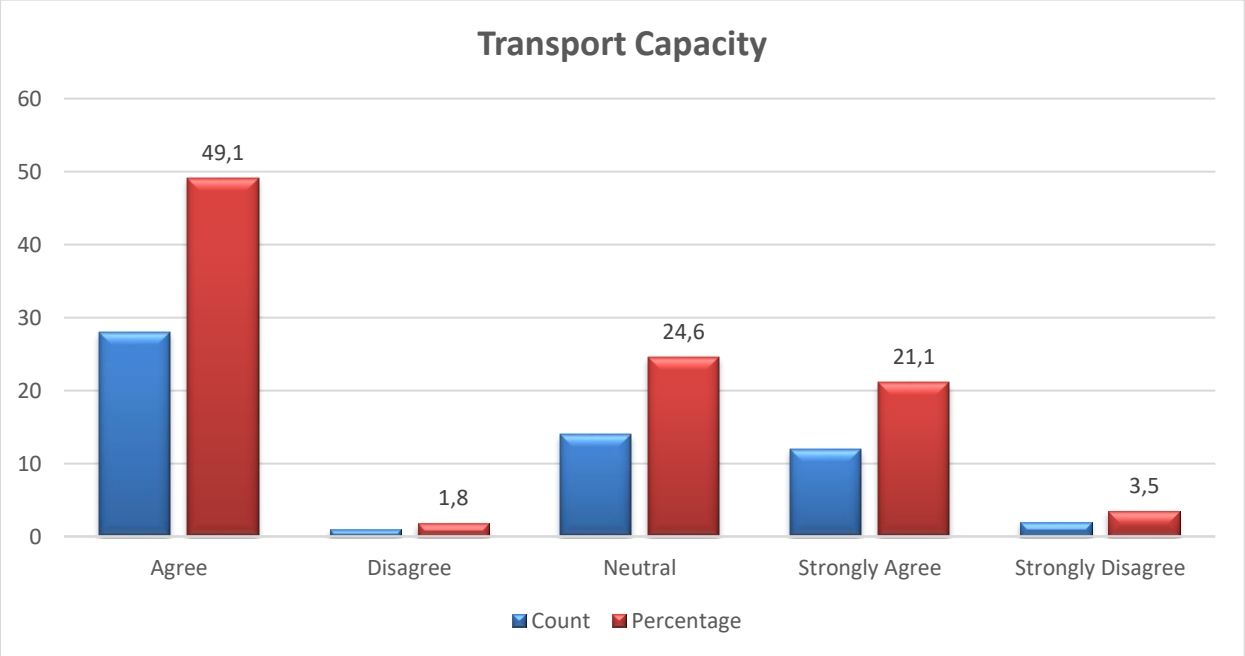


Figure 11: 3PL Transport Capacity

Statistic	Value
Mean	~3.79
Median	4.0
Mode	Agree
Standard Deviation	~0.91

On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), the average response is close to "Agree", indicating general satisfaction. The middle response is "Agree", showing that at least half of respondents agree or strongly agree. Agree is also the most frequent response, selected by 53 respondents (48.6%).

The standard deviation indicates moderate variability—most responses cluster around "Agree" and "Neutral".

Table 6 3: 3PL Transport Capacity

On the suitability of vehicles used by 3PL providers for terrain and weather conditions, responses were evenly split between "Always" and "Often" (both at 42.2%), suggesting consistent performance, while 11.9% selected "Sometimes" and 3.7% "Rarely," pointing to occasional challenges.

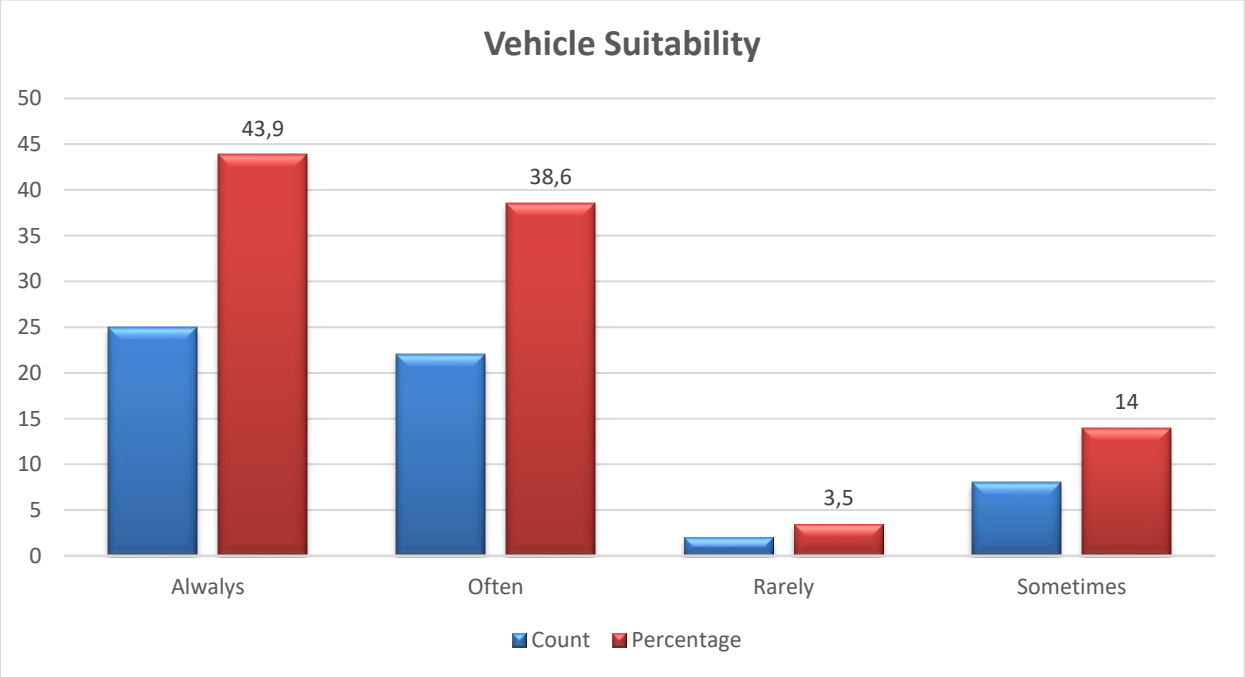


Figure 12: 3PL Vehicle Suitability

Statistic	Value
Mean	~3.34
Median	4.0
Mode	Always
Standard Deviation	~0.78

On a scale from 1 (Rarely) to 5 (Always), the average is between "Often" and "Always", leaning toward "Often". The middle response is "Always", suggesting that many respondents consistently find the vehicles suitable. Always is the most frequent response, tied with "Often" (both 42.2%).

The standard deviation indicates relatively low variability as most respondents agree on vehicle suitability.

Table 7: 3PL Vehicle Suitability

As for the condition and reliability of the delivery fleet, 45.9% rated it as "Good," 24.8% as "Fair," and 22.9% as "Excellent," with only 6.4% rating it as "Poor," indicating that most respondents view the fleet condition positively.

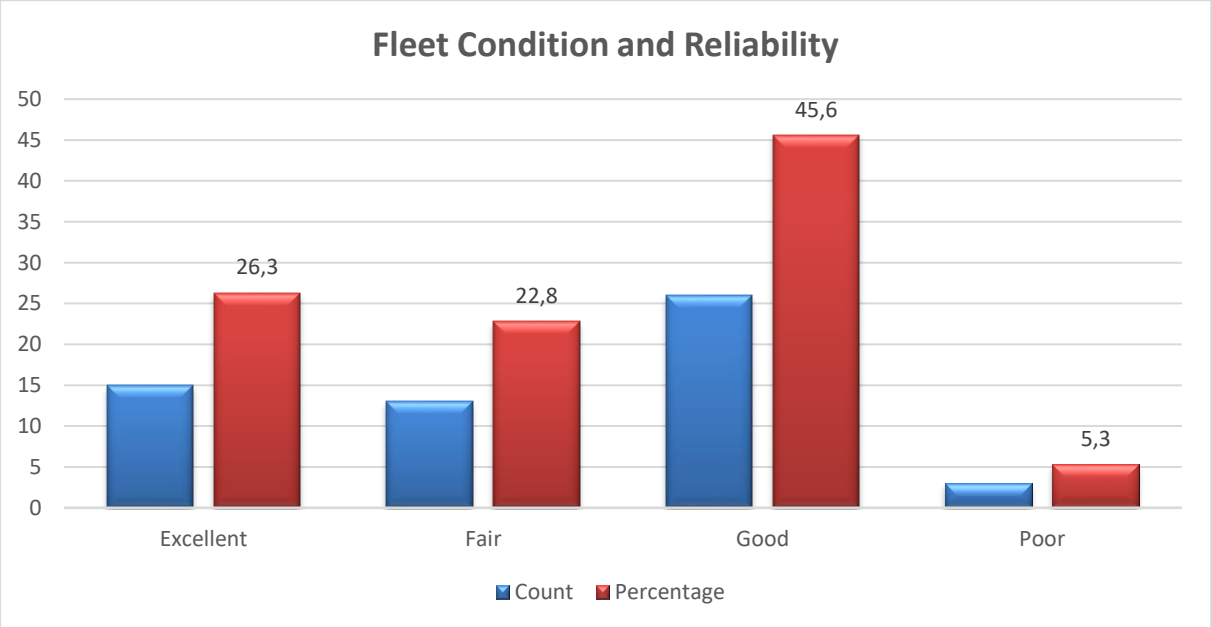


Figure 143: Fleet Condition and Reliability

Statistic	Value
Mean	~2.94
Median	3.0
Mode	Good
Standard Deviation	~0.84

On a scale from 1 (Poor) to 5 (Excellent), the average is close to "Good". The median response is "Good", showing that at least half of respondents rated the fleet as "Good" or "Excellent". Good is the most frequent response, selected by 50 respondents (45.9%). The deviation indicates moderate variability, and most responses are between "Fair" and "Excellent".

Table 8: Fleet Condition and Reliability

4.1.4 Customer Satisfaction with 3PL Services

The survey results indicate a generally positive perception of 3PL (third-party logistics) providers, though there is room for improvement in communication and responsiveness. Most of the respondents (56.9%) are satisfied with communication about delivery schedules, while a smaller portion (21.1%) are very satisfied. However, 4.6% expressed dissatisfaction.

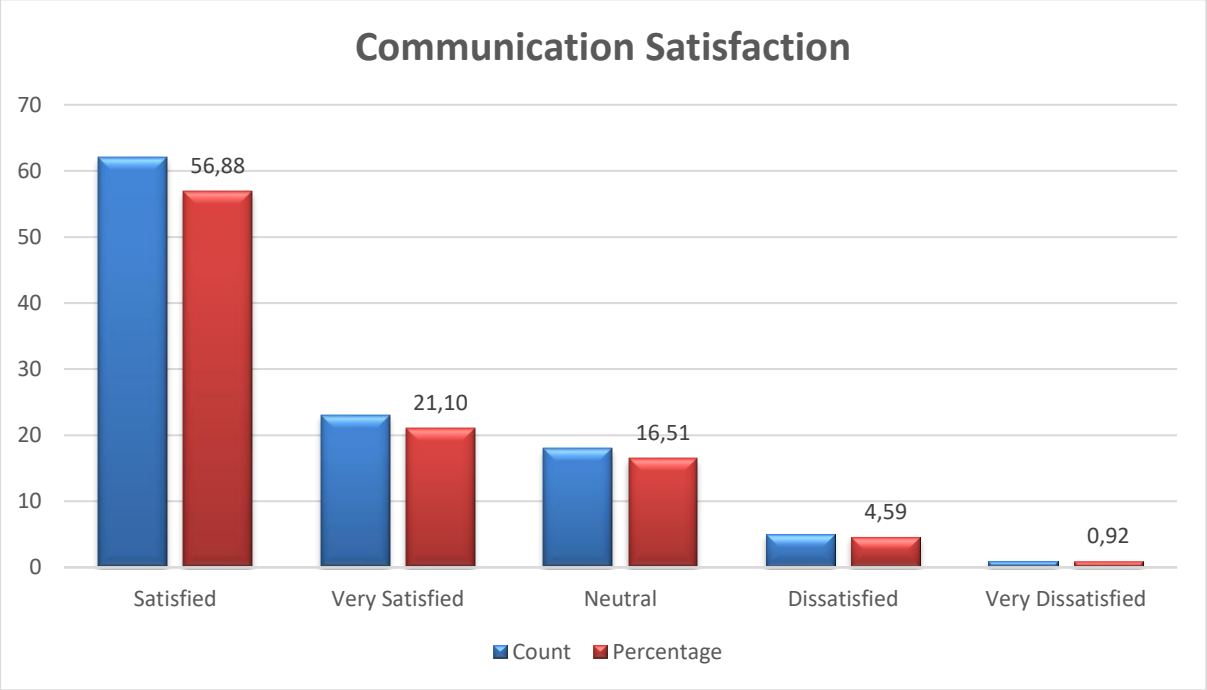


Figure 14: Communication Satisfaction

Regarding responsiveness to complaints or delivery issues, 45% found providers responsive and 15.6% very responsive, though 3.7% rated them unresponsive.

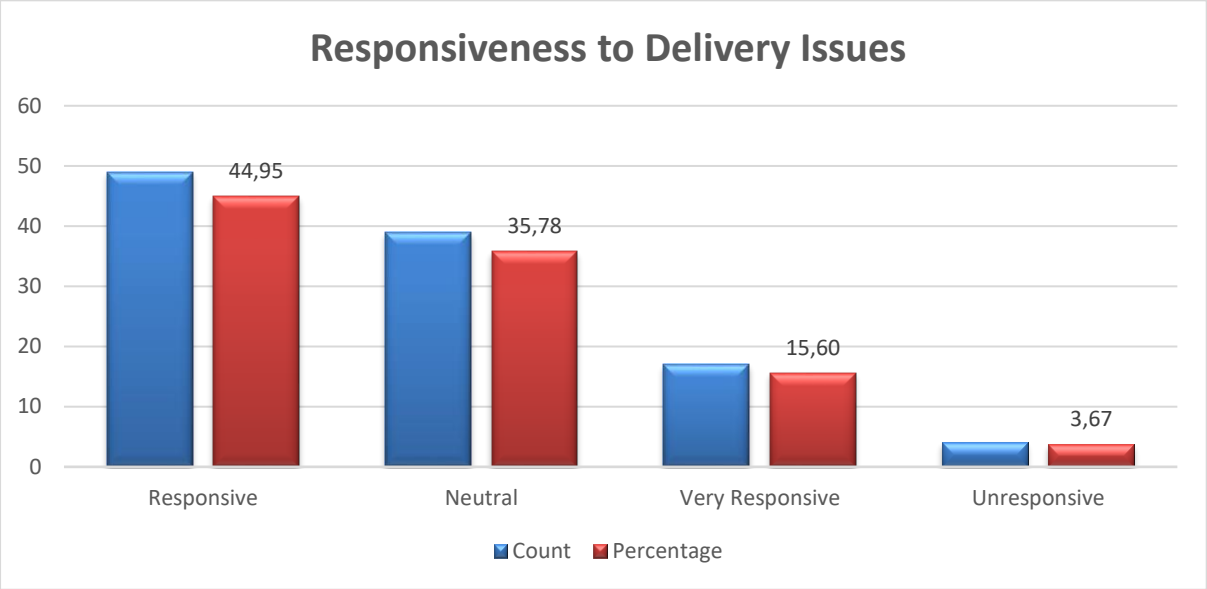


Figure 15: Responsiveness to complaints/Delivery issues

Overall satisfaction with 3PL delivery services is high, with 56% satisfied and 11.9% very satisfied, while only a small fraction (3.7%) reported dissatisfaction. Neutral responses across all categories suggest that while many users are content, a significant number remain ambivalent, highlighting opportunities for service enhancement.

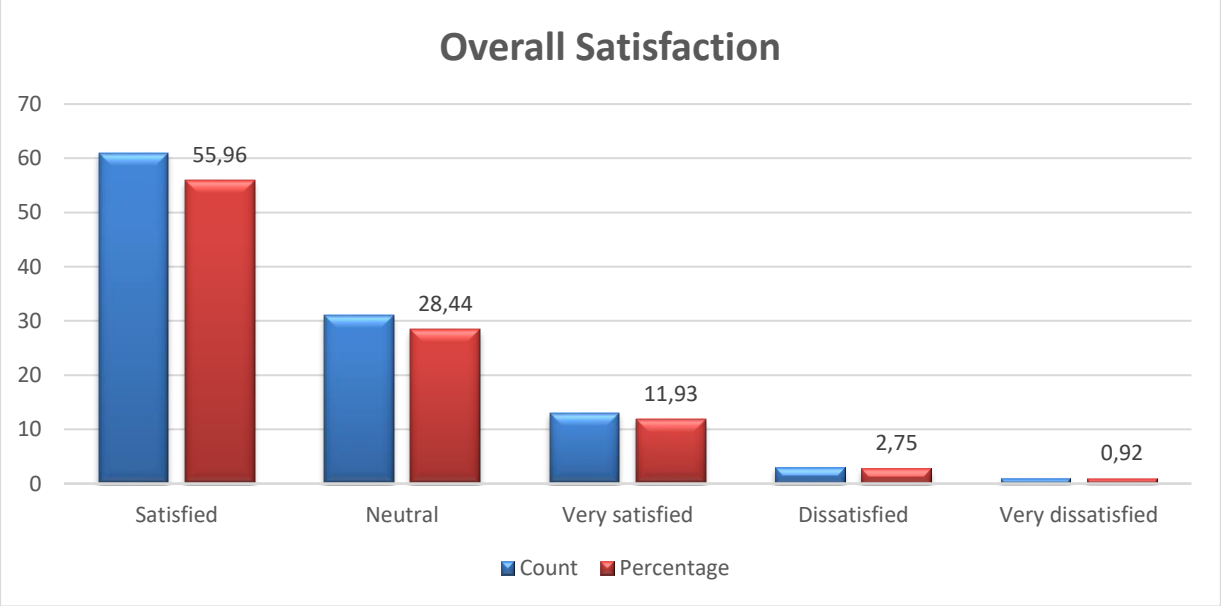


Figure 16: Overall Satisfaction

Question	Mean	Median	Mode	Standard Deviation	Key Frequencies
Satisfaction with Communication	**3.93**	**4.0**	**4.0 (Satisfied)**	**0.80**	**Satisfied (56.9%), Very Satisfied (21.1%), Neutral (16.5%)**
Responsiveness to Complaints	**3.69**	**4.0**	**4.0 (Responsive)**	**0.87**	**Responsive (45.0%), Neutral (35.8%), Very Responsive (15.6%)**
Overall Satisfaction	**3.61**	**4.0**	**4.0 (Satisfied)**	**0.55**	**Satisfied (56.0%), Neutral (28.4%), Very Satisfied (11.9%)**

Table 9: Summary statistics

The mean, which is the average score after converting responses to a 1–5 scale is close to 4, indication general satisfaction. The median, which is the middle value, shows that most responses are at least "Satisfied". The mode is the most frequent response, which is "Satisfied" or "Responsive" across all three questions. Standard Deviation measures variability in responses. Responsiveness to complaints has the highest variability (0.87), suggesting more diverse opinions on responsiveness.

Regarding communication, most respondents are satisfied or very satisfied, with a mean of 3.93. this suggests communication is generally effective, though a few are dissatisfied. With responsiveness, while many find 3PL providers responsive, the higher standard deviation (0.87) and large neutral group (35.8%) indicate inconsistency in experiences. The overall satisfaction has the lowest standard deviation (0.55), which implies more consistent satisfaction levels, with most respondents rating the service positively.

4.1.5 Impact on Medicine Availability

Since the integration of third-party logistics (3PL), the availability of essential medicines has shown a notable improvement, with 63.3% of respondents indicating that availability has improved and an additional 30.3% reporting significant improvement. Only a small fraction (6.4%) observed no change.

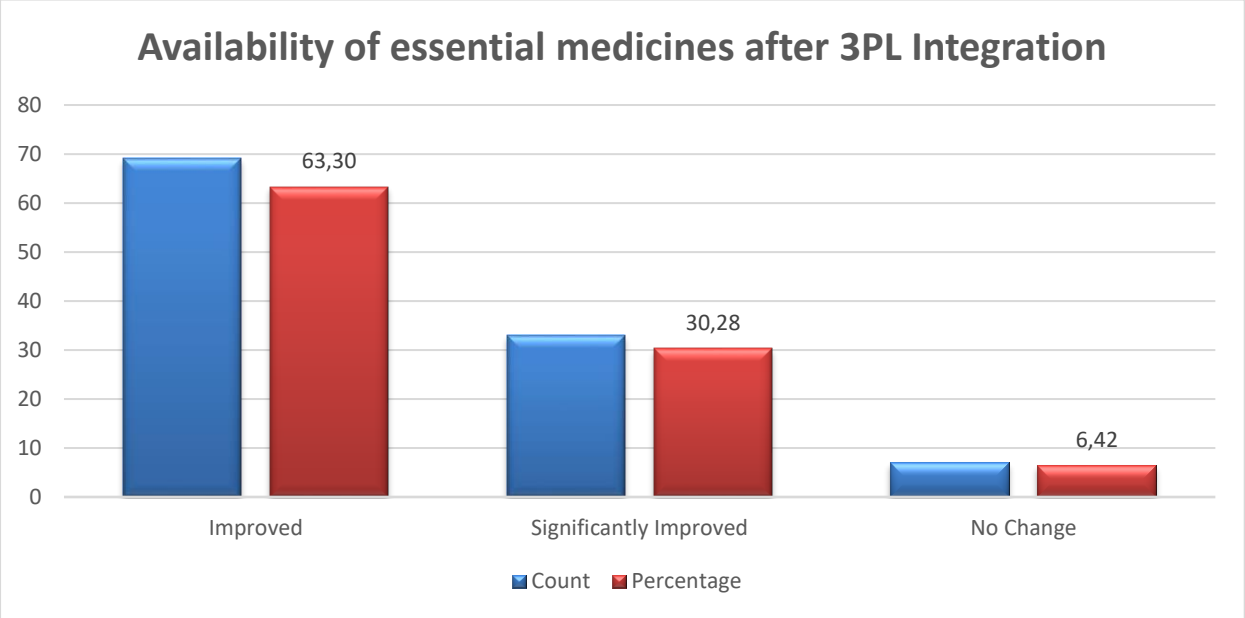


Figure 17: Availability of essential medicines after 3PL Integration

In terms of emergency or urgent deliveries, nearly half (48.6%) of the respondents stated that such deliveries are often successfully fulfilled, while 35.8% reported they are always fulfilled. Very few respondents indicated negative experiences, with only 2.8% each stating that emergency deliveries are rarely or never fulfilled.

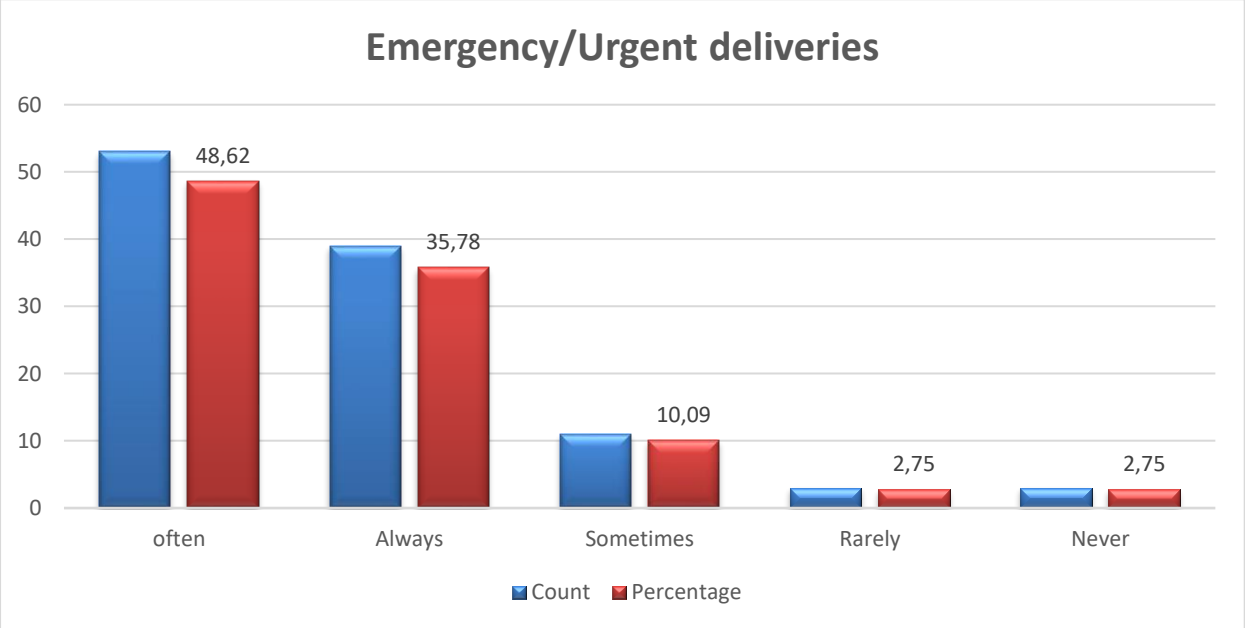


Figure 18:Emergency/Urgent deliveries

Furthermore, when asked whether 3PL has contributed to better patient outcomes through improved medicine availability, a combined 71.5% of respondents agreed or strongly agreed, reinforcing the perception that 3PL integration has had a positive impact on healthcare delivery.

Question	Mean	Median	Mode	Standard Deviation
Availability of Essential Medicines	4.24	4.0	4 (Improved)	0.56
Emergency Delivery Success	4.12	4.0	4 (Often)	0.90
Contribution to Patient Outcomes	4.00	4.0	4 (Agree)	0.85

Table 10:Statistical analysis

The statistical analysis of the 3PL effectiveness survey reveals a generally positive perception of its impact on healthcare delivery. Respondents reported that the availability of essential medicines has improved since the integration of 3PL, with a high mean score of 4.24 and low variability, indicating strong consensus. Emergency or urgent deliveries are also frequently fulfilled (mean = 4.12), though responses showed slightly more variation, suggesting differing experiences across regions or facilities. Additionally, most participants believe that 3PL has contributed to better patient outcomes, reflected in a mean score of 4.00. Overall, the data highlights that 3PL services are viewed as beneficial, particularly in improving medicine availability and supporting timely deliveries, though some areas may require targeted improvements to ensure consistent performance.

Below is a summary of the statistically significant chi-square test results ($p < 0.05$) from the collected data. These results indicate associations between pairs of variables that are unlikely to be due to chance. The top significant associations are sorted by p-value.

Variable 1	Variable 2	Chi²	p-value
Communication Satisfaction	Overall satisfaction	238.10	1.41
3PL provider responsiveness	Overall Satisfaction	177.23	1.58

Variable 1	Variable 2	Chi²	p-value
Communication Satisfaction	3PL provider responsiveness	162.54	1.60
Condition of delivery fleet	Availability of medicines since 3PL	125.20	1.32
Accuracy of deliveries	Emergency deliveries success	133.66	1.14

Table 11: chi-square test results - top significant associations are sorted by p-value

The interpretation of the chi-square analysis reveals several critical relationships that highlight the operational and perceptual dynamics of 3PL services. There is a very strong association between satisfaction with communication, responsiveness to complaints, and overall satisfaction, indicating that effective communication and timely responsiveness are key drivers of user satisfaction with 3PL providers. Additionally, the condition and reliability of the delivery fleet are strongly linked to perceived improvements in the availability of essential medicines, underscoring the importance of robust logistics infrastructure in ensuring consistent supply. Furthermore, the accuracy of deliveries is highly associated with the success of emergency or urgent deliveries, suggesting that system reliability plays a crucial role in the effectiveness of time-sensitive delivery service. These findings collectively emphasize the interconnectedness of operational efficiency and user satisfaction in the context of 3PL performance.

4.2 Assessment of Validity

The validity of this study is supported by the alignment between the survey questions and the core objectives of evaluating 3PL effectiveness in healthcare logistics. Construct validity is evident in the way the questions capture key dimensions such as delivery timeliness, communication, responsiveness, and perceived impact on medicine availability and patient outcomes. The use of chi-square tests to assess associations between variables further strengthens internal validity by confirming statistically significant relationships, such as between satisfaction with communication and overall satisfaction. Additionally, the consistency of positive trends across multiple indicators (e.g., improved availability, frequent emergency delivery success, and perceived patient outcome improvements) supports content validity, indicating that the instrument effectively measures what it intends to.

4.3 Assessment of Reliability

Reliability is demonstrated through the consistency of responses across related variables and the statistical measures derived from them. The mode and median values for key questions such as satisfaction, responsiveness, and perceived improvements consistently fall within the “Agree” or “Satisfied” range, indicating stable patterns in respondent perceptions. Moreover, the relatively low standard deviations for questions on medicine availability (0.56) and overall satisfaction (0.55) suggest a high level of agreement among participants, reflecting dependable and repeatable results. The use of ordinal scales with clearly defined categories also contributes to measurement reliability. While some variability exists in responses to emergency delivery success and patient outcomes, this is expected in diverse operational contexts and does not significantly detract from the overall reliability of the instrument.

4.4 Chapter summary

This chapter started with an introduction highlighting the techniques to be used for data analysis, then the analysis and findings of the data were also discussed, we different statistical summaries were presented. Further the assessment of the validity and reliability were also discussed in the closing phase of the chapter.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents the findings and analysis of the study on the effectiveness of third-party logistics (3PL) in enhancing last-mile delivery of essential medicines within Zambia's public health supply chain. The analysis is based on data collected from key stakeholders, including personnel from ZAMMSA, 3PL providers, and selected health facilities. The chapter begins with a summary of respondent demographics, followed by a detailed examination of responses related to delivery efficiency, logistical capacity, customer satisfaction, and the impact of 3PL on medicine availability and patient outcomes. Statistical tools, including descriptive analysis and chi-square tests, are used to interpret the data and uncover significant relationships between operational and perceptual variables. The findings provide a foundation for drawing conclusions and making practical recommendations for improving logistics performance in the health sector.

5.1 Efficiency of 3PL in Last-Mile Distribution

Conclusion: The analysis reveals that 3PL providers have generally improved the timeliness and accuracy of last-mile deliveries of essential medicines. A significant proportion of respondents reported that deliveries are "Always" or "Often" on time, and most rated delivery accuracy as "Good" or "Excellent." However, the presence of some responses indicating "Sometimes" or "Rarely" for on-time delivery and stockouts due to delays suggests that while the system is functioning well overall, there are inconsistencies in performance across different regions or facilities. These inconsistencies may be due to logistical bottlenecks, infrastructure limitations, or coordination issues.

Recommendations: To enhance efficiency, 3PL providers should implement real-time tracking systems and predictive analytics to anticipate and mitigate delays. ZAMMSA and its partners should conduct periodic route optimization and performance audits to identify underperforming areas. Additionally, establishing a centralized dashboard for monitoring delivery KPIs can help ensure accountability and continuous improvement in last-mile distribution.

5.2 Logistical Capacity of 3PL Providers

Conclusion: The findings indicate that most respondents perceive 3PL providers as having adequate transport capacity and suitable vehicles for Zambia's diverse terrain and weather conditions. The delivery fleet is generally viewed as reliable, with "Good" being the most common rating. However, the presence of neutral and less favorable responses suggests that logistical capacity may not be uniformly distributed or consistently maintained across all regions.

Recommendations: To address these disparities, 3PL providers should invest in fleet expansion and modernization, particularly in underserved or hard-to-reach areas. Regular vehicle maintenance schedules and terrain-specific vehicle deployment strategies should be enforced. Furthermore, logistics partners should consider incorporating contingency planning for adverse weather or road conditions to ensure uninterrupted service delivery.

5.3 Impact on Medicine Availability

Conclusion: The integration of 3PL has had a significant positive impact on the availability of essential medicines. Most respondents reported improvements, with many significant improvements. Emergency deliveries are also frequently fulfilled, and most respondents believe that 3PL has contributed to better patient outcomes. These findings underscore the value of 3PL in strengthening the public health supply chain.

Recommendations: To sustain and build on these gains, the Ministry of Health and ZAMMSA should continue to support and expand 3PL partnerships. Performance-based contracts should be introduced to increase high service levels. Additionally, integrating 3PL performance metrics into national health information systems can help track progress and inform policy decisions.

5.4 Practical Implications of Findings and Recommendations

5.4.1 Strategic Investment in Logistics Infrastructure

The strong association between fleet condition and medicine availability implies that investments in vehicle maintenance, terrain-appropriate transport, and route optimization are not just operational necessities but strategic levers for improving public health outcomes. Managers should prioritize budget allocations for fleet upgrades and ensure that vehicle deployment aligns with regional terrain and delivery demands.

5.4.2 Performance-Based Contracting for 3PL Providers

The variability in satisfaction and responsiveness suggests that not all 3PL providers are performing at the same level. This calls for the introduction of performance-based contracts that tie compensation or contract renewal to key performance indicators (KPIs) such as on-time delivery, emergency response success, and customer satisfaction scores. This approach can incentivize consistent service quality across providers.

5.4.3 Data-Driven Decision Making

The application of statistical tools such as chi-square analysis has proven instrumental in uncovering significant correlations between key operational variables and customer satisfaction outcomes in logistics management. This analytical approach enables researchers and practitioners to quantitatively assess whether observed patterns in service delivery, delivery times, or resource allocation have a statistically meaningful impact on end-user satisfaction levels. By systematically examining these relationships through hypothesis testing, organizations can move beyond anecdotal evidence to identify which operational factors truly influence performance metrics. For instance, a chi-square test might reveal that delayed shipments exceeding a certain threshold directly correlate with decreased customer satisfaction scores, providing empirical justification for process improvements. Such data-driven insights allow logistics managers to prioritize interventions where they will have the greatest measurable impact. Furthermore, these statistical methods help validate whether perceived problems in the supply chain are statistically significant or merely random variations, ensuring resources are allocated efficiently. The rigorous application of these analytical techniques transforms subjective operational assessments into objective, actionable business intelligence.

To fully capitalize on these insights, organizations should institutionalize data analytics by integrating advanced monitoring systems such as real-time dashboards and automated reporting mechanisms into their logistics oversight functions. These technological solutions enable continuous tracking of key performance indicators, allowing managers to spot emerging trends, detect inefficiencies, and respond proactively to potential disruptions before they escalate. Regular data reviews should be embedded into management routines, with standardized reports comparing current performance against historical benchmarks and industry standards. This evidence-based approach empowers decision-makers to implement targeted adjustments to logistics strategies, whether that involves reallocating warehouse resources, modifying delivery routes, or retraining staff in specific problem areas. By fostering a culture of data-driven

decision making, organizations can ensure that operational improvements are systematically implemented rather than being reactive or based on intuition. Over time, this analytical orientation leads to more predictable supply chain performance, enhanced customer satisfaction, and better resource utilization. Ultimately, the strategic integration of statistical tools and analytics platforms represents a competitive advantage in today's data-intensive logistics environment.

5.4.4 Strengthening Communication and Feedback Mechanisms

Given the strong link between communication, responsiveness, and overall satisfaction, managers should establish standardized communication protocols and responsive feedback systems. This includes real-time delivery updates, complaint resolution timelines, and regular stakeholder engagement forums to build trust and transparency.

5.4.5 Integration of 3PL Metrics into National Health Systems

The positive impact of 3PL on medicine availability and patient outcomes suggests that logistics performance should be integrated into national health monitoring systems. This allows for better alignment between supply chain operations and health service delivery goals, ensuring that logistics is recognized as a core component of healthcare infrastructure.

5.4.6 Limitations of the study and directions for future research

While this study provides valuable insights into the effectiveness of third-party logistics (3PL) in last-mile delivery of essential medicines, several limitations should be acknowledged. First, the study relied on self-reported data from respondents, which may be subject to bias, including social desirability or recall inaccuracies. Second, the sample was limited to selected organizations and high-volume health facilities, which may not fully represent the experiences of smaller or more remote facilities. Third, the cross-sectional nature of the survey captures perceptions at a single point in time, limiting the ability to assess changes or trends over time. Additionally, while the chi-square analysis revealed significant associations, it does not establish causality, and other confounding factors may influence the observed relationships. Finally, some variables such as supply chain disruptions, policy changes, or external donor support were not included in the analysis but could have impacted logistics performance.

Future research should consider longitudinal studies to track the impact of 3PL integration over time and across different regions. Expanding the sample to include a broader range of health facilities, including rural and low-volume sites, would enhance the generalizability of findings. Qualitative methods such as interviews or focus groups could complement quantitative data by providing deeper insights into the challenges and successes of 3PL implementation. Additionally, future studies could explore the cost-effectiveness of 3PL models compared to traditional delivery systems, as well as the role of digital tools and real-time tracking in enhancing logistics performance. Finally, incorporating patient-level outcomes and health service delivery indicators would provide a more comprehensive understanding of how logistics improvements translate into better healthcare access and outcomes.

5.5 Summary

This study assessed the effectiveness of third-party logistics (3PL) in improving last-mile delivery of essential medicines within Zambia's public health supply chain. Drawing on survey data from 109 respondents across ZAMMSA, 3PL providers, and high-volume health facilities, the analysis revealed that 3PL integration has positively influenced medicine availability, delivery timeliness, and overall satisfaction with logistics services. Most respondents reported improvements in on-time delivery, delivery accuracy, and emergency response, with strong associations found between satisfaction, communication, responsiveness, and logistics infrastructure.

Statistical analysis, including chi-square tests, confirmed significant relationships between key operational and perceptual variables, highlighting the interconnectedness of logistics performance and healthcare outcomes. While the findings demonstrate the value of 3PL in enhancing supply chain efficiency, they also point to areas for improvement, such as communication consistency and responsiveness. The study concludes with practical recommendations for strengthening logistics capacity, improving stakeholder engagement, and leveraging data for continuous improvement.

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27th June 2025

TO WHOM IT MAY CONCERN

ZCAS

UNIVERSITY

Dear Sir/ Madam,

RE: RESEARCH INTRODUCTORY LETTER FOR MS. WENDY MULITE

This serves to confirm that Ms. Wendy Mulite, student number 202401451, is a Bona Fide student at ZCAS University. She enrolled in the Master of Science in Procurement and Logistics Programme.

Ms. Mulite is currently working on her Dissertation, and your organization has been chosen as the main organization for reference and research activities. The title of her research is: EVALUATING THE EFFECTIVENESS OF THIRD-PARTY LOGISTICS (3PL) IN ENHANCING LAST MILE ESSENTIAL MEDICINES DISTRIBUTION IN ZAMBIA'S PUBLIC HEALTH SUPPLY CHAIN: A CASE OF ZAMBIA MEDICINES AND MEDICAL SUPPLY AGENCY (ZAMMSA).

Kindly assist her with any information that may be relevant to her in this regard. The information gathered will be purely used for academic purposes. Should you need more information about the student, please do not hesitate to get in touch with the undersigned on the numbers below.

Yours faithfully,

ZCAS University

Jonathan Chiyesu

ACTING ACADEMIC AFFAIRS MANAGER

ZCAS UNIVERSITY

P.O BOX 50497 RW

LUSAKA- ZAMBIA

27 JUNE 2025

STUDENT ADMINISTRATION