An Examination of the Impact of a Yard Management System on Three Third-Party Logistics Operations Centers

Ziang Wang

B.A., Beijing Jiaotong University, 2011

M.S., Emporia State University, 2013

Submitted to the Faculty of the School of Education of Baker University

in partial fulfillment of the requirements for the degree of

Doctor of Education in Instructional Design and Performance Technology

Regena M. Aye

Regena M. Aye, Ed.D.
Major Advisor

Anna J. Dunn

Anna Dunn, Ph.D.

Dusti D. Howell

Dusti Howell, Ph.D.

Date Defended: February 25, 2025

Abstract

The current study aimed to quantitatively and qualitatively evaluate a Yard Management System (YMS) implemented in 2018 to improve yard visibility, reduce detention occurrences in the facility, and increase the selected third-party logistics distribution centers' inbound/outbound performance in terms of pounds. Pershing's Human Performance Technology Fundamental theory states that information communication is essential for successful organizational performance (Pershing, 2006). The YMS was designed to provide real-time yard status updates and optimize the movement of trailers, containers, and other assets to improve yard operations. The implementation of the new YMS possessed the potential to provide the distribution center personnel with improved visibility into the yard.

The findings demonstrated that the YMS significantly reduced detention occurrences and improved the inbound and outbound performance of the facilities. Managers, operators, and yard drivers at the distribution centers reported positive perceptions regarding the system, noting improved communication, yard visibility, and work efficiency. However, the implementation process presented challenges, including employee resistance, learning curves, and infrastructure limitations. The challenges outlined in the findings could be mitigated through clear communication with employees about the new system benefits and alignment with operational objectives, comprehensive training programs, and upgrades to technical infrastructure. The study provided insights into how a YMS enhances logistics operations while identifying key factors for successful implementation.

Dedication

This dissertation is dedicated to my family, whose unwavering support and encouragement have been my foundation throughout my academic journey. I extend my heartfelt gratitude to my mentors and colleagues, whose wisdom and insights have been instrumental in shaping this work. Finally, I pay tribute to all those who believe in the transformative power of innovation and efficiency in the logistics industry. It is my hope that this work contributes meaningfully to the advancement of our industry.

Acknowledgments

I would like to express my deepest gratitude to all those who have supported me throughout the journey of completing this dissertation.

First and foremost, I am profoundly grateful to my family for their unwavering support, patience, and encouragement. Your belief in me has been a constant source of strength and motivation.

To my beloved wife, Dr. Ting Wang, your love, understanding, and intellectual companionship have been invaluable. I cannot count the thoughtful suggestions you provided throughout my dissertation process. Thank you for being my rock and my inspiration.

To my daughter, Amilia, your presence has been a source of joy and a reminder of what truly matters in life. Your smiles and laughter have been a beacon of light during even the most challenging times.

I would also like to extend my heartfelt thanks to my advisor, Dr. Regena Aye, and research assistant, Dr. Kyunghwa Cho, and mentor, Dr. Dusti Howell, for their invaluable guidance, insightful feedback, and continuous support. Your expertise and dedication have been instrumental in shaping this work, and I am forever grateful for your mentorship.

To my colleagues and friends, thank you for your camaraderie and encouragement and for serving as a sounding board for my ideas. Your support has been invaluable throughout this journey. I am also deeply grateful to the staff and management of the three mixing centers who participated in this study. Your cooperation and willingness to share your experiences made this research possible.

I offer my heartfelt thanks to all who have contributed to this work. Your support, guidance, and encouragement have made this achievement possible.

Table of Contents

List of Tables

Chapter 1

Introduction

A supply chain consists of entities directly involved in supplying and distributing products, services, funds, and information from the source to the destination (Mentzer et al., 2001). Supply chains are one of the foundations of human life in modern society that deliver necessities, such as water and food, medicines for healthcare, and energy (Council of Supply Chain Management Professionals, n.d.). Supply Chain Management (SCM) involves multiple aspects, including master planning, sourcing, manufacturing, delivering, and returning (Felea & Albăstroiu, 2013). As interest in SCM has increased since the 1960s (Rodrigue, 2020), researchers have begun to discuss the relationship between SCM and logistics. Research conducted by Cooper et al. (1997) and Murphy and Wood (2008) have provided evidence that SCM involved more extensive elements than logistics. As new technologies such as AI and machine learning have emerged, logistics has played a key role in SCM, allowing the supply chain to expand and experience tremendous growth (Toorajipour et al., 2021).

In a supply chain, logistics includes the activities of all production materials between a point of origin (e.g., suppliers) and a point of consumption, such as customers, field warehouses, and factory storages, as well as all activities of the corresponding information flow between the points (Pfohl, 1997). The product flow is either preceded, accompanied, or followed by the information flow, such as the order transfer, delivery note within a trailer, or recycling. Logistics management activities usually include "inbound and outbound transportation management, fleet management, warehousing, materials handling, order fulfillment, logistics network design, inventory management, supply/demand planning, and management of third-party logistics services providers"

(Council of Supply Chain Management Professionals, n.d., para. 6). Also included in logistics management activities are sourcing and purchasing, production planning and scheduling, packaging, assembling, and customer service to varying degrees (Council of Supply Chain Management Professionals, n.d.).

Since the 1970s, software systems for warehouse and inventory management have been used to support the logistics process (Hompel & Schmidt, 2006). In the 1990s, Lieb (1992) conducted a survey to investigate the use of third-party logistics in the American industry. Lieb's findings indicated that training programs should incorporate partnership building, computer and information system integration, and third-party relationship management when contracting with logistic suppliers (Lieb, 1992). Since the late 1990s, global connectivity and the increasing complexity of logistics have led to rapid growth in Traffic Management Systems (TMS) designed to optimize procurement, plan multimodal transport connections, and control and monitor transport processes (Nettsträter et al., 2015).

Upon entering the 21st century, many enterprises have attempted to focus on their main activities and look for third-party contractors that could fulfill other processes to reduce logistics costs and decrease additional service burdens and delays (Giri & Sarker, 2017). A couple of studies have shown that relevant information systems have become more widely implemented with the rapid development of information technology, such as Warehouse Management Systems (WMS) (Hu et al., 2016) and Transportation Management Systems (TMS) (Zou et al., 2015). A WMS manages the quantity, storage, and bin locations and their relationships, which are used to control, detect, and optimize the complex warehousing and distribution processes (Hompel & Schmidt, 2006).

Examples of the processes a WMS can manage include order fulfillment, the processes between receiving and shipping, and other related services (Lee, 2021; Nettsträter et al., 2015).

The information technology functions can better adapt to users' needs in administrative tasks (Schmitt, 2002). From 2010 to 2020, third-party logistics revenue in the United States increased steadily yearly (Armstrong & Associates, 2021). The 2020 Third-Party Logistics Study reported that over two-thirds of shippers and over 90% of third-party logistics agreed that contracting with third-party logistics providers improved end-customer service and increased logistics efficiency with innovative approaches (Third-Party Logistics Study, 2020). In 2020, Handojono et al. described the potential cost savings of logistics, especially in warehouse operations, by strategically integrating information technologies to support partner companies' supply chains.

This chapter begins with the Background, which provides context and establishes the relevance of the research topic within the logistics and supply chain domain, followed by the *Statement of the Problem*, which identifies the specific operational challenges the study addresses. The *Purpose of the Study* and *Significance of the Study* sections outline the research objectives and highlight the potential contributions to improving efficiency and reducing delays in logistics operations. The *Delimitations and Assumptions* define the scope of the study and its underlying premises. The Research Questions are presented in detail to guide the inquiry into how a yard management system (YMS) can address these operational issues. The chapter also features a *Definition of Terms* section to ensure conceptual clarity. Finally, it concludes with the *Organization of the Study*, which provides an overview of the structure of the research document.

Background

Until the new Yard Management System (YMS) was implemented in three distribution centers in the Eastern, Midwestern, and Western United States in 2018, a manual process was used in the selected three centers, which included a clipboard, checklist sheets, and Excel spreadsheet to track the inbound and outbound shipments. Yard visibility was based on manual yard checks twice per shift during three eight-hour shifts. Due to the real-time changes of the site, the accuracy of the location information of the trailer was low, resulting in a substantial amount of time spent looking for the correct trailer location, which led to delivery delays between the transportation company and the warehouse.

Input from multiple warehouse managers, supervisors, and yard drivers was collected to identify each stakeholder group's operation needs and describe any issues the new YMS should address to implement a YMS and improve yard visibility. The new system was developed based on shipment as a unique reference of inbound and outbound traffic, reflecting the status of each shipment in the yard. As the YMS remote terminal deployed in each shag truck, an onboard computer provided real-time yard activity data, including trailer status (e.g., inbound loaded, outbound assigned, loaded, and reject), trailer movement (from location A to B), and prioritization. From the onboard terminal, the yard check function provided a quick checklist for each trailer in the yard to help the shag drivers perform yard checks. The YMS was launched at the three mixing centers in the West, Midwest, and East of the United States in January 2018.

Pershing's (2006) Human Performance Technology Fundamentals (HPTF), an evidence-based approach to enhancing workplace performance, was selected as the

theoretical framework for the current study to identify performance gaps, design interventions to bridge them, and evaluate the impact of the interventions implemented for improving progress on measured targets. Pershing's HPTF theory process begins with an analysis of the problem and associated performance gap, followed by the design of an intervention to address issues identified in the analysis (2006). After implementation, the performance improvement is evaluated to determine the success of the intervention. Pershing's (2006) HPTF theory emphasizes data-driven decision-making and continuous improvement to ensure that interventions are effective and that organizational culture promotes performance improvement by creating an environment where performance improvement strategies are embedded.

Statement of the Problem

The most substantial supply chain or logistics delays are usually not caused by inefficient loading or transiting but by inefficient processes in manufacturing plants and distribution centers, leaving truck drivers and their loads unaware of the time to enter and exit the facilities (Mera & Sirikande, 2022; Speltz & Murray, 2019). According to Storms et al. (2023), the reason for inefficient process delays is that most plants and distribution centers rely on manual laborers to perform intensive yard work with pen and paper and lack a clear understanding of the availability of dock doors and lot capacity in the yard. Delays caused by the lack of yard visibility can result in higher time demurrage and detention charges, late delivery charges, additional equipment leases, and production shutdowns that cost companies millions of dollars (Storms et al., 2023).

Several studies have examined the application of HPTF to improve cross-functional teams' organizational performance (Foshay et al., 2013) and encourage team

collaboration (Abaci & Pershing, 2017). Kahle-Piasecki (2011) and McLaughlin (2016) employed HPTF as the theoretical framework in the business environment to improve employee performance. Results of both Kahle-Piasecki (2011) and McLaughlin (2016) revealed the support that managers training to be mentors received in mentoring, the barriers encountered in mentoring, and the performance gap between mentoring practices in the workplace and the purpose of the mentoring program. Despite tremendous efforts, there has remained a gap in the research literature surrounding logistics management systems and methods or strategies to improve the systems' efficiency. Few studies have utilized HPTF as the theoretical framework for examining information technology systems at third-party logistics corporations to improve the inbound and outbound volume measured by pounds, assist with decreasing detention time, and improve performance.

Purpose of the Study

The purpose of the current explanatory sequential mixed methods study was to evaluate the impact of the YMS implemented in 2018 based on the Pershing Human Performance Technology Fundamentals on detention occurrences and inbound and outbound volumes as measured in pounds (Pershing, 2006). For each of the three sites, the quantitative measures of annual inbound and outbound products in pounds were compared from 2018 to 2022 for differences over time. These quantitative results were further explained by investigating the perceptions of managers, operators, and yard drivers regarding the YMS, which were gathered via semi-structured interviews. All participants were asked the same questions. By employing a two-pronged approach, the current study effectively combined quantitative analysis of changes in numeric measures

with qualitative examination focusing on participants' perceptions of the YMS, thus providing a multifaceted and comprehensive investigation into the system's impact.

Significance of the Study

According to McCrea (2020), the yard invisibility issues experienced in logistics corporations—facilities that manage and optimize goods storage, transportation, and distribution in supply chains—often lead to high detention charges and negatively impact the inbound and outbound volumes. By evaluating the implementation of YMS, the current study's findings provided a scientific basis for the need for logistic distribution centers to improve yard visibility and viable solutions to the challenges faced. The results can help logistics managers and operators identify the best practices to improve operational efficiency and minimize holdup incidents.

Delimitations

The researcher made delimitations in research to narrow the scope of the study (Creswell, 2021). The data collected for analysis included the impact of YMS on the volume of inbound and outbound measured, and managers', operators', the detention occurrence measured, and yard drivers' perception of the system at three mid-sized distribution centers of a third-party distribution center (located in Western, Midwestern, and Eastern U.S.) where the new YMS was implemented in 2018. Quantitative measures in the forms of inbound products by pounds, outbound products by pounds, and detention occurrences were collected from the selected distribution center's operating database and analyzed to understand how the YMS had potentially impacted operations. Participants included three managers (one per site), three operators (one per site), and nine-yard drivers (three per site). Another delimitation for the current study involved the time

frame for the quantitative measure comparison: 2018 before the implementation of the new YMS compared to 2022 before the labor schedule change at the three centers from three shifts a day to two.

Assumptions

Assumptions encompass universally acknowledged or validated principles as foundational premises for researchers to construct their investigations (Williams, 1980). The first assumption was that the new YMS was implemented with fidelity at each site. The second assumption was that all quantitative measures of data analyzed from the third-party distribution center operations database were accurately recorded and updated at each of the three sites, and it was also assumed that changes in the quantitative measures from 2018 to 2022 reflected the impact of the implemented YMS. Other assumptions for the current research study included that the organization's employee records for job title and employment status were accurate for all three sites examined, and all interviewees understood the questions asked of them and responded openly and honestly.

Research Questions

A research question is "a question that a research project sets out to answer" (Mattick et al., 2018, p.104). Six research questions guided the current explanatory sequential mixed methods study of the impact of YMS on operational efficiency at three distribution centers (located in the Western, Midwest, and Eastern United States) for a logistics service provider. The lack of sufficient research on such systems provided an opportunity to investigate new techniques that could potentially improve the operational effectiveness of logistics service providers.

Research Question 1

To what extent is there a difference in the annual number of inbound products by pounds from 2018 to 2022 at the Western, Midwestern, and Eastern logistics service providers overall and for each site?

Research Question 2

To what extent is there a difference in the annual number of outbound products by pounds from 2018 to 2022 at the Western, Midwestern, and Eastern logistics service providers overall and for each site?

Research Question 3

To what extent is there a difference in the annual detention occurrence from 2018 to 2022 at the Western, Midwestern, and Eastern logistics service providers overall and for each site?

Research Question 4

What are the perceptions of third-party logistics distribution center managers at the Western, Midwestern, and Eastern sites regarding the YMS implemented in 2018?

Research Question 5

What are the perceptions of third-party logistics distribution center operators at the Western, Midwestern, and Eastern sites regarding the YMS implemented in 2018?

Research Question 6

What are the perceptions of yard drivers of the third-party logistics distribution center at the Western, Midwestern, and Eastern third-party logistics distribution center sites regarding the YMS implemented in 2018?

Definition of Terms

The terms used in the current study have been operationally defined using reliable and reputable sources. By providing clear and accurate definitions of terms' specific meanings for the current study, potential confusion can be minimized, and a consistent understanding of the terms can be achieved. All definitions are from trusted sources, ensuring all readers understand the terms throughout the dissertation correctly.

Psychological Theories

According to Rawat and Jain (2022), psychological theories offer comprehensive, evidence-based explanations for the enduring outcomes of human behavior, shedding light on the reasons behind individuals' beliefs, actions, and reactions. These theories encompass personality traits, early life experiences, and interpersonal relationships.

Third-Party Logistics

Aghazadeh (2003) defined third-party logistics as an independent economic entity that creates value for its client by bringing in to help logistics management, including transportation management, inventory management, and value-added services. Third-party logistics can include trucking companies, warehouse operators, and contract manufacturers.

Yard Management Systems

According to Paolucci et al. (1998), a yard management system is software that facilitates real-time monitoring of the yard's status. In this study, the information to be managed involves four types—yard lot (space resources), trailer status, gate event (inbound and outbound), and detention alert. The gate events involve objects falling into the container on arrival and departure and moving internally to the yard.

Detention

Detention is the "charge that the merchant pays for the use of the container outside of the terminal or depot, beyond the free time period" (United Nations Conference on Trade and Development, 2018, para 1). Transportation corporations, such as truck companies, lease containers to merchants for a limited period of free use and charge detention fees to discourage merchants from delaying the return of containers

Inbound Logistics

Transferring raw materials or components from suppliers to manufacturers is called inbound logistics (Association for Supply Chain Management, n.d.). In the current study, inbound logistics refers to the completed products sent from other distribution centers to the local center.

Outbound Logistics

Outbound logistics refers to transporting completed products or other products to the next stage in the supply chain (Association for Supply Chain Management, n.d.). Outbound logistics can also refer to the mixed shipment of products based on clients' requirements from manufacturers and other distribution centers to customers, retailers, or other final destinations (Council of Supply China Management Professionals, n.d.c).

Organization of the Study

The current study aimed to evaluate the YMS implemented in 2018, which attempted to increase the inbound and outbound volume and reduce the detention occurrences of third-party logistics. Chapter 1 introduced the topic and provided the necessary background information. Chapter 1 also included the problem and purpose statement, the significance of the study, delimitations, assumptions, research questions,

and the definition of terms. Chapter 2 presents a review of relevant literature. Chapter 3 provides the study methodology employed for data collection and analysis. Chapter 4 presents the results of the data analysis. Chapter 5 discusses the findings and conclusions of the dissertation.

Chapter 2

Review of the Literature

The current study focused on identifying the impact of yard visibility on the operation of a third-party logistics distribution center by measuring the number of inbound and outbound products and the detention occurrence. In this literature review, a substantive amount of literature provides direction for the research questions and hypotheses. The literature review includes publications addressing barriers and challenges to third-party logistics and information management systems used by them. Publications have also elaborated on the importance of information technology and systems to third-party logistics' daily operation. Further, the literature review addresses performance technology as studied by Pershing (2006), who advanced the human performance technology model. The literature provides a theoretical lens for understanding the research topic and problem and informing the findings' analysis. The current study could be meaningful because over 90% of IT solution developers have expressed that their solutions serve the transportation industry, such as logistics providers, warehouse operators, and carriers (Inbound Logistics, 2019). Findings from the current study may provide implications for IT professionals in future system development regarding logistic corporations' needs for designing and developing the system.

Barriers and challenges to third-party logistics

Outsourcing logistics functions is a popular strategy for companies when addressing complex and expensive logistics problems (Heizer & Render, 2011). By entrusting a third-party service provider to take care of the movement and storage of materials, companies can focus on core business activities and reduce costs associated

with managing the logistics process. Additionally, outsourcing logistics can provide access to the specialized skills and technologies needed to manage complex supply chains and obtain a competitive advantage (Heizer & Render, 2011). The purpose of third-party logistics is distinct from that of most outsourcing, which aims to acquire talents, resources, and expertise (such as competitive advantages and special knowledge) that are unavailable within the organization. Instead, third-party logistics aims to provide goods and services that clients do not own (Hertz & Alfredsson, 2003).

In the early 1970s, the term "third-party logistics" was coined to describe a specialized company that provides logistical services on behalf of a customer, which contrasted with the traditional two-party agreements between shippers and carriers (bin Mohamad Makmor et al., 2019). Intermodal marketing companies emerged as intermediaries who accepted goods from shippers and delivered them to rail carriers, thus becoming third parties to the contract and giving rise to third-party logistics. Third-party logistics has become an umbrella term for many services, including transportation and freight management, freight accounting, public/contract warehousing, distribution management, and freight consolidation (bin Mohamad Makmor et al., 2019). Furthermore, third-party logistics considers the distribution of finished or semi-finished products, processed and unprocessed products, and raw materials (DeGroote & Marx, 2013).

Several studies have determined that price, reliability, service quality, financial stability, communication, geographic coverage, and experience are essential factors that influence the selection of third-party logistics (Aguezzoul, 2007; Bagchi & Virum, 1996; Sahay et al., 2006; van Laarhoven & Sharman, 1994). These factors also play a role in

choosing third-party logistics service providers, yet some organizations have found that financial opportunities are paramount in their satisfaction compared with other factors (Aktas & Ulengin, 2005). Innovations, as essential as other success factors in third-party logistics, focus on providing an agile capability for new and emerging logistics management technologies, promoting productivity, new product development, and customer satisfaction (Power et al., 2001). Wu (2006) has suggested that technological innovation can be used to measure the success of third-party logistics. He argued that using patent data for technological innovation could positively affect the other elements related to the selection of third-party logistics.

In reality, although many of the world's top third-party logistics companies rely on new technology to analyze decisions, operations, and policies to improve productivity, most third-party logistics companies are unable to handle the technological changes in logistics services flexibly (Zhu & Geng, 2013; Selviaridis & Martin, 2007). The challenges brought by new technologies include, on the one hand, the continuous change of technology; on the other hand, the inconsistency in the strategy of information dissemination about information technology from third-party logistics companies, the lack of understanding of information technology from management and leaders, and the lack of knowledge of the fundamental meaning and specific requirements of IT adoption from technology providers for logistics companies (Harland et al., 2007; Mathiyazhagan et al., 2016). In addition, due to the lack of demonstration reporting systems, inadequate infrastructure, inefficient collaboration channels, and inadequate safety and control in third-party logistics, companies may not take advantage of innovative platforms that

connect to their customers' internal platforms, such as traffic management systems (Selviaridis & Spring, 2007).

In practice, 80% of customer expectations were unfulfilled, leading to a discrepancy between expectation and satisfaction (Gupta et al., 2011). This discrepancy is attributed to various external and internal factors, such as natural disasters, regulations and policies, market forces, and preferential limitations (Holgui-Veras, 2000; Kannana & Tan, 2005; Naylor et al., 1999). Internal factors, including lack of transparency in bureaucracy and cost-reduction efficiency, also create the satisfaction gap (Kaynak & Hartley, 2008; Kim, 2009; Sahay & Mohan, 2006). Furthermore, the incompatibility of information systems between service providers and customers can further exacerbate the widening gap between consumer expectations and satisfaction. Therefore, third-party logistics should be more information-oriented and leverage modern technology to meet customer expectations effectively. They should also consider regulatory requirements and customer needs to ensure these targets are sustainable (Kannan & Tan, 2005).

Another challenge that third-party logistics faces in daily operations is minimizing lead time (Mathiyazhagan et al., 2016). The aggregate lead time in logistics can be measured as the combined duration of a component's process, transportation, and inventory time from the supplier through production to the finished product and ultimately to the end consumer (Harland et al., 2007; Abdulrahman et al., 2012). The significance of customer lead time is that it gauges the time the supply chain takes to respond to customer demand (Cheong, 2001). Factors such as the required technology, personnel availability, and production and supply chain delivery efficiency affect lead time (Zajac & Olsen, 1993). The development of information and communication

technologies may provide operational assistance to improve transportation efficiency and ultimately reduce lead time (Lieb & Lieb, 2011).

Information management systems in third-party logistics

Since the 1970s, the initial warehouse and inventory management software system has been used to manage the number and (bins) locations and their relationships (Hompel et al., 2008). After discovering inventory cost savings, the warehouse management system was given more functions, such as monitoring system status and operation and optimization strategies (Nettsträter et al., 2015). Vendors of warehouse management systems continue to expand the scope of their software systems and increasingly offer features derived from enterprise resource planning software, supply chain management software, or transportation management systems. For instance, support processes among order fulfillment, receipt, and shipping, integrated information systems and control panels, travel and route planning, vendor-managed inventory, and support billing and value-added services in a multi-customer scenario (Nettsträter et al., 2015).

In recent years, with the development of information technology, more solutions have been added to WMS to improve performance. For instance, Pane et al. (2018) approved that implementing RFID in WMS could improve the goods selection process of logistics corporations in Indonesia. Deng et al. (2018) proposed that an automatic three-dimensional warehouse scheme can improve the efficiency and accuracy of the online production process while providing digital management to enhance the competitiveness of enterprises. Fauzan et al. (2020) suggested that a WMS with Zaeni Convection would be beneficial in optimizing the process of managing goods, automating calculations of

raw materials, regulating the entry and exit of goods, generating reports on inventory and expenditure, and providing computerized data storage.

As logistics chains grew ever more complex in the late 1990s, TMS emerged to manage the demands of these transport chains and all their functions. The systems enabled planning and optimizing procurement and distribution structures with cost or time containment in mind, creating multimodal transport chains, optimizing delivery transport, and controlling and monitoring the resulting transport process (Nettsträter et al., 2015). It was primarily made possible with the help of freight forwarder customization software from transport and logistics service providers, which included route planning software and was used to enhance early IT-based transport-related logistics.

TMS generally allows planning, controlling, monitoring, and optimizing transportation networks and logistics chains. The essential functional areas of these systems are order management, scheduling, transportation planning and optimization, tracking and tracing, and fleet and resource management (Nettsträter et al., 2015). Enterprises for transportation management solutions can be divided into three groups: pure TMS developers, sales partners, and providers. The group of providers is a combination of the other two groups that directly develop and implement their software solutions, provide customer consultation, and develop other software solutions outside the system interface. However, despite the incredible increasing demand for TMS and transport solutions in recent years, the number of companies offering TMS is limited. Several ERP vendors are beginning to offer TMS products to meet the growing demand for comprehensive transportation management solutions. The increased operating range

of these solutions is likely to cause a significant rise in overall system costs (Nettsträter et al., 2015).

Although several studies have discussed using various technologies, such as artificial intelligence and machine learning (Woschank et al., 2020), IoT (Golpîra & Khan, 2021; Humayun et al., 2020), and cyber-physical systems (Winkelhaus & Grosse, 2019), relatively little research has been done on transportation management systems. The core of the yard management system is to deal with scheduling inbound and outbound freight reservations while effectively managing yard resources and improving the efficiency and throughput related to the shipper's distribution yard and ports (Mccrea, 2010).

Compared with other processes involved in supply chain management, logistics corporations have a lower interest in yard management, making it the supply chain's bottleneck (Raymond., 2018). Most current studies about yard management mainly focus on port (Ha, 2009; Paolucci et al., 1998; Zhen et al., 2013) and train (Chang et al., 2020) yard management. Several studies have also explored the use of technologies, such as RFID and electronic seal, to improve the efficiency of yard management and visibility (Alieksikikv et al., 2022; Chang et al., 2020; Michel, 2018; Park et al., 2006).

An outbound logistics management survey conducted by Eid (2022) using PepsiCo's production plant as an example highlighted long wait times for trailers in parking spaces, human errors in picking up standing trailers, large volumes of pallets stacked in loading areas, limited warehouse space, and congestion in parking lots as the primary causes of inefficient outbound operations. The researcher attributed the decreased efficiency to a lack of yard visibility and proposed an Excel spreadsheet-based

venue information management file to record relevant information on departures. The results indicated that the tool effectively improved the efficiency of outbound operations.

Human performance technology fundamental model

Human Performance Technology Fundamental (HPTF) founders, such as Thomas Gilbert, Joe Harless, and Donald Tosti, recognized the power of rigorous observation and measurement based on scientific processes to improve individual performance (Dean & Ripley, 1997). Through the analysis of observations from performance improvement cases, relationships between variables can be identified, leading to the development of theories and models. HPT research investigates the applicability of principles, processes, and tools in real-world applications and knowledge domains within everyday life, aiming to provide empirically substantiated solutions for practical challenges faced by diverse social institutions, such as government, industry, and businesses. Swanson (1999) proposed three theoretical bases of HPTF—economic theory, systems theory, and psychological theory—by arguing:

> [E]conomic theory is recognized as a primary to survive along with its financial metrics at the organizational level; systems theory recognizes purpose, pieces, and relationships that can enhance or strangle systems and subsystems; and psychological theory acknowledges human beings as brokers of productivity along with their cultural and behavioral nuances (p. 11)

Since its inception, the field of HPTF has seen the development of several performance improvement models, broadly classified into three categories—diagnostic models, holistic models, and process models (Wilmoth et al., 2010). Diagnostic models, such as Gilbert's (1978) behavioral engineering model and Wile's (1996) synthesized

performance model, facilitate practitioners to identify the needs, causes, and gaps in human performance projects (Abaci, 2017). Holistic models, such as Stock's three-dimensional HPTF model, are often nonlinear models that describe domains of overlapping shapes, designed to represent how domains coexist in a performance context. Unlike holistic models, process models, such as Pershing's (2006) HPT model, are often linear, with grouping activities, looking for performance gaps, considering multiple interventions, and feedback loops evaluating outcomes (Abaci, 2017).

Pershing's (2006) HPTF is a comprehensive strategy for boosting organizational productivity. Pershing defined HPTF as "human performance technology is the study and ethical practice of improving productivity in organizations by designing and developing effective interventions that are results-oriented, comprehensive, and systemic (p. 6)." It considers research-based methods and techniques to develop and implement interventions to enhance individual, team, and organizational performance, including developing compelling job descriptions, providing training and development, introducing new technology, strengthening organizational structures and policies, and improving communication.

Pershing (2006) pointed out that the definition contained several key elements: study, ethical practice, improving productivity, organizations, designing and developing, effective intervention, results-oriented, and comprehensive and systemic. Several of them are relevant to the current study, such as *designing*, involving creating a comprehensive plan to improve performance, including performance analysis, determining objectives, defining the target population, categorizing and prioritizing the intervention, and assessing outcomes (Pershing, 2006). The difference between *performance design* and

development is that performance design indicates what performance should be, while development is how to achieve it (Reigeluth, 1983). Needs assessment is a fundamental step in the design process to determine the differences between the current and desired state, which asks the designer to make decisions and assumptions based on the information provided for the project (Stefaniak et al., 2018). For instructional design evaluation, Stefaniak et al. (2018) pointed out that designers would encounter various challenges in evaluation, such as being lost in needs analysis and overwhelmed by uncertainty and pressure from employers. Therefore, the designer should discuss with various stakeholders to understand their needs and willingness to participate in any intervention for instructional design evaluation to understand the situation further.

Interventions involve introducing systemic solutions to the organization to improve its human performance and overall productivity (Pershing, 2006). Such interventions target the organization's crucial processes and functions, enhancing their effectiveness and boosting overall productivity. Sanders and Thiagarajan (2005) divided performance interventions into six categories: improving knowledge, motivation, material resources, structure and process, information, and health. The research-based performance improvement process includes selecting, designing, developing, and implementing interventions (Abaci, 2017). The HPTF process fails if a single intervention or set of interventions does not close the performance gap. Interventions must be effective and efficient, produce transferable results, and generate a positive return on investment, which requires evaluative studies, a valuable component of the overall development process (Abaci, 2017).

Several studies used the HTPF model. Jang (2008) identified the themes and issues that emerged in two academic journals -- Performance Improvement Quarterly and Performance Improvement -- to gain insight into the development of the field. Abaci and Pershing (2013) studied international practitioners in Human Resource Development and HPTF, focusing on general demographics, occupational demographics, and the amount of time spent on workplace learning and performance improvement activities. The HPTF model has also been applied to systems improvement. For instance, Lee (2007) used the HPTF model to construct an educational system for nuclear organizations based on case studies. He highlighted the performance base as an effective method for looking at the problem holistically and solving it scientifically. Molenda and Pershing (2004) integrated instructional with non-instructional activities in a corporation and proposed a Strategic Impact Model to explore how instructional intervention relates to other performance intervention types.

Summary

The literature review also examined the various components of a third-party logistics and information management system, including warehouse, transport, and yard management. The challenges associated with implementing these systems and their benefits to an organization were discussed. Also provided was an overview of Human Performance Technology Theory, which can be used to evaluate, design, develop, and assess information systems to improve performance. Chapter 3 presents a detailed description of the research methods used to evaluate the implemented YMS.

Chapter 3

Methods

Research has indicated that a met-need information technology system is essential to managers, operators, and supply chain users because it provides real-time visibility into the status of goods, services, and resources throughout the supply chain (Reyes et al., 2020). Real-time visibility could enable managers to make better decisions, operators to respond to customer needs quickly and effectively, and yard drivers to move to different positions swiftly (Wycislak, 2022). The YMS implemented in 2018 aimed to increase efficiency, reduce detention occurrence, and improve customer satisfaction by providing a comprehensive view of the supply chain. The development of the YMS was based on the yard visibility requirements of three distribution centers of medium-sized third-party logistics corporations located in the Western, Midwest, and Eastern United States as the research setting.

The purpose of the current explanatory sequential mixed methods study was to evaluate the impact of the YMS implemented in 2018 based on the Pershing Human Performance Technology Fundamentals on inbound and outbound volumes measured in pounds and detention occurrences (Pershing, 2006). The quantitative phase utilizes one-way ANOVA to analyze operational data from 2018 to 2022, focusing on changes in inbound and outbound volumes and detention occurrences pre- and post-YMS implementation. The qualitative phase involved semi-structured interviews with managers, operators, and yard drivers, providing contextual insights into the quantitative findings.

Research Design

The current study was designed as explanatory sequential mixed methods research (Schoonenboom & Johnson, 2017). The study's architecture encompassed a two-phase approach, with the initial quantitative phase informing the subsequent qualitative phase. In the quantitative portion, statistical analyses were conducted to assess the impact of the YMS. Numeric data was systematically accessed and retrieved from the operational systems of three distinct sites. The comparative analysis involved evaluating changes in relevant metrics before and after the implementation of the YMS, enabling the identification of any significant temporal shifts.

Following the quantitative phase, the study transitioned into the qualitative component. Semi-structured interviews were employed to garner insights from key stakeholders, including the selected centers' managers, operators, and yard drivers. They provided a deeper understanding of the quantitative results and contextualized them within the organizational and human aspects influenced by the YMS implementation. Qualitative exploration unraveled nuanced perspectives and untangled complexities embedded in the quantitative outcomes.

The explanatory sequential mixed method design facilitated triangulation, allowing cross-verifying results from both phases. The approach aimed to enhance the robustness of the study by providing a comprehensive and multifaceted examination of the impact of the implemented YMS across the three investigated sites

Selection of Participants

The selection of participants for this study was sequentially divided into two phases: the quantitative phase and the qualitative phase. In the researcher's division, only

three distribution centers in the West, Midwest, and East of the United States have fully implemented YMS. Therefore, convenient sampling was adopted, and the three distribution centers were selected as participants. The data years were selected from 2018 to 2022—before the implementation of the new YMS (2018) and before the change in the labor schedules of the three centers (2022) from three shifts a day to two.

In the qualitative phase, purposive and convenient sampling was adopted to delve deeper into the experiences and perceptions of key stakeholders—managers, operators, and yard drivers—regarding the YMS. Manager and operator participants were purposively selected based on their involvement in the operation to capture a range of experiences, expertise, and perceptions within the study context from the three distribution centers. Yard driver participants adopted the convenient sampling method—the researcher selected the inbound or outbound yard drivers of the three distribution centers who used the YMS for interviews during the qualitative data collection. The sample size of the yard drivers was determined based on data saturation, wherein the researcher continued data collection until no new insights or themes emerged through a thoughtful and purposeful selection process.

Measurement

This study utilized quantitative and qualitative measurement instruments to evaluate the YMS's impact comprehensively.

Quantitative Measurement Instrument

The quantitative segment of the study's primary metrics includes the inbound product measured by pounds (total weight of products received at the distribution centers), the outbound product by pounds (total weight of product dispatched from the

centers), and detention occurrence measured by dollars (instances where vehicles or products are detained beyond a predetermined time frame). The data was collected through the operational systems in the selected distribution centers. The reliability of the systems ensured accurate and consistent data collection, allowing for robust statistical analysis. Data was exported to SPSS to compare pre- and post-YMS implementation values using one-way ANOVA.

Qualitative Measurement

Based on information technology, instructional design, logistics expertise, and a literature review, the semi-structured interview protocol (standard questions for all and provides optional follow-up questions if needed) was constructed to explore the perceptions of managers, operators, and yard drivers of third-party logistic distribution centers about the YMS. The interview protocol included standardized core questions addressing the experience during implementation and use of the YMS. The interview protocol includes seven questions. The first two questions were designed to initiate conversation with participants and collected participants' demographic information, including their location, position, and years of employment. Four questions focused on exploring the impact of the YMS on operations, the advantages offered by the YMS, and the challenges associated with its implementation and use. The final question invited participants to provide additional comments, allowing them to address topics or perspectives not explicitly covered by the interview protocol (Appendix E).

The uniform approach aimed to ensure consistency in data collection and facilitate direct comparisons across stakeholder perspectives. It enabled a comprehensive range of insights regarding their roles, responsibilities, and experiences with the YMS.

Follow-up questions were tailored to gather additional insights based on the participant responses. Despite the standardized interview protocol, efforts were made to adapt questioning techniques to each stakeholder group's unique contexts and experiences, ensuring that their perspectives were accurately captured and analyzed.

The quantitative component of the current study evaluated inbound and outbound volumes measured in pounds and detention occurrences, providing an objective evaluation of the YMS impact on logistics performance. The qualitative component included semi-structured interviews with stakeholders who provided insights into the challenges, benefits, and usability of the YMS. Integrating quantitative metrics and qualitative perspectives offered a comprehensive assessment of the system’s effectiveness and operational impact.

Data Collection Procedures

The data collection phase of this study includes steps the researcher took before, during, and after the data collection. First, the researcher requested permission to access the three selected distribution centers' databases and to study human subjects from the Baker University Institutional Review Board. Permission to collect quantitative data was obtained through formal agreements with the participating logistic corporation on June 3rd, 2024, ensuring compliance with ethical guidelines. The IRB application was approved on June 24th, 2024. Initiative data were collected between 2018 and 2022 from the distribution centers' SQL Server database and downloaded to SPSS on the researcher's computer for analysis.

The distribution centers' managers assisted in recruiting yard driver participants. The informed consent (Appendix F) and interview questions (Appendix E) were sent to

the three distribution centers' managers, operators, and yard drivers on July 1st, 2024. Participants were required to voluntarily agree to the informed consent form before participating in the interviews, ensuring they understood their rights and the purpose of the study. A total of 14 participants were interviewed, including three managers, three operators, and eight yard drivers. The interviews lasted approximately 30 minutes each, with semi-structured questions designed to gather detailed insights into their experiences with the YMS. Interviews were scheduled at times convenient for participants to ensure their availability and comfort. The data collection was completed on September 16th, 2024.

Data Analysis and Integration

The quantitative approach of this study was designed to provide objective and measurable insights into whether efficiency gains were achieved due to the implementation of YMS. Research questions 1 to 3 investigated the impact of YMS on the volume of inbound and outbound by pounds and detention occurrences by dollars with one-way ANOVA. The independent variable was the implementation of a YMS, and the dependent variables were inbound products by pounds, outbound products by pounds, and detention occurrence. The one-way ANOVA provided a measure of the magnitude of the difference between the before and after values and the probability of the difference being due to chance. Parametric analysis was used in a one-way ANOVA to compare the means between the first year of implementing the YMS (2018) and the last year before the labor schedule change (2022). A p-value of .05 was considered statistically significant, meaning the results were unlikely to have happened by chance, and the null hypothesis of non-difference can be rejected. Collected data were analyzed with SPSS.

Subsequently, the qualitative phase comprised in-depth interviews with managers, operators, and yard drivers to answer research questions 4 to 6. The phase aimed to explore their perspectives on the YMS, capture detailed insights, and gain a deeper understanding of the system's effectiveness. All interview recordings were transcribed verbatim to establish a foundational understanding of the dataset. Subsequently, an open coding process was initiated, wherein each text segment was assigned descriptive labels or codes representing emergent themes. This phase allowed for the exploration of diverse perspectives and facilitated the identification of recurring patterns. Axial coding established connections between codes and developed more comprehensive categories following open coding. A coding framework was developed through constant comparison and iterative refinement to encapsulate the richness of participants' responses. The analytical process remained dynamic, incorporating reflexivity to acknowledge and address the researcher's potential biases. The qualitative data were analyzed with Atlas.ti. Additionally, it sought to provide context for and complement the quantitative findings. The sequential inheritance approach was consistent with the study's overall goal—to provide a comprehensive and robust analysis of the impact of implemented YMS on warehouse efficiency gains.

Research Question 1

To what extent is there a difference in the annual number of inbound products by pounds from 2018 to 2022 at the Western, Midwestern, and Eastern logistics service providers?

Hypothesis 1. There is a difference in the mean number of inbound products by pound from 2018 to 2022 for all three logistics service provider sites (Western, Midwestern, and Eastern) combined.

A one-way ANOVA was conducted to address RQ1 and test the hypothesis (H1). The dependent variable was the mean number of inbound products by pound, grouped by the independent variable, which was the year (2018 represented before the intervention of the YMS and 2022 represented after). For H1, data from all three sites were combined to compare pre- and post-YMS implementation. A one-way ANOVA was chosen for hypothesis testing as it examines the mean differences between groups where the means are continuous variables. The significance level was set at 0.05. When appropriate, effect sizes were reported.

Research Question 2

To what extent is there a difference in the annual number of outbound products by pounds from 2018 to 2022 at the Western, Midwestern, and Eastern logistics service providers?

Hypothesis 2. There is a difference in the mean number of outbound products by pound from 2018 to 2022 for all three logistics service provider sites (Western, Midwestern, and Eastern) combined.

A one-way ANOVA was conducted to address RQ2 and test the hypothesis (H2). The dependent variable was the mean number of outbound products by pound, grouped by the independent variable, which was the year (2018 represented before the intervention of the YMS and 2022 represented after). For H2, data from all three sites were combined to compare pre- and post-YMS implementation. A one-way ANOVA was

chosen for hypothesis testing as it examines the mean differences between groups where the means are continuous variables. The significance level was set at 0.05. When appropriate, effect sizes were reported.

Research Question 3

To what extent is there a difference in the annual detention occurrence from 2018 to 2022?

Hypothesis 3. There is a difference in the mean number of detention occurrences by dollars from 2018 to 2022 for all three logistics service provider sites (Western, Midwestern, and Eastern).

A one-way ANOVA was conducted to address RQ3 and test the hypothesis (H3). The dependent variable was the mean number of detention occurrences by dollars, grouped by the independent variable, which was the year (2018 represented before the intervention of the Yard Management System (YMS) and 2022 represented after). For H3, data from all three sites were combined to compare pre- and post-YMS implementation. A one-way ANOVA was chosen for hypothesis testing as it examines the mean differences between groups where the means are continuous variables. The significance level was set at 0.05. When appropriate, effect sizes were reported.

Research Question 4

What are the perceptions of third-party logistics distribution center managers at the Western, Midwestern, and Eastern regions sites regarding the YMS implemented in 2018?

Research Question 5

What are the perceptions of third-party logistics distribution center operators at the Western, Midwestern, and Eastern regions sites regarding the YMS implemented in 2018?

Research Question 6

What are the perceptions of yard drivers of the third-party logistics distribution center at the Western, Midwestern, and Eastern third-party logistics distribution center sites regarding the YMS implemented in 2018?

The data for Research Questions 4, 5, and 6 were transcribed and coded to identify recurring themes and patterns across third-party logistics distribution center managers, operators, and yard drivers' perceptions of the YMS implemented in 2018. The themes were synthesized to comprehensively understand the stakeholders' perceptions at the sites in the Western, Midwestern, and Eastern regions sites. In addition, the quantitative and qualitative findings were integrated to provide a holistic view of the YMS implementation's impact from the perspectives of all stakeholders, facilitating potential recommendations for improvements or optimization.

Reliability and Trustworthiness

The researcher employed rigorous research methods and adhered to established protocols to ensure validity and reliability. For the quantitative portion of the study, data collection was carefully designed, utilizing appropriate sampling techniques and statistical analyses to ensure the validity and reliability of the findings. For the qualitative portion of the study—interviews of managers, operators, and yard drivers—the researcher ensured credibility by conducting the interviews systematically and transparently and

using the same-question semi-structured interview protocols and same optional follow-ups with all participants by providing participants the opportunity to check their interview transcript for validity. In addition, the researcher paid close attention to ethical considerations in data collection and analysis, maintaining participants' privacy and confidentiality to avoid biased responses to interview questions that may result from identity exposure.

Trustworthiness was further enhanced by triangulation, where multiple data sources and methods are used to corroborate findings, thereby reducing biases and increasing the robustness of the results. The researcher also practiced transparency by documenting the research process, methodologies, and limitations. By upholding reliability and trustworthiness throughout the study, the current study's design established a strong foundation for the credibility and validity of its findings, contributing to the body of knowledge in the yard management systems and logistics field.

Researcher's Role

In investigating the impact of implementing YMS on logistics warehouse operations, the role of the researcher is shaped by the integrated context of industrial engineering, with a particular focus on logistics and supply chain management. Based on experience with similar projects, the researchers had an in-depth understanding of various warehouse management systems, which influenced the methods of analysis and interpretation of the data in this study. Acknowledging prior professional interactions with stakeholders is critical, as relationships cultivated in past projects may introduce subtle perspectives to researchers' understanding of participants' perceptions of yard management systems. Given the potential for confirmation bias arising from positive

experiences with similar systems, the researchers conducted rigorous data analysis to mitigate the bias and provide an unbiased assessment. By articulating these aspects transparently, this study strives to increase credibility and foster trust in the research process, emphasizing the seriousness of potential influences from the researcher's background and experience.

Limitations

One limitation of this study was that only three third-party medium-sized distribution centers were selected as the research setting, and the study's findings may not generalize to other similar regional distribution center sites within the same third-party provider, other logistic center provider companies or the overall operation state of logistics corporations in the United States. Due to the participants' association with the researcher at work, they may inadvertently respond in a manner consistent with the perceived expectations, resulting in a distortion of the accuracy of their reported perception. In addition, the COVID-19 global pandemic may have affected operations; however, it was impossible to isolate individual sites' business consequences due to other related supply chain issues.

Summary

The current study employed an explanatory sequential mixed methods research approach to examine the impact of the YMS implemented in 2018 in terms of quantitative measures on individual inbound and outbound units measured in pounds and detention occurrences, as well as qualitative measures of managers, operators, and yard drivers' perceptions of the system's impact on the quantitative variables and analyzed. By utilizing an explanatory sequential mixed method design, combining quantitative pre- and

post-implementation analysis and qualitative interviews to delve into participants' perceptions, this study aimed to provide a nuanced understanding of the impact of the implemented YMS. Integrating the complementary methods allowed the researcher to triangulate findings, enhance the validity of results, and offer a well-rounded perspective on the phenomenon under investigation.

Chapter 4

Results

Research Question 1

A one-way between-subjects ANOVA was conducted to compare the effect of the implementation of YMS on inbound volume by pounds (Table 1). The results indicate a significant effect of the implementation of YMS on inbound volume at $p < .05$ [F (1, 70) = 5.519, p = 0.022]. The results suggest that implementing a YMS significantly affects inbound volume measured by pounds.

Table 1

One-way ANOVA results regarding the inbound volume before and after YMS implementation

	df	Mean Square	F	Sig.
Between Groups	1	997320913021853.600	5.519	.022
Within Groups	70	180702333772981.300		
Total	71			

Research Question 2

A one-way between-subjects ANOVA was conducted to compare the effect of the implementation of YMS on outbound volume by pounds (Table 2). The results indicate a significant effect of the implementation of YMS on outbound volume at the $p <. 05$ [F (1, 70) = 5.998, p = 0.017]. The results suggest that implementing YMS significantly affects outbound volume measured by pounds.

Table 2

One-way ANOVA results regarding the outbound volume before and after YMS implementation

	df	Mean Square	F	Sig.
Between Groups	1	1114484575652139.40	5.998	.017
Within Groups	70	185818710340478.10		
Total	71			

Research Question 3

A one-way between-subjects ANOVA was conducted to compare the effect of the implementation of YMS on detention occurrence (Table 3). The results indicate a significant effect of the implementation of YMS on detention occurrence at the $p < .05$ [$F(1, 70) = 21.297$, $p = 0.000$]. These results suggest that implementing YMS significantly affects detention occurrence.

Table 3

One-way ANOVA results regarding the detention occurrence before and after YMS implementation

	df	Mean Square	F	Sig.
Between Groups	1	1058.000	21.297	.000
Within Groups	70	49.679		
Total	71			

Research Question 4

Research Question 4 explored the perceptions of managers at third-party logistics distribution centers located in the Western, Midwestern, and Eastern regions of the United States about the YMS implemented in 2018. Participating general managers had held their positions for approximately or over ten years. Their responsibilities included overseeing facilities operations, ensuring safety, maintaining productivity, enforcing regulatory compliance, and supervising staff to ensure efficient business operations. Interviews with three managers revealed a positive attitude toward the YMS on operational efficiency, aligning with the findings from the quantitative analysis. These insights highlight the managers' acknowledgment of the system's benefits in improving logistics management.

Theme 1: The YMS Improves Yard Management While Driving Continuous Improvement

The YMS transformed yard management by improving communication and overall efficiency by providing real-time visibility to allow teams to make informed decisions and reduce errors. It had notably enhanced productivity despite initial challenges, such as technical issues and employee adaptation, mitigated through targeted training and system improvements. The YMS's adaptability enables customization to address unique operational requirements, fostering continuous improvement and delivering sustained value for yard management.

The YMS improves yard visibility. When asked about how the implementation of the YMS impacted yard visibility, managers emphasized its significant contributions to transparency and efficiency. The system enabled real-time monitoring of inbound and outbound activities, trailer locations, and loading status, reducing reliance on manual, error-prone processes. It enhanced visibility and allowed teams to identify and resolve issues, saving time and resources promptly. The capacities proved particularly beneficial during peak times when rapid adjustments were critical to maintaining workflow efficiency. Participant GM2 highlighted the advantages of the YMS, "It [The YMS] helped by giving us real-time visibility of everything that was going on. When questions arose, we were able to get our answers very quickly because all that information was in the system and at our fingertips." Similarly, Participant GM1 noted the system's role in improving yard management efficiency, "We have seen a marked improvement in the amount of time spent reconciling the yard to ensure that everything is where we think it is. YMS definitely played a big part in that."

Integrating YMS with other systems, such as SAP and transportation management, further streamlined operations by synchronizing data and empowering managers to make faster, data-driven decisions, as Participant GM3 noted a general image of how YMS improved efficiency as:

> Before the YMS was implemented, we had a lot of manual records and a lot of writing. The yard hunters didn't have what they would need to do for the eight hours of work. So when we implemented the YMS, we were able to communicate back and forth with the yard hostler. With YMS implemented, there was more visibility not only for the yard hostler and the shipping window but also for the managers and the supervisors. I like it the most because it keeps us track of where we're at. For example, if I know there are 50 inbounds, we know the yard is full of mapping, which will kind of guide us to where we're at for the day. It also keeps track of the hours of the employees and how long it takes to do their jobs so that we can use that data in the future to talk to employees about it. But the most important thing to me was that I knew what was out there just by looking at the timelines.

The YMS reduced workload complexity. The participating managers highlighted that yard employees, especially operators and drivers, welcomed the shift from a manual, paper-based process to a digital system offering real-time updates. The shift alleviated common frustration, such as the need to physically check trailer statuses or reliance on delayed communications, making tasks more manageable and significantly reducing time demands. The process enhanced job efficiency and overall employee satisfaction. Participant GM1 noted the positive impact on staff, stating:

> YMS took a lot of the pressure and strains off of those operators out there. Having everything right there on a tablet at their fingertips, not having to constantly re-heel back and forth into our transportation department for moves to be completed. Everything's live, and everything's real-time, and that definitely goes a long way toward employee satisfaction.

Similarly, Participant GM2 emphasized how the YMS simplified workload and improved employee experience, “Everybody enjoys it, makes their job easier … They can see some of the reports that help them, help us get the product to the customer in a timely manner.”

Theme 2: Managers’ Challenges and Lessons Learned During the YMS's Implementation

Managers acknowledged facing struggles with technical issues during the implementation of the YMS, such as network instability and staff resistance due to unfamiliarity with the system. However, these hurdles were effectively resolved through a combination of targeted interventions. Network upgrades improved system reliability, while comprehensive training sessions equipped employees with the skills to operate the YMS confidently. The in-house YMS experts were designated to assist with ongoing learning and troubleshooting, ensuring that employees could adapt effectively and troubleshoot issues as they arose. Participant GM2 identified the impact of the unstable network during the initial phase, stating, “…it [network] would sometimes go down, and then we're trying to figure out if everything in the YMS was still accurate. But since we've upgraded the network, we've not seen any outages since that's taken place.”

Participant GM3 noted the initial uncertainty among employees and their subsequent improvement as they grew accustomed to the system:

> There was newer to us, and employees were more scared of what was and what was going to happen. How does it work? But once that fear went away, the technical skills even got better. They used systems and data entry, and all that good stuff helped them get even better at it.

Participant GM1 further mentioned that the challenges encountered during the initial system implementation were resolved collaboratively, bringing teams together to identify root causes and implement corrective action, as stated:

> If we have an issue or we had an issue, we would get together as a group. We determined what the issue was and what the root cause was, and then we would go back and implement whatever measures needed to be taken to fix the issue.

Research Question 5

Research Question 5 explored the perceptions of operators at third-party logistics distribution centers located in the Western, Midwestern, and Eastern regions of the United States about the YMS implemented in 2018. Participating operators had held their positions for over fifteen years. Their responsibilities include managing communications with trucking companies that deliver and ship products, coordinating with the warehouse and yard, resolving operation issues, training warehouse and yard personnel, and using the Integrated Management System (YMS is one of the components of an Integrated Management System) to set up workflow processes. Interviews with three operators revealed a positive attitude toward the YMS on operational efficiency, aligning with the

findings from the quantitative analysis. These insights highlight the operators' acknowledgment of the system's benefits in improving logistics operations.

Theme 1: The YMS Improved Operational Efficiency and Employee Satisfaction

The YMS improved operational efficiency by providing real-time visibility into yard operation, thereby improving the accuracy and timeliness of trailer tracking and resource allocation, reducing errors, and addressing the inefficiencies of manual, paper-based systems. Employees benefited from workflow improvements through features such as the Shag List and digital scheduling tools, which minimized redundant tasks and facilitated better communication between yard and warehouse teams. The enhancements reduced stress during peak time and empowered operators with greater control over workload.

The YMS improved communication and coordination. When asked about the advantages of implementing YMS in logistic centers, operators highlighted its ability to streamline interactions between yard and warehouse teams using shared digital platforms and integrating data systems. The integration allowed team members to access real-time information, reducing reliance on traditional communication methods, such as phone calls, radios, or in-person updates. One key feature, the Shag List, served as a centralized digital platform for assigning and tracking tasks, ensuring alignment between yard operators and warehouse employees on priorities and task statuses. Participant OP2 emphasized the benefit, stating, “Before, we used to handwrite papers or call them over the radio. Now, it is typed up and visible on the screen. The Shag List has definitely reduced errors on that as well.” Similarly, Participant OP1 observed that the YMS

allowed employees to instantly determine the correct placement of trailers, stating, “The YMS made them [employees] see right away what should be in what locations.”

The YMS reduced waiting time. Real-time visibility into trailer locations and statuses provided by the YMS enabled operators to efficiently identify and assign available parking spots and trailers, minimizing loading, uploading, and trailer movement delays. Features such as digital scheduling tools enable further efficient appointment management, reducing bottlenecks during peak periods by effectively balancing workloads. The reduced reliance on manual searches or communication shortened wait times and enhanced productivity. Participant OP1 highlighted this benefit, stating:

> The YMS makes it much easier to track the trailers and make sure that everything is correct in the yard, make sure the moves are done on time because we have that visibility. It definitely helps with the warehouse workflow because people don't have to wait.

Similarly, Participant OP3 emphasized the impact of the kiosk function within the YMS, explaining that it streamed operations by allowing drivers to check out independently, reducing the need and time for yard employee intervention and enabling operators to focus on other tasks. According to OP3, the functionality “saves a lot of time and headaches,” further illustrating that the YMS facilitated smoother yard operations.

Theme 2: Operators faced minor challenges during the implementation

Operators’ perceptions of the challenges during the YMS implementation mirrored those identified by managers, including employee learning curves, technical difficulties, and coordination issues. Early challenges often stemmed from limited familiarity with the system, leading to confusion and slower adoptions. Technical issues

such as Wi-Fi connectivity problems and synchronization errors with existing systems like SAP occasionally disrupted operations. Participant OP3 identified the employee learning curve, stating:

> The only issue we had, in the beginning, was just teaching people how to use the system … we would go back and say, hey, this is what you have to do, or you have to push this button or clear the screen or things like that. I think it was mostly the only issue that we had in the beginning.

In addition to the employee adaptation challenges, Participant OP2 highlighted technical hurdles during the first implementation: "Most of it [the challenges] was with computers and other stuff like that, as well as wireless signals. The hostler took to the IMS very well." The three participating operators generally expressed that the YMS implementation process was not overwhelmingly difficult, with challenges manageable and resolved mainly over time.

To address the challenges, operators suggested strategies for improvement, particularly emphasizing the importance of step-by-step instructions and comprehensive documentation to support early adoptions. Participant OP2 illustrated this approach by explaining:

> We just had to put step-by-step processes in place. So that way, we know that this person has to do this before that person can do it. Unload the truck before you can move it and do things like that.

Research Question 6

Research Question 6 explored the perceptions of yard drivers at third-party logistics distribution centers located in the Western, Midwestern, and Eastern regions of

the United States about the YMS implemented in 2018. The most experienced participating yard driver had been employed for 12 years. Interviews with eight operators revealed a positive attitude toward the YMS on operational efficiency, aligning with the findings from the quantitative analysis. These insights highlight the yard drivers' acknowledgment of the system's benefits in improving work efficiency.

Theme 1: The YMS improves yard drivers' work efficiency and team communication

When asked about the yard drivers' perception of the implemented YMS, they generally identified the YMS enhanced operational workflows by minimizing the manual tasks traditionally required of yard drivers with its automating processes and providing real-time visibility into trailer locations and statuses. The advancements contribute to reducing errors and associated costs while simultaneously improving employee satisfaction by simplifying complex tasks and alleviating workloads.

The YMS enhanced efficiency by reducing time and optimizing workflows. When participated yard drivers were asked about the impact of the YMS on daily workflow, they described its ability to enhance work efficiency by automating labor-intensive tasks, such as paper tracking and physical yard checks, which reduced the time required to locate, move, and manage trailers. The eliminated redundant manual processes allowed the YMS to facilitate a shorter turnaround time and enabled the completion of more loading and unloading tasks. Participant YD1 noted the efficiency improvements with the implemented YMS:

> It's just super easy to look at all of it at once and see what's empty, what's still loaded, what's loaded, and what's ready to go out. You really don't need to spend very much time. Before we had YMS, we researched every single yard spot. We'd

> have to send somebody out there to write it down by hand. This … saved so much time, and we took the traffic window from a two-person job down to a one-person job, and that's the biggest thing for me.

Participant YD2 further emphasized the role of the YMS's scheduling function in reducing waiting time, explaining:

> With that [YMS], we can move the trailers. I know what trailers are coming in just because of the scheduling, and that's on the warehouse side. And so, when the scheduling and all that is done, I can move the trailers and know where everything's going. It's easier for my peer to know where I am and what my moves are, and we can work together to know what moves need to go and in what doors. That schedule helps map out the doors and the mass where the trailers need to go.

The YMS enhanced efficiency by improving communication. Several participants emphasized that the system reduces the reliance on radios and manual checks, allowing for more convenient communication between yard drivers, operators, and warehouse employees. For instance, adding comments to trailer moves ensures drivers have the necessary information (e.g., seal status and trailer specifics) directly within the system, eliminating delays caused by needing to verify details at the office. The Shag List further prioritized tasks by critical assignments, ensuring clarity and reducing miscommunication. Participant YD5 explained, "The biggest thing with the Shag Lists and the traffic coordinator is that they can comment about it, which saves much time, not having to communicate over the radio."

The drivers also noted that the YMS enables efficient multitasking, such as managing multiple trailer moves without unnecessary backtracking or delays. The system's real-time updates also allow office employees to focus on load assignments and outside carriers without disruptions from drivers seeking clarification and ensure smoother workflows for all stakeholders. Participant YD8 highlighted:

> The most effective is the system itself. By having that computer screen there, they can put up a move, and they don't have to say a word to us when we know what needs to be done. That allows them to focus on the outside carriers checking in and out as well as the loaders and pickers and giving their assignments. That takes a level of frustration off of the office staff that does load assignments. And it also takes a level of stress off of us drivers having to go in and disrupt their process so we can continue ours.

Theme 2: Yard drivers' challenges during the early YMS implementation stages and recommendations

During the implementation of the YMS, participating yard drivers reported minor challenges, primarily centered on initial familiarity with the system and adapting to its process. Many participants identified the primary hurdle as learning the system's functions, such as navigating the interface, understanding codes for trailer status, and managing specific tasks like moving trailers within the system. Participant YD5 described this experience, stating:

> When I first started to learn it, just learning where are the functions at. I had to move a trailer in the system to another location … After all that, once I picked everything up, I haven't had a lot of issues.

Similarly, Participant YD2 highlighted the effort required to memorize trailer status codes, noting:

> Trying to figure out the code card for like empty trailers, loaded trailers, and the status code. That was the only thing that it took me a little while to try and get everything memorized. But once I did, it was freaking easy.

Participant YD8 echoed these sentiments, reflecting on initial concerns about using the system:

> The biggest challenge was the initial learning … I was more worried about that computer screen than anything else. It took me a short period of time to learn the steps and the processes. Once it was down, it's very easy.

Technical issues, although minimal, included early software bugs like duplicated shipments and the added complexity of logging in through security layers, increasing the time needed to access the system. Participant YD1 described the bugs challenges as “We had some issues where trailers were doubled up on shipments at the very beginning. It's more like a software bug. And then debugging. Very simple fix.” Despite the challenges, drivers emphasized that the issues were resolved relatively quickly. They described the YMS as one of the most accessible platforms, with its benefits outweighing the initial learning curve. As familiarity grew, the system’s usability and efficiency led to increased acceptance and improved operational workflows.

Addressing the challenges encountered during the early stage of YMS implementation required a collaborative and structured approach. Consistent peer, supervisor, and trainer support could ease the learning process. Participant YD5 highlighted this importance and noted, “Any little problems, I just talked to my trainer or

manager supervisor who was available. He helped me with everything." Adopting a step-by-step approach to resolving issues, rather than overwhelming employees with multiple changes simultaneously, fostered gradual improvement and confidence. As Participant YD1 emphasized, "We tackled one thing at a time. And I think that helped everybody improve." Peer-to-peer mentoring also merged as an effective strategy, where experienced employees supported those facing difficulties, further strengthening the process. As observed by Participant YD7, "The people that caught on quicker would help and train the other ones that were slow to catch on." Additionally, Participant YD8 emphasized the importance of patience and thoroughness during the learning phase to ensure a smoother transition and long-term efficacy, advising, "It's better to be thorough, make sure you get the proper steps down… a little sacrifice and a little bit of time at the beginning allows a more efficient end." These strategies collectively fostered a supportive environment, enabling employees to adapt to the new system effectively.

Summary

In conclusion, implementing the YMS across the three third-party logistics distribution centers significantly improved inbound and outbound volume and reduced detention occurrences. General managers, operators, and yard drivers expressed a positive outlook on YMS, citing enhanced yard visibility, improved operational coordination, reduced manual labor, facilitated real-time decision-making, streamlined communication, and optimized labor management, leading to more efficient workflow and a noticeable reduction in errors and delays.

While initial challenges such as network instability, technical setup, and employee resistance were noted, the issues were effectively addressed through infrastructure

upgrades, comprehensive training, and peer support. The system's advantages, such as real-time tracking, digital record-keeping, and improved schedule, have made YMS an integral tool in daily operations, increasing productivity and reducing manual workloads. The transition from manual to digital processes has led to significant improvements in logistics operations, with YMS playing a critical role in efficient yard management across all three regions.

Chapter 5

Interpretation and Recommendations

Chapter 5 offers a comprehensive interpretation of the research findings presented in Chapter 4. It begins with a concise summary of the current study, followed by a critical review of the literature relevant to the findings. The chapter concludes with a discussion of the implications for practice, recommendations for future research, and final reflections.

Study Summary

This section presents a summary of the current study, beginning with an overview of the relevant literature that informed the identification of the research problem. It restates the study's purpose statement and outlines the six research questions guiding the investigation. The section then concisely reviews the quantitative data related to inbound and outbound volume and detention occurrences. Additionally, it summarizes the qualitative research methodology utilized in the study and highlights the key findings derived from the analysis of interview data.

Overview of the Problem

The absence of effective yard monitoring and management can result in demurrage and detention fees, delivery delays, additional equipment rentals, and production stoppages, causing companies to incur financial losses (Storms et al., 2023). Therefore, instead of issues with transportation, inefficiency within manufacturing plants and distribution centers is often the primary cause of supply chain delays. These inefficiencies arise due to many facilities continuing to rely on manual, paper-based systems to manage yard operations, resulting in a lack of clear insights into dock

availability and lot capacity (Mera & Sirikande, 2022; Speltz & Murray, 2019; Storms et al., 2023).

The Human Performance Technology Framework (HPTF) has been widely studied as a tool to enhance organizational outcomes, such as effectiveness in promoting collaboration within cross-functional teams and employee performance (Abaci & Pershing, 2017; Foshay et al., 2013; Kahle-Piasecki, 2011; McLaughlin, 2016). Research into applying HPTF to third-party logistics companies has been limited. The current study takes HPTF as the theoretical framework to identify the effectiveness of the information technology system of the third-party logistics company in improving performance by reducing retention occurrence by dollars and increasing inbound and outbound in pounds.

Purpose Statement and Research Questions

The current explanatory sequential mixed method study assesses the impact of a YMS implemented in 2018 based on HPTF (Pershing, 2006). The study evaluated changes in detention occurrences by dollars and inbound and outbound by pounds across the three sites over five years from 2018 to 2022 to identify any significant trends or differences. Semi-structured interviews with managers, operators, and truck drivers were conducted to explore their perceptions of implementing YMS, supplement the quantitative results, and comprehensively assess its impact.

The study answered the following research questions:

Research Question 1

To what extent is there a difference in the annual number of inbound products by pounds from 2018 to 2022 at the Western, Midwestern, and Eastern logistics service providers overall and for each site?

Research Question 2

To what extent is there a difference in the annual number of outbound products by pounds from 2018 to 2022 at the Western, Midwestern, and Eastern logistics service providers overall and for each site?

Research Question 3

To what extent is there a difference in the annual detention occurrence from 2018 to 2022 at the Western, Midwestern, and Eastern logistics service providers overall and for each site?

Research Question 4

What are the perceptions of third-party logistics distribution center managers at the Western, Midwestern, and Eastern sites regarding the YMS implemented in 2018?

Research Question 5

What are the perceptions of third-party logistics distribution center operators at the Western, Midwestern, and Eastern sites regarding the YMS implemented in 2018?

Research Question 6

What are the perceptions of yard drivers of the third-party logistics distribution center at the Western, Midwestern, and Eastern third-party logistics distribution center sites regarding the YMS implemented in 2018?

Review of the Methodology

The explanatory sequential mixed methods design employed in the current study comprehensively evaluated the impact of the YMS implemented in 2018. The study integrated quantitative metrics, inbound and outbound product volumes measured in pounds, and detention occurrence measured in dollars, with qualitative insights gathered through semi-structured interviews with managers, operators, and yard drivers. The quantitative data revealed objective data that changes over time. The qualitative data captured stakeholders' perceptions about the YMS and further explained quantitative findings about the significant changes in improving inbound and outbound volumes and reducing detention occurrences. Triangulating quantitative and qualitative findings enhanced the interpretation of the YMS's effectiveness.

The study adopted the purposive sampling method to select distribution centers in the West, Midwest, and East of the United States that fully implemented YMS to obtain a comprehensive understanding and reduce biases due to geographic location. Purposive sampling during qualitative data collection ensured that critical stakeholders with relevant expertise and experience were included.

The quantitative analysis adopted one-way ANOVA with SPSS to assess pre- and post-implementation differences of the YMS and identify whether the effectiveness gains were achieved. The independent variable was the implementation of a YMS, and the dependent variables were inbound products by pounds, outbound products by pounds, and detention occurrence. The one-way ANOVA provided a measure of the magnitude of the difference between the before and after values and the probability of the difference being due to chance. Parametric analysis was used in a one-way ANOVA to compare the

means between the first year of implementing the YMS (2018) and the last year before the labor schedule change (2022). A p-value of .05 was considered statistically significant, meaning the results were unlikely to have happened by chance, and the null hypothesis of non-difference can be rejected.

The qualitative data were collected through semi-structured interviews. The interview recordings were transcribed and open-coded, with each text segment assigned descriptive labels or codes representing emergent themes. This phase allowed for the exploration of diverse perspectives and facilitated the identification of recurring patterns. A coding framework was developed through constant comparison and iterative refinement to encapsulate the richness of participants' responses. The researcher revisited and re-coded previously coded interviews when a new theme emerged to ensure consistent categorization and accurate data representation. The qualitative data were analyzed with Atlas.ti.

Major Findings

Quantitative results revealed that implementing the YMS led to substantial operational improvements at the three distribution centers. Specifically, the fully implemented YMS in 2022 significantly increased inbound and outbound volume compared to the pre-implementation period in 2018. The system also contributed to a marked reduction in detention occurrences, suggesting its effectiveness in enhancing the distribution centers' overall work efficiency.

Qualitative results revealed the perceptions of managers, operators, and yard drivers toward implementing and using the YMS. Research Question 4 explored the perceptions of three distribution center managers regarding the implemented YMS in

2018. The managers highlighted that the YMS enhanced communication and real-time yard visibility. It improved monitoring of inbound and outbound activities, trailer tracking, and workload management, particularly during peak periods. It also simplified tasks for yard employees by replacing manual, paper-based processes with digital systems offering real-time updates, alleviating frustrations, such as needing physical trailer checks, and enhancing job satisfaction. The challenges during the implementation included network instability and initial employee resistance due to unfamiliarity with the system. Approaches to addressing the challenges could be upgrading networks to improve system reliability and conducting comprehensive training programs to build employees' confidence and technical skills.

Research Question 5 revealed operators' perceptions of the implemented YMS in 2018 at the distribution centers. The operators emphasized that the system provided real-time visibility into yard operations, which improved trailer tracking accuracy, optimized resource allocation, and addressed inefficiencies of manual systems by streamlining trailer placement and appointment management, which reduced wait times and increased productivity. Features systems, such as the Shag List and digital scheduling tools, facilitated communication and coordination between yard and warehouse teams, reduced redundant tasks, and alleviated stress during peak times. Operators also described encountering minor challenges during the implementation, including technical difficulties, employee adaptation, and coordination issues, which were resolved with step-by-step instructions and comprehensive training.

Research Question 6 examined yard drivers’ perception of the YMS implemented in 2018, and they revealed the system's contributions to operational efficiency and team

communication. Drivers noted that the system simplified workflows by automating labor-intensive tasks, reducing manual processes, and providing real-time visibility into trailer locations and statuses. The advancements minimize errors, reduce turnaround times, and improve employee job satisfaction. The system also enhanced communication and coordination between yard drivers, operators, and warehouse teams through features such as the Shag List, which prioritized tasks and reduced reliance on radios and manual checks. The improvements enabled efficient multitasking that allowed drivers and operators to focus on their responsibilities without disruptions. Despite the benefits, the YMS posed minor challenges, such as a learning curve for new users and occasional technical issues (e.g., early software bugs). The challenges in the learning curve were addressed through consistent support from peers and supervisors and step-by-step instruction.

Findings Related to the Literature

The literature highlighted that in addition to factors such as price, reliability, and services, technical innovation that improves logistics productivity and customer satisfaction was the main factor for a company to select a third-party logistics provider (Aguezzoul, 2007; Bagchi & Virum, 1996; Power et al., 2001; Sahay et al., 2006; van Laarhoven & Sharman, 1994). Meanwhile, one of the major challenges that third-party logistics providers faced in their daily operations was to minimize delivery time (Mathiyazhagan et al., 2016). Technology, personnel availability, productivity, and supply chain delivery efficiency affect delivery times (Zajac & Olsen, 1993). The current study's findings confirmed that applying technology that met users' needs—implementing YMS—could reduce delivery times by improving yard visibility, tracking

inbound and outbound shipments in real-time, simplifying communication, and reducing idle times.

In addition to confirming previous studies that insufficient infrastructure hindered the application of innovative technologies in third-party logistics centers (Selviaridis & Spring, 2007), the current study expanded factors that obstacles to the application of information management in the centers—the resistance and learning curve of employees to new technologies. Resistance stemmed from employees' reluctance to move away from familiar, manual processes or skepticism about the benefits of new systems. The hesitation resulted in inefficiency during the early stages of the transition. Also, employees may experience initial frustration or confusion when navigating new systems. Therefore, a training program with sufficient training time and ongoing support was necessary to develop skills to use the system.

Pershing's (2006) HPTF model pointed out that interventions aimed to improve human performance and overall organizational productivity by targeting critical processes and functions. Overall, implementing YMS has significantly increased the volume of inbound and outbound and reduced detention occurrence, confirming that systematic intervention could improve productivity in the operating environment. It also supported Abaci's (2017) assertion that interventions must produce measurable outcomes to close performance gaps by providing tangible evidence of their efficiency and effectiveness.

Sanders and Thiagarajan (2005) categorized performance intervention into six areas: improving knowledge, motivation, material resources, structure and process, information, and health. The YMS streamlined trailer management and provided real-

time data, optimized the structural process efficiencies within the distribution centers, and improved access to information, allowing for more swift decision-making, corresponding to the literature defined as crucial factors—material resources, structure and process, and information—for boosting operational performance.

Conclusions

The current explanatory sequential mixed method explored the impact of the YMS implemented in 2018 and the managers', operators', and yard drivers' perceptions of the YMS. The current study's findings provided a scientific basis for the need for logistic distribution centers to improve yard visibility and provide viable solutions to the challenges faced. The results can help logistics managers and operators identify the best practices to improve operational efficiency and minimize holdup incidents.

Implications for Action

The current study's findings indicated that implementing YMS in third-party logistics distribution centers could increase the volume of inbound and outbound and reduce detention occurrences. However, resistance to adopting new technology in the initial implementation stage was a well-documented challenge (Roger, 1995). The logistics centers could emphasize clear communication with employees about the new system's benefits and their alignment with operational goals to help employees understand the rationale behind the change and reduce uncertainty. In addition to communication, the distribution centers could develop a comprehensive training program, providing ongoing support to employees, such as one-on-one training and problem-oriented training, and focus on real-life scenarios they were likely to encounter while using the system. Peer mentoring programs also could be effective in overcoming

resistance. Early adopters—employees who quickly adapt to and embrace the new technology—served as mentors to their colleagues, offering practical tips and emotional support. Besides accelerating resistant employees' fostering of the new system, the peer mentoring programs could facilitate collaboration and teamwork, reinforcing a positive organizational culture during the transition.

It was worth noting that the centers should prioritize network stability and technical infrastructure improvements when implementing YMS to support the seamless operation of the system, minimize operational disruptions, and promote better coordination among employees. A lack of reliable connectivity might fail to leverage YMS benefits, such as immediate access to data and efficient scheduling, leading to potential delays and communication disruptions. In addition, the frustration with new systems due to unstable networks and infrastructure can further lead to resistance from resistant employees.

Recommendations for Future Research

With the rapid development of technologies such as artificial intelligence, machine learning, and the Internet of Things, future research could explore the feasibility and practices of emerging technologies to enhance or complement the capabilities of YMS. Another valuable area of research is interoperability between YMS and other systems, such as Warehouse Management Systems or Transportation Management systems, to identify synergies and challenges in multi-system environments. Future research could explore how seamless integration between these systems could improve supply chain coordination, data sharing, and communication while identifying technical and organizational barriers to interoperability.

As logistics centers become more dependent on real-time data and connected systems, they become more vulnerable to cybersecurity threats, including ransomware attacks, data breaches, and system outages (Lund et al., 2024). Future research should examine strategies for integrating cybersecurity frameworks into YMS to protect sensitive operational data, ensure system integrity, and maintain business continuity.

Concluding Remarks

This study investigated the impact of implemented YMS on third-party logistics centers' inbound and outbound volume and detention occurrence. The findings revealed that implementing YMS improved inbound and outbound volumes and reduced detention occurrence by improving yard visibility and communication. However, several challenges, including employee resistance, the learning curve, and infrastructure limitations, must be resolved to realize the system's potential benefits. In future practices, it might be necessary for logistic providers to invest in technology infrastructure, ongoing employee training, and explore innovative solutions to keep pace with emerging technologies.

References

Abaci, S., & Pershing, J. A. (2013). International practice of workplace learning and performance improvement: A status report. *Bilgi Ekonomisi ve Yönetimi Dergisi, 8*(1), 163-173.

Abaci, S., & Pershing, J. A. (2017). Research and theory as necessary tools for organizational training and performance improvement practitioners. *TechTrends, 61*(1), 19-25.

Abdulrahman, M. D., Gunasekaran, A., & Subramanian, N. (2014). Critical barriers in implementing reverse logistics in the Chinese manufacturing sectors. *International Journal of Production Economics, 147,* 460-471.

Aghazadeh, S. M. (2003). How to choose an effective third party logistics provider. *Management Research News, 26*(7), 50-58.

Aguezzoul, A. (2007, November). The third party logistics selection: A review of literature. *International Logistics and Supply Chain Congress*, p. 7.

Aktas, E., & Uiengin, F. (2005). Outsourcing logistics activities in Turkey. *Journal of Enterprise Information Management, 18*(3), 316-329.

Alieksieiev, V., Kovalenko, V., Stryzhak, V., Varchenko, I., Stryzhak, M., Heiden, B., & Tonino-Heiden, B. (2023). Towards the improvement of Yard Management Systems (YMS) using Radio Frequency Identification (RFID). *International Conference on Reliable Systems Engineering*, 222-232.

Armstrong & Associates. (2021). Third-party logistics (3PL) revenue in North America from 2010 to 2020. https://www.statista.com/statistics/763462/north-america-3pl-revenue/

Association for Supply Chain Management. (n.d.). What is logistics? https://www.ascm.org/scm/logistics/

Bagchi, P. K., & Virum, H. (1996). European logistics alliances: A management model. *The International Journal of Logistics Management*, *7*(1), 93-108.

bin Mohamad Makmor, M. F., bin Saludin, M. N., & binti Saad, M. (2019). Best practices among 3rd Party Logistics (3PL) firms in Malaysia towards logistics performance. *International Journal of Academic Research in Business and Social Sciences*, *9*(5), 394-405.

Chang, M. C., Zhao, G., Pandey, A. K., Pulver, A., & Tu, P. (2020, October). Railcar detection, identification and tracking for rail yard management. *2020 IEEE International Conference on Image Processing*, 2271-2275.

Cheong, M. L. (2004). Logistics outsourcing and 3PL challenges. *Singapore-MIT Alliance*, *N2-B2c-15*. Nanyang Technological University.

Council of Supply Chain Management Professionals. (n.d.a.). The importance of supply chain management. https://cscmp.org/CSCMP/Develop/Starting_Your_Career/Importance_of_Supply_Chain_Management.aspx

Council of Supply Chain Management Professionals (n.d.b.). CSCMP supply chain management definitions and glossary.

https://cscmp.org/CSCMP/Educate/SCM_Definitions_and_Glossary_of_Terms.aspx

Council of Supply Chain Management Professionals. (n.d.c.). Outbound logistics. In CSCMP Supply Chain Management Definitions and Glossary. https://cscmp.org/CSCMP/Educate/SCM_Definitions_and_Glossary_of_Terms/CSCMP/Educate/SCM_Definitions_and_Glossary_of_Terms.aspx?hkey=60879588-f65f-4ab5-8c4b-6878815ef921

Cooper, M. C., Lambert, D. M., & Pagh, J. D. (1997). Supply chain management: More than a new name for logistics. *The International Journal of Logistics Management, 8*(1), 1–14.

Creswell, J. W. (2021). *A concise introduction to mixed methods research*. SAGE publications.

DeGroote, S. E., & Marx, T. G. (2013). The impact of IT on supply chain agility and firm performance: An empirical investigation. *International Journal of Information Management, 33*(6), 909-916.

Deng, M., Mao, J., & Gan, X. (2018). Development of automated warehouse management system. *MATEC Web of Conferences, 232*, 03051.

Djahel, S., Doolan, R., Muntean, G. M., & Murphy, J. (2014). A communications-oriented perspective on traffic management systems for smart cities: Challenges and innovative approaches. *IEEE Communications Surveys & Tutorials*, *17*(1), 125–151.

Eid, S. (2022). *Yard Management Improvements in the Outbound Logistics Department at PepsiCo Veurne* [University of Twente]. http://essay.utwente.nl/89752/1/Eid%2C%20Sherif_%20BSc_IEM.pdf

Fauzan, R., Shiddiq, M. F., & Raddlya, N. R. (2020). The designing of warehouse management information system. *IOP Conference Series: Materials Science and Engineering, 879*(1), 012054.

Felea, M., & Albăstroiu, I. (2013). Defining the concept of supply chain management and its relevance to Romanian academics and practitioners. *Amfiteatru Economic Journal, 15*(33), 74-88.

Foshay, W. R., Villachica, S. W., & Stepich, D. A. (2014). Cousins but not twins: Instructional design and human performance technology in the workplace. In Spector, J.M., Merrill, M. D., & Bishop, M. J. (Eds.), *Handbook of Research on Educational Communications and Technology*, (pp,39-49). Springer Verlag.

Gilbert, T. F. (1978). *Human competence*. McGraw-Hill.

Giri, B. C., & Sarker, B. R. (2017). Improving performance by coordinating a supply chain with third party logistics outsourcing under production disruption. *Computers & Industrial Engineering, 103*, 168-177.

Golpîra, H., Khan, S. A. R., & Safaeipour, S. (2021). A review of logistics internet-of-things: Current trends and scope for future research. *Journal of Industrial Information Integration, 22*, 100194.

Gupta, R., Sachdeva, A., & Bhardwaj, A. (2011). Criteria of selecting 3PL provider: A literature review. *World Academy of Science, Engineering and Technology, 59*(11), 2020-2024.

Ha, C. S. (2009). The design and implementation of container yard management system using booking list. *Journal of the Korea Academia-Industrial Cooperation Society, 10*(11), 3163-3169.

Handojono, M., Alyona, C., Patty, A. C., Louth, F., & Dahoklory, I. (2022). Integrating E-supply chain management for the competitive advantages of early stage company. *International Conference on Applied Science and Technology on Social Science 2022*, 591–595.

Harland, C. M., Caldwell, N. D., Powell, P., & Zheng, J. (2007). Barriers to supply chain information integration: SMEs adrift of eLands. *Journal of Operations Management, 25*(6), 1234-1254.

Heizer, J., & Render, B. (2011). *Operations management* (10th ed.). Pearson.

Hertz, S., & Alfredsson, M. (2003). Strategic development of third party logistics providers. *Industrial Marketing Management, 32*(2), 139-149.

Holguín-Veras, J., Polimeni, J., Cruz, B., Xu, N., List, G., Nordstrom, J., & Haddock, J. (2005). Off-peak freight deliveries: Challenges and stakeholders' perceptions. *Transportation Research Record, 1906*(1), 42-48.

Hompel, M., & Schmidt, T. (2006). *Warehouse management: Organisation und steuerung von Lager-und kommissioniersystemen*. Springer-Verlag.

Hu, K., Chen, Y., & Li, T. (2016). Optimal design of warehouse management systems based on system dynamics. *Journal of Industrial Engineering and Management, 9*(1), 1-17.

Humayun, M., Jhanjhi, N. Z., Hamid, B., & Ahmed, G. (2020). Emerging smart logistics and transportation using IoT and blockchain. *IEEE Internet of Things Magazine, 3* (2), 58-62.

Inbound Logistics. (2019). 2019 Logistics IT Market Research Survey. https://www.inboundlogistics.com/articles/2019-top-100-logistics-it-providers-and-market-research-survey/

Jang, H. Y. (2008). Themes and issues as reflected in human performance technology literature: A content analysis (Publication No. 3319886) [Doctoral dissertation, Indiana University]. ProQuest Dissertations and Theses Global.

Kahle-Piasecki, L. (2011). *Mentoring: What organizations need to know to improve performance in the 21st century workplace* (Publication No. 3474769) [Doctoral dissertation, The University of Toledo]. ProQuest.

Kannan, V. R., & Tan, K. C. (2005). Just in time, total quality management, and supply chain management: Understanding their linkages and impact on business performance. *Omega, 33*(2), 153-162.

Kaynak, H., & Hartley, J. L. (2008). A replication and extension of quality management into the supply chain. *Journal of Operations Management, 26*(4), 468-489.

Kim, S. W. (2009). An investigation on the direct and indirect effect of supply chain integration on firm performance. *International Journal of Production Economics, 119*(2), 328-346.

Kumar, B., & Sharma, A. (2021). Managing the supply chain during disruptions: Developing a framework for decision-making. *Industrial Marketing Management, 97*, 159-172.

Lee, S. (2021). Warehouse management system: Definition and benefits. Supply Chain 24/7. https://www.supplychain247.com/article/warehouse_management_system_definition_and_benefits

Lieb, R. C. (1992). The use of third-party logistics services by large American. *Journal of Business Logistics, 13*(2), 29.

Lund, B. D., Lee, T. H., Wang, Z., Wang, T., & Mannuru, N. R. (2024). Zero trust cybersecurity: Procedures and considerations in context. *Encyclopedia*, *4*(4), 1520-1533.

Mathiyazhagan, K., Haq, A. N., & Baxi, V. (2016). Analysing the barriers for the adoption of green supply chain management-the Indian plastic industry perspective. *International Journal of Business Performance and Supply Chain Modelling*, *8*(1), 46–65.

Mattick, K., Johnston, J., & de la Croix, A. (2018). How to… write a good research question. *The Clinical Teacher*, *15*(2), 104-108.

Mera, D. E., & Sirikande, S. K. (2021). *Overcoming the Driver Shortage by Addressing Driver Detention*. https://dspace.mit.edu/handle/1721.1/142935?show=full

McCrea, B. (2010). YMS: Harmony in the yard. *Logistics Management, 49*(8), 46–50.

McCrea, B. (2020). Using YMS to close supply chain gaps: A point in the supply chain where two worlds collide, and where driver safety issues can germinate, the yard deserves more attention as more companies look to streamline their warehousing and distribution activities on the way to becoming a" shipper of choice.". *Logistics Management (Highlands Ranch, Co.), 59*(4), 36-40.

McLaughlin, M. F. (2016). *Managers coaching employees to improve performance: Supports and barriers* (Publication No. 10032421) [Doctoral dissertation, Capella University]. ProQuest.

Mentzer, J., Witt, W. D., Keebler, J., Min, S., Nix, N., Smith, D., & Zacharia, Z. (2001). Defining supply chain management. *Journal of Business Logistics, 22*(2), 1-25.

Michel, R. (2018). Breaking through on yard visibility. *Logistics Management, 34*, 26–30.

Molenda, M., & Pershing, J. A. (2004). The strategic impact model: An integrative approach to performance improvement and instructional systems design. *TechTrends, 48*(2), 26-33.

Murphy, P. R., & Wood, D. F. (2008). *Contemporary logistics* (Vol. 415). Pearson Prentice Hall.

Naylor, J. B., Naim, M. M., & Berry, D. (1999). Leagility: Integrating the lean and agile manufacturing paradigms in the total supply chain. *International Journal of Production Economics, 62*(1-2), 107-118.

Nettsträter, A., Geißen, T., Witthaut, M., Ebel, D., & Schoneboom, J. (2015). Logistics software systems and functions: An overview of ERP, WMS, TMS and SCM systems. *Cloud Computing for Logistics*, 1-11.

Pane, S. F., Awangga, R. M., & Azhari, B. R. (2018). Qualitative evaluation of RFID implementation on warehouse management system. *TELKOMNIKA ,16*(3), 1303-1308.

Paolucci, M., Recagno, V., & Sacone, S. (1998). Designing container yard management systems. *WIT Transactions on The Built Environment, 37*, 351-360.

Park, J. S., Oh, S., Cheong, T., & Lee, Y. (2006, August). Freight container yard management system with electronic seal technology. *2006 4th IEEE International Conference on Industrial Informatics*, 67-72.

Pershing, J. A. (2006). Human performance technology fundamentals. In P. J. Schraeder, & J. A. Pershing (Eds.), *Handbook of Human Performance Technology* (pp. 5-34).

Pfohl, H. (1997). Logistics: State of the art. *Human Systems Management, 16*(3), 153-158.

Power, D. J., Sohal, A. S., & Rahman, S. U. (2001). Critical success factors in agile supply chain management-An empirical study. *International Journal of Physical Distribution & Logistics Management, 31*(4), 247-265.

Ramaa, A., Subramanya, K. N., & Rangaswamy, T. M. (2012). Impact of warehouse management system in a supply chain. *International Journal of Computer Applications, 54*(1).

Rawat, T., & Jain, S. (2022). Depression detection: approaches, challenges and future directions. In *Artificial Intelligence, Machine Learning, and Mental Health in Pandemics* (pp. 209-234). Academic Press.

Raymond, S. (2018). Yard management: A case for RTLS. *Journal of Supply Chain Management, 54*(3), 179-193

Reyes, P. M., Visich, J. K., & Jaska, P. (2020). Managing the dynamics of new technologies in the global supply chain. *IEEE Engineering Management Review, 48*(1), 156–162.

Rodrigue, J. (2020). *The geography of transport systems*. Routledge.

Rogers, E.M. (1995). Diffusion of Innovations: Modifications of a Model for Telecommunications. In: Stoetzer, MW., Mahler, A. (eds) *Die Diffusion von Innovationen in der Telekommunikation. Schriftenreihe des Wissenschaftlichen Instituts für Kommunikationsdienste*, vol 17. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-79868-9_2

Sahay, B. S., & Mohan, R. (2006). Managing 3PL relationships. *International Journal of Integrated Supply Management, 2*(1-2), 69-90.

Sanders, E. & Thiagarajan, S. (2005). Introduction. In Sanders, E. & Thiagarajan, S. (Eds.), *Performance intervention maps* (pp. ix-xxii). American Society for Training & Development.

Schmitt, C. (2002). *Technology in schools: Suggestions, tools, and guidelines for assessing technology in elementary and secondary education*. US Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.

Schoonenboom, J., & Johnson, R. B. (2017). How to construct a mixed methods research design. *Kolner Zeitschrift fur Soziologie und Sozialpsychologie, 69*(Suppl 2), 107.

Selviaridis, K., & Spring, M. (2007). Third party logistics: A literature review and research agenda. *The International Journal of Logistics Management, 18*(1), 125-150.

Speltz, E., & Murray, D. (2019). Driver detention impacts on safety and productivity. *American Transportation Research Institute*, *22*. https://truckingresearch.org/wp-content/uploads/2019/09/ATRI-Detention-Impacts-09-2019.pdf

Stefaniak, J., Baaki, J., Hoard, B., & Stapleton, L. (2018). The influence of perceived constraints during needs assessment on design conjecture. *Journal of Computing in Higher Education, 30*(1), 55-71.

Stolovitch, H. D., & Keeps, E. J. (2006). *Handbook of human performance technology: Principles, practices, and potential.* John Wiley & Sons.

Storms, K., Sys, C., Vanelslander, T., & Van Deuren, R. (2023). Demurrage and detention: from operational challenges towards solutions. *Journal of Shipping and Trade*, *8*(1), 1-31.

Third-Party Logistics Study. (2020). The state of logistics outsourcing: Results and findings of the 24th annual study.

https://www.infosysbpm.com/portland/resources/documents/third-party-logistics-study.pdf

Toorajipour, R., Sohrabpour, V., Nazarpour, A., Oghazi, P., & Fischl, M. (2021). Artificial intelligence in supply chain management: A systematic literature review. *Journal of Business Research, 122*, 502–517.

United Nations Conference on Trade and Development. (2018). Demurrage and detention charges in container shipping. https://unctad.org/news/demurrage-and-detention-charges-container-shipping

Van Laarhoven, P., & Sharman, G. (1994). Logistics alliances: the European experience. *The McKinsey Quarterly, 1*, 39-50.

Wang, Y., & Sarkis, J. (2021). Emerging digitalisation technologies in freight transport and logistics: Current trends and future directions. *Transportation Research Part E: Logistics and Transportation Review, 148*, 102291.

Wile, D. (1996). Why doers do. *Performance + Instruction*, *35*(2), 30-35. Doi: 10.1002/pfi.417035020

Williams, M. A. (1980). Assumptions in research. *Research in Nursing & Health*, *3*(2), 47-48.

Wilmoth, F. S., Prigmore, C., & Bray, M. (2010). HPT models: An overview of the major models in the field. In R. Watkins, & D. Leigh (Eds). Handbook of improving performance in the workplace, volume two: Selecting and implementing performance interventions (pp. 5-23). John Wiley & Sons.

Winkelhaus, S., & Grosse, E. H. (2020). Logistics 4.0: A systematic review towards a new logistics system. *International Journal of Production Research, 58*(1), 18-43.

Woschank, M., Rauch, E., & Zsifkovits, H. (2020). A review of further directions for artificial intelligence, machine learning, and deep learning in smart logistics. *Sustainability, 12*(9), 3760.

Wu, Y. C. J. (2006). Assessment of technological innovations in patenting for 3rd party logistics providers. *Journal of Enterprise Information Management, 19*(5), 504–524.

Zajac, E. J., & Olsen, C. P. (1993). From transaction cost to transactional value analysis: Implications for the study of inter-organizational strategies. *Journal of Management Studies, 30*(1), 131–145.

Zhen, L., Jiang, X., Lee, L. H., & Chew, E. P. (2013). A review on yard management in container terminals. *Industrial Engineering and Management Systems, 12*(4), 289–304.

Wycislak, S. (2022). From real-time visibility to operational benefits–tensions on unfinished paths. *The International Journal of Logistics Management,* in-press.

Zou, Y., Yu, B., Wang, Y., & Zhu, Y. (2015). Research on the application of transportation management system. *Applied Mechanics & Materials, 776,* 517–520

Appendices

Appendix A. YMS Research Approval Letter

06/03/2024

Ted Kinney

Holman Logistics

400 S Weaver St. Suite A

Emporia, KS 66801

To whom it may concern,

I am writing on behalf of Holman Logistics, and I hereby grant my informed consent to the research study titled An Examination of the Impact of a Yard Management System on Three Third-Party Logistics Operations Centers," conducted by Ziang Wang. This letter formally authorizes the researcher to access and utilize our corporation's data for the study.

Understanding the objectives and scope of the research, as outlined in the proposal and subsequent communications, we acknowledge that the study seeks to examine the potential effects of Yard Management Systems on inbound and outbound volume as well as detention cost within our operational framework.

By granting access to our data, we recognize the value of contributing to academic inquiry and advancing knowledge in logistics and supply chain management. We acknowledge that:

The shared data will be used exclusively for research purposes and treated with the utmost confidentiality and security.

All findings, analyses, and presentations resulting from the study will be presented aggregated and anonymized, ensuring that our corporation's sensitive information remains protected.

Our corporation will not incur any financial or legal liability for sharing this data for the research study.

Our corporation's participation is voluntary, and we retain the right to withdraw our data from the study without prejudice.

We trust that the researcher and their team will maintain the highest ethical standards throughout the research process and adhere to all relevant laws and regulations about data privacy and protection.

Please be assured that we are committed to supporting academic endeavors that contribute to industry knowledge and development. We look forward to the insights that this study may yield and the potential benefits it could bring to our operational practices.

Sincerely,

Ted Kinney

Director of Operations

Holman Logistics

Mobile: 262-914-8999, tkinney@holmanusa.com

I have read and understood the above terms and confirm my agreement to participate in the research study.

Signature: _____ Date: 6-3-2024

[Researcher's Name]

Signature: _____ Date: 6-3-24

[Manager's Name]

Appendix B. Baker University IRB Request

BAKER UNIVERSITY

IRB Request

Date 06/01/2024

IRB Protocol Number _____
(IRB use only)

I. Research Investigator(s) (students must list faculty sponsor)

Department(s) School of Education

	Name	Signature	
1.	Ziang Wang	Ziang Wang	Principal Investigator
2.	Regena M. Aye	Regena M. Aye	☑ Check if faculty sponsor
3.	Kyunghwa Cho		☐ Check if faculty sponsor
4.			☐ Check if faculty sponsor

Principal investigator contact information

Phone (620) 803-8623

Email ZiangWang@stu.bakeru.edu

Address 1910 Darlene Way, Emporia, KS

Note: When submitting your finalized, signed form to the IRB, please ensure that you cc all investigators and faculty sponsors using their official Baker University (or respective organization's) email addresses.

Faculty sponsor contact information

Phone (785) 633-7703

Email raye@bakeru.edu

Expected Category of Review: ☐ Exempt ☑ Expedited ☐ Full ☐ Renewal

II. Protocol Title

An Examination of the Impact of a Yard Management System on Three Third-Party Logistics Operations Centers

III. Summary:

The following questions must be answered. Be specific about exactly what participants will experience and about the protections that have been included to safeguard participants from harm.

A. In a sentence or two, please describe the background and purpose of the research.

The absence of yard visibility can lead to low accuracy location information of trailers in a third-party logistics center, resulting in a significant amount of time spent looking for the correct trailer location and causing delivery delays between the transportation company and the warehouse. The current study uses Pershing's Human Performance Technology Fundamentals to evaluate the impact of a Yard Management System (YMS) on detention cost and inbound and outbound products by pounds.

B. Briefly describe each condition, manipulation, or archival data set to be included within the study.

The mixed-method study plans to collect quantitative archival data regarding detention cost and inbound and outbound products by pounds between 2018 and 2022 from three distribution centers of a third-party logistics corporation's SQL Server databases. The archival data comprises historical records of detention occurrences and volume measurements recorded in pounds from three logistics centers in the Eastern, Midwestern, and Western regions for 2018 and 2022. The archival data does not contain any personally identifiable information about individuals, as it solely pertains to operational metrics within the logistics centers. All data will be anonymized and aggregated for analysis to ensure confidentiality and compliance with ethical guidelines. The study will also

IV. Protocol Details

A. What measures or observations will be taken in the study? If any questionnaire or other instruments are used, provide a brief description and attach a copy.

The study will use an ANOVA test to measure the archival quantitative data acquired from the third-party logistic corporation's SQL Server database about the impact of the implemented Yard Management System on detention occurrence and inbound and outbound volumes. The archival data will be collected from three logistic centers located in the Eastern, Midwestern, and Western United States.

Interviews will be conducted to collect qualitative data about logistic corporation managers, operators, and truck drivers' perceptions of the newly implemented YMS. The interview includes seven main interview questions to

B. Will the subjects encounter the risk of psychological, social, physical, or legal risk? If so, please describe the nature of the risk and any measures designed to mitigate that risk.

Subjects will not encounter the risk of psychological, social, physical, or legal risk.

C. Will any stress to subjects be involved? If so, please describe.

There will be no stress to the subjects involved. They can end the interview at any time.

D. Will the subjects be deceived or misled in any way? If so, include an outline or script of the debriefing.

The subjects will not be deceived or misled in any way. The interview questions are not intuitive.

E. Will there be a request for information which subjects might consider to be personal or sensitive? If so, please include a description.

There are no personal or sensitive subjects for using archival data for the quantitative analysis. The researcher has acquired permission to access the data.
While collecting qualitative data through interviews for this study, there are instances where the information requested could be considered personal or sensitive by the participants because it delves deeply into individual experiences, feelings, and perceptions to understand the subject matter thoroughly. The interview protocol includes a clear description and informs participants beforehand during the consent process to address the situation. They will be assured of the confidentiality and anonymity of their responses to protect their privacy. The

F. Will the subjects be presented with materials which might be considered to be offensive, threatening, or degrading? If so, please describe.

In the context of the current study, the subject will not be presented with materials considered offensive, threatening, or degrading. The purpose of the study is to gather quantitative data on the impact of the Yard Management System on detention occurrence and inbound and outbound volume, and qualitative insights from stakeholders, including managers, operators, and truck drivers. The qualitative data will be collected through interviews designed to explore their perspectives and opinions related to the implementation and effect of the Yard Management System in the distribution center. The interview will be conducted respectfully and professionally, ensuring participants feel comfortable sharing their insights without encountering offensive or degrading material.

G. Approximately how much time will be demanded of each subject?

Each interview will be approximately 30 minutes.

H. Who will be the subjects in this study? How will they be solicited or contacted? Provide an outline or script of the information which will be provided to subjects prior to their volunteering to participate. Include a copy of any written solicitation as well as an outline of any oral solicitation.

The subjects in this study include three distribution centers and their managers, operators, and truck drivers. The researcher will recruit participants via email and oral solicitation before volunteering. The invitation letter and informed consent forms will be compiled via SurveyMonkey on a web page for participants to read and sign and the research to collect.

Refer to the documents Recruitment Documents and Informed Consent for details.

I. What steps will be taken to insure that each subject's participation is voluntary? What if any inducements will be offered to the subjects for their participation?

There will be no inducements to be offered to the subjects for participation.

The oral solicitation will clearly state that participation is entirely voluntary. The solicitation will emphasize that subjects have the right to refuse participation or withdraw from the study at any point without facing any consequences or penalties. Informed consent forms will be provided to all potential participants, outlining the purpose of the study, the interview process, and their rights as participants. These forms will clearly state that participation is voluntary.

J. How will you insure that the subjects give their consent prior to participating? Will a written consent form be used? If so, include the form. If not, explain why not.

Informed consent forms will be provided to all potential participants, clearly outlining the purpose of the study, the interview process, and their rights as participants. The researcher will email the subject the Consent Agreement. The subject must review, sign, and return the Consent Form to the researcher before the interview is conducted., The consent Agreements are provided below.

K. Will any aspect of the data be made a part of any permanent record that can be identified with the subject? If so, please explain the necessity.

No aspect of the data collected will be made a part of any permanent record that can be identified with the subject to ensure confidentiality and anonymity. All information obtained during the study will be treated with strict confidentiality and reported in an aggregated and anonymized manner. Individual identities will be protected, and any data presented or published will be done so in a way that ensures the subjects cannot be identified. Collected qualitative data will be deleted after two years of the accomplishment of the study.

L. Will the fact that a subject did or did not participate in a specific experiment or study be made part of any permanent record available to a supervisor, teacher, or employer? If so, explain.

No, the fact that a subject did or did not participate in a specific experiment or study will not be made part of any permanent record available to a supervisor, teacher, or employer.

M. What steps will be taken to insure the confidentiality of the data? Where will it be stored? How long will it be stored? What will be done with the data after the study is completed?

Access to the data will be limited to the designated researcher of the study, who will handle the data with strict confidentiality and adhere to ethical guidelines and legal requirements. All data collected will be stored securely. Depending on the nature of the study, data may be stored on encrypted electronic devices or in locked physical storage facilities to prevent unauthorized access. Personally identifiable information will be separated from the research data to maintain anonymity. Data will be assigned unique identifiers or pseudonyms to protect the participants' identities further. Only aggregated and anonymized data will be reported or published to ensure no individual participant can be identified from the findings. Any audio or video recordings of the interviews will be

N. If there are any risks involved in the study, are there any offsetting benefits that might accrue to either the subjects or society?

In the context of the study on perceptions of the newly implemented yard management system, there might be minimal risks associated with participating, such as potential discomfort or time commitment during the interview process.

In terms of offsetting benefits, both the subjects and society can potentially gain several advantages. Subjects themselves can benefit by having the opportunity to voice their opinions and experiences related to the yard management system. Their insights can improve the system, enhance work processes, increase efficiency, and

O. Will any data from files or archival data be used? If so, please describe.

The study will use archival data of detention occurrence and inbound and outbound volume measured in pounds from three logistics centers located in Easter, Midwestern, and Western in 2018 and 2022 to conduct quantitative method research. The archival data will be collected from three distribution centers of a third-party logistics corporation's SQL Server databases. The researcher acquires permission from the logistics corporation division manager to access the data for analysis. The logistics corporation retains data ownership, and the researcher is granted access solely to conduct the specified research project. Measures were implemented to safeguard the confidentiality and security of the data, including storage of the data in password-protected devices and restricted

Appendix C. Baker University IRB Approval

BAKER UNIVERSITY
Own Confidence

Baker University Institutional Review Board

June 24, 2024

Dear Ziang Wang and Regena Aye,

The Baker University IRB has reviewed your project application and approved this project under Expedited Status Review. As described, the project complies with all the requirements and policies established by the University for protection of human subjects in research. Unless renewed, approval lapses one year after approval date.

Please be aware of the following:

1. Any significant change in the research protocol as described should be reviewed by this Committee prior to altering the project.
2. Notify the IRB about any new investigators not named in original application.
3. When signed consent documents are required, the primary investigator must retain the signed consent documents of the research activity.
4. If this is a funded project, keep a copy of this approval letter with your proposal/grant file.
5. If the results of the research are used to prepare papers for publication or oral presentation at professional conferences, manuscripts or abstracts are requested for IRB as part of the project record.
6. If this project is not completed within a year, you must renew IRB approval.

If you have any questions, please contact me at skimball@bakeru.edu or 785.594.4563.

Sincerely,

Scott Kimball, PhD
Chair, Baker University IRB

Baker University IRB Committee
Tim Buzzell, PhD
Steve Massey, EdD
Jiji Osiobe, PhD
Susan Rogers, PhD

Appendix D. Invitation Letter

Dear potential participant,

I invite you to participate in my research study, "An Examination of the Impact of a Yard Management System on Three Third-Party Logistics Operations Centers," headed by Ziang Wang at the Graduate School of Education at Baker University. I am an IT professional who develops and implements yard management systems.

As you may know, distribution center yard invisibility can cause high detention charges and negatively impact the inbound and outbound volumes. My research will help us determine if a yard management system impacts detention occurrence, inbound and outbound volumes, and stakeholders' perceptions. The findings in this study will be helpful to system developers in developing a system that meets the stakeholders' needs, improve efficiency, and reduce operating costs.

Participation in this study is entirely voluntary. I sincerely hope that you will participate.

If you would like to know more about the study, please email me at ZiangWang@stu.bakeru.edu.

Best regards,
Ziang Wang, Ed.D. candidate
IT specialist
Holman Logistics
ZiangWang@stu.bakeru.edu

Appendix E. Interview Protocol

Research Questions:

RQ 4: What are the perceptions of third-party logistics distribution center managers at the Western, Midwestern, and Eastern sites regarding the YMS implemented in 2018?

RQ 5: What are the perceptions of third-party logistics distribution center operators at the Western, Midwestern, and Eastern sites regarding the YMS implemented in 2018?

RQ 6: What are the perceptions of truck drivers delivering to the Western, Midwestern, and Eastern third-party logistics distribution center sites regarding the YMS implemented in 2018?

Creswell and Poth's (2016) interview Guidelines

- Staying within the study boundaries
- Using the provided protocol to guide the interview
- Ensuring the interview is completed on time
- Maintaining respect and courtesy throughout
- Actively listening by limiting questions and advice

Opening Script:

[Begin by exchanging pleasantries.]

> Thank you again for participating in this study. The purpose of this study is to explore the impact of the Yard Management System implemented in 2018 on detention occurrence and inbound and outbound volumes as measured in pounds. The interview lasts around 30 minutes.
>
> Before we proceed with the interview questions, I'd like to address a few points. Firstly, I appreciate you signing the consent form. Thank you for that. Secondly, if there's a moment where you'd like to pause the interview or decline to answer any specific questions, please feel free to let me know. Thirdly, I'll be recording our conversation, but I want to assure you that your identity and the contents of this interview will be kept confidential. Additionally, once the study concludes, I'll delete the recording permanently.

Based on all the information I shared, there are two questions for you:

1. Do you have any questions regarding the study or the interview?
2. May I record this interview?

[RENAME PARTICIPANT's NAME IN ZOOM]

> Thank you. I started recording. With the interview on recording, can you confirm verbally that I have your permission to record the interview?
>
> Thank you. Let's start.

Interview Questions:

Question (Prompt)	Probes and Follow-up Questions	Rational
Q1: Could you describe your roles and responsibilities as logistics distribution center manager, operator, or truck driver?	Probe for: • Center location • Time in the current role • Time at the center	• Open conversation • Demographics
Q2: What strategies have you implemented to improve inbound and outbound performance	Probe for: • Which strategy proved the most effective, and why do you think that was the case? • Can you share any insights or lessons learned from implementing these strategies?	• Open conversation • Demographics
Q3: In your experience, how does implementing the Yard Management System impact yard visibility within the distribution center?	Probe for: • How has the YMS integration with other systems (like the Warehouse or Transportation Management systems) influenced overall operational efficiency? • What feedback have you received from yard staff regarding the YMS?	• RQ 4 • RQ 5 • RQ 6
Q4: From your perspective, what operational improvements have been observed since implementing the Yard Management System in the yard?	Probe for: • Can you identify areas where improvements are most noticeable in yard operations? • Could you describe how the YMS has impacted employee satisfaction and workload in the yard?	• RQ 4 • RQ 5 • RQ 6
Q5: What features or aspects of the Yard Management System are the most valuable or advantageous for	Probe for: • Are there any features of the YMS that mainly help deal with peak times or unexpected surges in activity?	• RQ 4 • RQ 5 • RQ 6

distribution center operations?	• Which YMS features have improved communication and coordination between the yard and warehouse staff most effectively? • What aspects of the YMS have had the most significant impact on reducing errors or improving accuracy in yard operations?	
Q6: What key challenges did you face while implementing the YMS, and how did they affect yard operations?	Probes for: • Could you specify any technical issues encountered with the YMS during the initial setup? • How did these challenges impact the day-to-day operations in the yard during the implementation phase? • What measures were taken to address these challenges, and were they effective? • Were there any unexpected challenges that arose during the implementation, and how were these managed? • How did the implementation challenges affect the staff's acceptance and usage of the YMS? • Looking back, what would you have done differently to mitigate these challenges?	• RQ 4 • RQ 5 • RQ 6
Q7: Do you have any other comments you would like to share about your experience with the Yard Management System?		• RQ 4 • RQ 5 • RQ 6

Closing Script: That's all my questions. Thank you very much for your participation and time. Your response is invaluable to my study. Do you have further questions for me?

Thank you again!

Appendix F. Informed Consent

An Investigation on Impact of A Yard Management on Third-Party Logistics Operations Informed Consent Form

Purpose: The first purpose of the current concurrent mix method study is to evaluate the impact of the new Yard Management System (YMS) based on the Pershing Human Performance Technology Fundamentals on detention charges and inbound and outbound volumes. The researcher explores the impact of a YMS for third-party logistics inbound and outbound products in pounds and detention cost by comparing the quantitative measures from 2018 to 2022 for significant changes. It also investigates the perceptions of managers, operators, and truck drivers from different sites on the new YMS.

Participant Selection: This study employs specific selection process participants to ensure the representation of critical stakeholders—managers, operators, and truck drivers—and diverse perspectives related to the YMS. Manager and operator participants are purposively selected based on their involvement in the operation to capture a range of experiences, expertise, and perceptions within the study context. Truck driver participants adopt the convenient sampling method—the researcher randomly selects the inbound or outbound truck drivers of the three logistics centers who used the YMS for interviews during the qualitative data collection. By employing a thoughtful and purposeful selection process, the study aims to enhance the validity and richness of the data gathered and provides a comprehensive understanding of the YMS from multiple perspectives.

Risks: There are no anticipated risks associated with participating in this study. However, if you feel uncomfortable with a question, you may skip it or exit the interview anytime.

Benefits: In offsetting benefits, the subjects and society can gain several advantages. Subjects themselves can benefit by having the opportunity to voice their opinions and experiences related to the Yard Management System. Their insights can improve the system, leading to enhanced work processes, increased efficiency, and a better working environment. On a broader scale, society can benefit from the study as it contributes to the advancement of knowledge in the field of distribution center operations. The research findings may lead to the development of best practices and guidelines that can be applied within the specific organization and in similar contexts across different industries and sectors. By participating in the study, subjects can contribute to positive changes in their work environment and influence the industry, leading to improved practices, increased efficiency, and better working conditions.

Compensation: No.

Confidentiality: Any feedback you provide in the interview will be kept confidential. Your data will remain anonymous, which means your name will not be linked to the data you provide. Only the researcher has access to the collected data. All collected data will be deleted after two years of the completion of the study.

Voluntary Participation/Right to Withdraw: Participation in this study is completely voluntary. Refusal to participate will involve no penalty. You can decide not to answer any question you feel is too personal or sensitive. You have the right to withdraw from the study at any point without penalty or notice to the researcher(s). You are under no obligation to participate in this study.

Voluntary Consent: I have read the above statements and understand what is being asked of me. I also understand that my participation is completely voluntary and that I can withdraw my consent at any time, for any reason, without penalty. On these terms, I certify that I am willing to participate in this research project.

For questions about this study or if you would like to know the results of the study, please contact:

Principal Investigator:
Ziang Wang
ziangwang@stu.bakeru.edu

Faculty sponsor/advisor:
Dr. Regena Aye
regena.aye@bakeru.edu

*I have read the above statement and consent to participate in this interview.
Yes
___ No

Signature _____