

**MAKERERE**



**UNIVERSITY**

**COLLEGE OF BUSINESS AND MANAGEMENT SCIENCES (CoBAMS)**

**ASSESSING AUTOMATION OF DISTRIBUTION OPERATIONS AT  
JOINT MEDICAL STORE IN UGANDA**

**BY**

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**A RESEARCH REPORT SUBMITTED TO THE GRADUATE SCHOOL IN PARTIAL  
FULFILLMENT FOR THE AWARD OF A MASTER OF BUSINESS  
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**DECLARATION**

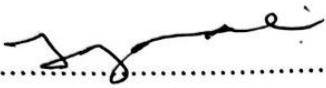
I **Bridget Abamushaba**, hereby declare that this research report is my original work and has never been presented or submitted to any institution of higher learning for any award.

Signed: .....  ..... Date: *10th October 2025* .....

**Bridget Abamushaba**

### APPROVAL

This research report by **Bridget Abamushaba** was compiled under my supervision and guidance. With my approval, it is now complete and ready for submission to the board of examiners of Makerere University, College of Business and Management Sciences.

Signed:  .....

Date: 15/10/2025 .....

**Dr. Jude Thaddeo Mugarura**

## **DEDICATION**

This report is dedicated to my family, Mr Mugisha Wilson Nsingwire and Mrs. Betty Adyeri Mugisha, my siblings Kemba, Bernice, Faith, Albert, Osborne and Sabatine whose unwavering love, encouragement, and patience have been the foundation of my journey. Their constant support and prayers have strengthened my resolve, and their belief in me has inspired every step of this work. Above all, I thank God for being the source of my strength and wisdom throughout this journey.

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## **LIST OF ABBREVIATIONS AND ACRONYMS**

CEO	Chief Executive Officer
CG	CORPORATE GOVERNANCE
JMS	Joint Medical Store
CoBAMS	College of Business and Management Science
CVI	Content Validity Index
GDP	Gross Domestic Product
KRI	Key Risk Indicators
ORM	Operational Risk management
SD	Standard Deviation
SPSS	Statistical package for social scientists

## ABSTRACT

The study investigated the automation of distribution operations at Joint Medical Store (JMS) in Uganda. The study was premised on three objectives; to examine the automation practices of distribution operations at Joint Medical Store (JMS,) To assess the challenges faced in automating distribution operations at Joint Medical Store (JMS) and to establish strategies for improving the automation of distribution operations at Joint Medical Store (JMS). The study employed a descriptive cross sectional research design with a quantitative study approach which involved collecting numerical data from 85 respondents out of a sample of 108 JMS staff, using a survey questionnaire. Data were analyzed using the statistical package for social science (SPSS Version 27).

Findings on automation practices revealed high adoption levels, with automated order processing systems ranked highest (mean = 4.33), followed by barcode scanners, regular system updates, and integration procedures, all rated “high” or “very high.” However, some practices like inventory management and staff training showed moderate variability, indicating room for improvement. Regarding challenges, network interruptions (mean = 3.57) and limited funding (mean = 3.43) were the most significant barriers, while technical skill gaps and lack of specialized personnel were rated as moderate. Staff resistance and infrastructure limitations were ranked lowest, though still relevant. In terms of improvement strategies, allocating more funding (mean = 3.83), providing refresher courses (mean = 3.80), and enhancing training programs (mean = 3.78) received strong support, while infrastructure upgrades and procurement reforms were rated moderately. Overall, the results highlight a strong foundation for automation at JMS, tempered by technical and organizational constraints that require strategic investment and capacity building. Therefore, the study recommends allocating dedicated funding for automation initiatives to ensure consistent investment in technologies that enhance distribution efficiency, including inventory management systems, barcode scanners, and real-time tracking tools. It further recommends enhancing staff training programs to build technical competence and confidence in using these tools through structured onboarding, role-specific instruction, and continuous learning. To strengthen system reliability and reduce dependence on external support, the study also recommends recruiting specialized technical personnel to maintain and optimize automation systems.

## **CHAPTER ONE:**

### **INTRODUCTION**

#### **1.1 Introduction**

The automation of distribution operations at Joint Medical Store (JMS) in Uganda has become increasingly vital for enhancing efficiency, accuracy, and responsiveness within the national healthcare supply chain. As a central medical warehouse serving both public and private health facilities, JMS has adopted various automation tools, including barcode scanners, Radio Frequency Identification (RFID) systems, and automated order processing platforms. However, the implementation of these technologies faces challenges such as skill gaps and infrastructure constraints. This study was therefore conducted to assess the current state of automation at JMS, identify operational and human resource barriers, and propose strategic interventions to strengthen automation practices and improve service delivery across Uganda's health sector.

This chapter presents key components of the study, including the background to the study, statement of the problem, purpose of the study, objectives, research questions, scope, and significance.

#### **1.2 Background**

The automation of drug distribution is integral to improving the efficiency of pharmaceutical supply chain management. This process encompasses various stakeholders involved in the handling, storage, and delivery of medications, ensuring the seamless movement of supplies (Sharma et al., 2021). Such growth is driven by the increasing prevalence of counterfeit drugs, the rising demand for more effective supply chain management, and expanding investments in pharmaceutical research and development (Hänninen et al., 2023).

The global pharmaceutical asset management market, projected to grow at a Compound Annual Growth Rate (CAGR) of 10.8% from 2018 to 2030, underscores the urgent need to refine operational processes and adopt advanced hardware solutions (Hakim, 2021). Technologies such as track-and-trace systems and Radio Frequency Identification (RFID) tags have emerged as

pivotal in enhancing inventory management, addressing counterfeiting concerns, and supporting the proper storage and handling of pharmaceutical products (Mordor Intelligence, 2024; Grand View Research, 2024). RFID-enabled platforms are increasingly favored for their near-zero read latency, real-time monitoring capabilities, and ability to reduce stock-outs and recall costs—especially for high-value biologics and temperature-sensitive drugs (TraceLink, 2024). Regulatory frameworks such as the Drug Supply Chain Security Act (DSCSA) in the United States and the EU Falsified Medicines Directive have further accelerated the adoption of serialization and automated verification systems (FDA, 2024). As automation gains traction, it fosters improved accountability, transparency, and responsiveness across pharmaceutical supply chains (Industry Growth Insights, 2024).

In Sub-Saharan Africa, distribution challenges are exacerbated by infrastructure gaps and limited access to technology (Sah & Furedi-Fulop, 2022). Many organizations operate in areas with unstable transportation and communication systems, leading to slower asset turnover and higher costs (World Bank, 2021). According to a 2022 African Union survey, 58% of organizations struggle with stock management due to poor practices, while a lack of formal training forces them to rely on outdated methods (Sah & Furedi-Fulop, 2022). This inefficiency results in overstocking or stock-outs, which diminishes profitability, causes asset value loss, and hinders growth potential. Addressing these issues is crucial for boosting the region’s competitiveness and promoting long-term economic development (Alhassan & Muhammad, 2022).

In Uganda, distribution management in terms of order fulfilment, warehousing, inventory management, and transportation poses a significant challenge within the health sector, particularly among pharmaceutical facilities (Atim, 2018). According to Lugada et al. (2022), less than half (42%) of pharmacies in the country use computer hardware for asset management, and only 6% employ Electronic Management Systems. Komakech et al. (2022) highlighted additional challenges, including ineffective structures to support inventory planning, coordination, and management, inadequate funding, shortages of skilled staff, and slow adoption of electronic asset management. These factors collectively hinder the efficient distribution of drugs in Uganda (Nabukeera, 2019).

Joint Medical Store (JMS) in Uganda faces persistent challenges that undermine its efficiency and reliability in pharmaceutical distribution. These include inventory losses, pilferage, and damage, which inflate operational costs and disrupt supply continuity (Darus, 2021). Skill gaps and limited staff involvement in inventory planning weaken accountability and responsiveness (IAPHL, 2023). Infrastructure constraints—such as inadequate cold chain capacity and limited storage space—complicate the handling of temperature-sensitive products, (Komakech, 2023). Additionally, poor documentation, fragmented communication, and insufficient training expose JMS to operational and outsourcing risks, calling for strategic interventions to strengthen its automation and service delivery systems.

For an organization to efficiently deliver medicines, it must quickly respond to short-term changes in demand or supply and handle external disruptions smoothly. The Joint Medical Store (JMS), a private-not-for-profit organization jointly owned by the Uganda Catholic and Protestant Medical Bureaux, has adopted electronic distribution systems to improve efficiency in procurement and supply chain responsiveness. Electronic distribution enhances cost reduction, transparency, accountability, and timely information flow through systems like barcoding, Electronic Data Interchange (EDI), Enterprise Resource Planning (ERP), and web-based communication (Madawaki et al., 2022). These allow JMS to promptly respond to facility needs (McCarthy & Golicic, 2022). However, despite these efforts, JMS faces challenges such as the delivery of expired drugs, misplaced stock, and underutilization of automation tools, leading to inefficiencies in distribution (Office of the Prime Minister, 2017). This has prompted the need to investigate automation in JMS's distribution operations.

Several scholars have explored various aspects of drug distribution. Internationally, Bett (2018) investigated the impact of inventory management practices on the economic performance of SMEs in Bangalore, revealing a strong positive correlation between effective inventory management and economic indicators. Similarly, Lugada et al. (2022) examined health inventory management systems in Uganda, highlighting deficiencies such as the lack of computer hardware and limited adoption of Electronic Inventory Systems, with only about 6% of facilities utilizing them. Additionally, Olawale and Garwe (2010) studied the challenges faced by SMEs in South Africa, identifying inadequate inventory practices as a significant contributor to business failures. Despite these contributions, there is limited research specifically focusing on automation of distribution

operations in Uganda. Therefore, this study aims to address this empirical gap by analysing the automation of distribution operations at Joint Medical Store (JMS) in Uganda (Daniels et al., 2020; Shanmugaraja et al., 2020).

This study is anchored on Principal–Agent Theory, which elucidates the relationship between principals (e.g., healthcare facility managers) and agents (e.g., JMS employees) who act on their behalf. The theory is particularly relevant in contexts where agents are expected to implement systems designed to enhance organizational performance. In this case, JMS’s automation systems aim to promote best practices in distribution, and their successful implementation depends on agent compliance and role clarity (Nwaobia et al., 2016; Boniface, 2018). This theoretical lens helps clarify stakeholder responsibilities and informs the study’s analysis of system uptake and performance outcomes.

### **1.3 Statement of the Problem**

Effective automated systems enable access to real-time data, fostering better decision-making. Globally, many governments and private distributors have automated distribution operations to provide real-time data, enhance efficiency, and improve responsiveness in the distribution of medicines and medical supplies (Świrska, 2022). These initiatives aim to resolve distribution challenges, reduce costs, and improve responsiveness to customer demands or public health needs (Oluwagbade & Odumbo, 2025).

In Uganda, JMS has adopted systems such as barcode technology, the JMS+ Enterprise Resource Planning (ERP) system, and automated cold-chain monitoring devices to modernize inventory management. These technologies were intended to address persistent issues such as manual record-keeping errors, delays in delivery, and stock-outs. While these systems have enhanced transparency and efficiency to some degree, significant challenges persist.

For example, a 2023 internal assessment revealed that out of more than 3,000 health facilities served by JMS, approximately 2,750 did not receive the required or planned supplies, resulting in a shortfall valued at UGX 21.7 billion (Joint Medical Store [JMS], 2023). Additionally, JMS recorded a 146% increase in non-viable stock, rising from UGX 9.8 billion in 2022 to UGX 24.1 billion in 2023, which contributed to increased costs for storage and destruction, further straining

operational resources (JMS, 2023). During the COVID-19 pandemic, JMS also faced challenges in vaccine management. By November 2023, 3.2 million doses had expired, leading to a financial loss of UGX 16.2 billion, while another 4.1 million doses were at risk of expiry by December 2023 if not utilized (JMS, 2024; Business Focus, 2024).

Scholarly works by Rika (2023) and Ajulong et al. (2021) emphasize that such inefficiencies in drug distribution, particularly in inventory management and last-mile delivery, are common in Uganda and across low- and middle-income countries. Both underscore the urgent need for robust technological interventions to strengthen distribution systems and minimize wastage. Given this background, this study investigated the automation of distribution operations at Joint Medical Store (JMS) in Uganda.

#### **1.4 Purpose of the Study**

To investigate the automation of distribution operations at Joint Medical Store (JMS) in Uganda.

#### **1.5 Study Objectives**

1.5.1 To examine the automation practices of distribution operations at Joint Medical Store (JMS).

1.5.2 To assess the challenges faced in automating distribution operations at Joint Medical Store (JMS).

1.5.3 To establish strategies for improving the automation of distribution operations at Joint Medical Store (JMS).

#### **1.6 Research Questions**

The study sought to answer the following research questions:

1.6.1 What are the automation practices of distribution operations at Joint Medical Store (JMS)?

1.6.2 What are the challenges faced in automating distribution operations at Joint Medical Store (JMS)?

1.6.3 What are the strategies for improving the automation of distribution operations at Joint Medical Store (JMS)?

## **1.7 Scope of the Study**

This section is sub divided into Content Scope, geographical and time scope

### **1.7.1 Content Scope**

The study was primarily focused on examining the automation practices of distribution operations at JMS, assessing the challenges encountered in automating these operations, and identifying ways to improve the automation of distribution processes. This focus was selected in response to persistent inefficiencies, elevated operational costs, and recurrent delays in the timely delivery of essential medical supplies to health facilities across Uganda—issues that directly compromise service quality and undermine the intended benefits of automation in public health logistics.

### **1.7.2 Geographical Scope**

The study was conducted at key operational sites of Joint Medical Store (JMS) within Kampala District, Central Region, Uganda. These included the JMS headquarters, central warehouse, and pharmacy in Nsambya, as well as the distribution unit in Old Kampala. These locations were selected due to their strategic role in coordinating medical supply distribution across Uganda and their relevance to the automation systems under study.

### **1.7.3 Time Scope**

The study focused on the period between 2019 and 2025, a transformative phase for Joint Medical Store (JMS) marked by substantial investments in automation across its distribution operations. Key milestones during this period include the adoption of barcode technology, implementation of the JMS+ ERP system, and enhancement of cold chain management through partnerships with B Medical Systems. These innovations were introduced to address persistent inefficiencies, stock-outs, and delays, with the goal of improving supply chain performance and ensuring timely delivery of medical supplies to health facilities across Uganda (JMS, 2023; New Vision, 2019).

## **1.8 Significance of the Study**

The study will benefit the following stakeholders

### **1.8.1 Joint Medical Store**

The findings will help JMS identify areas where automation can be improved in distribution operations. By enhancing automation, JMS can increase operational efficiency, reduce logistical costs, and ensure timely and accurate delivery of essential medicines and supplies to health facilities across Uganda.

### **1.8.2 Government of Uganda**

The study will provide the government with valuable insights into the effectiveness of automation within non-state health supply chains. This can inform policies that strengthen collaborations with private-not-for-profit distributors like JMS to improve national healthcare service delivery.

### **1.8.3 Healthcare Facilities**

The study will support healthcare facilities by promoting more reliable and efficient distribution systems. With improved automation, hospitals and clinics will experience fewer stock-outs, more consistent access to medicines, and better-quality care, leading to enhanced service delivery for patients.

### **1.8.4 Pharmaceutical Suppliers**

Suppliers will gain insights into the challenges and opportunities in JMS's distribution process. Understanding the needs and limitations of JMS can foster stronger partnerships, improve communication, and help suppliers meet demand more effectively.

### **1.8.5 Scholars and Researchers**

The study will fill existing knowledge gaps by providing a deeper understanding of automation practices in Uganda's healthcare sector, particularly in drug distribution. It will shed light on challenges such as technology integration in supply chains and provide evidence-based insights for future research.

### **1.9 Justification of the Study**

The study is justified by the pressing need to address inefficiencies within the distribution operations of JMS. Despite significant investments in automation between 2019 and 2025, challenges such as delivery delays, stock-outs, and wastage due to expired drugs persist. Internal assessments in 2023 revealed that non-viable stock at JMS increased by 146%, while millions of vaccine doses expired unused. These inefficiencies increase operational costs, compromise service delivery to healthcare facilities, and ultimately impact patient care.

The study's focus on automation is timely and relevant, as JMS has adopted systems like barcode technology, the JMS+ ERP system, and automated cold chain management devices to improve operations. However, gaps in the full integration and utilization of these technologies underscore the need for a detailed investigation into their effectiveness. Understanding the impact of automation on real-time inventory tracking, delivery timelines, and overall supply chain efficiency is essential for addressing these gaps (Sharma et al., 2021).

By focusing on the period of 2019 to 2025 a transformative phase for JMS, this research captured valuable lessons for scaling automation initiatives and informing similar projects in other regions.

This study is significant not only for improving Uganda's healthcare supply chain but also for advancing the broader discourse on automation in public health distribution systems, particularly in developing countries (Hänninen et al., 2023).

## **CHAPTER TWO:**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

Literature review plays an essential role in the research process as it provides substantial information to a researcher on a specific topic that relates to a practical research problem (Budhathoki, 2021). This section covers, the key concepts of the study, the theoretical review and the empirical review where past information is discussed in line with study objectives.

#### **2.2 Key concepts of the study**

Defining key concepts is vital when one undertakes research, and this stems from the fact that in some instances, one concept may actually have different and/or diverse meanings (Hesketh & Cooper, 2023). Thus, this section provides the definitions of the key concepts adopted in this current study.

##### **2.2.1 Automation of Distribution Operations**

In the healthcare sector, automation of distribution operations refers to the application of technology to streamline the movement, storage, and tracking of pharmaceutical products from manufacturers to healthcare facilities and, ultimately, to patients (Ramamoorthy, 2024). This includes the use of software systems, robotics, barcoding, Radio Frequency Identification (RFID) tracking, and automated dispensing units to ensure accurate, efficient, and secure delivery of medicines. By minimizing manual handling, automation reduces the risk of human error, enhances inventory management, and accelerates supply chain processes (Abedi et al., 2023).

The primary objective of automating drug distribution in healthcare is to improve both efficiency and safety. For example, hospitals use automated storage and retrieval systems (ASRS) and pharmacy robots that can prepare prescriptions with high precision, significantly reducing medication dispensing errors (Sarkis et al., 2024). These technologies also offer real-time data on stock levels, expiration dates, and consumption rates, enabling better forecasting and timely replenishment. Automation further supports compliance with regulatory standards by maintaining digital audit trails of every transaction in the supply chain (Chava, 2022).

As healthcare systems face increasing demand and complexity, automation serves as a critical enabler of resilience and responsiveness. Especially in public health programs, where timely access to essential medicines can be life-saving, automated systems help reduce stock-outs, eliminate wastage, and ensure medicines reach underserved communities reliably (Zayas-Cabán et al., 2021). Moreover, digital platforms integrated with national health information systems allow for centralized oversight and coordination, helping policymakers and supply chain managers make data-driven decisions that enhance service delivery and patient outcomes (Trenfield et al., 2022).

### **2.2.2 Inventory management**

Inventory management is the heart of pharmaceutical supply system, without which, the entire pharmaceutical supply system would not be viable (Gizaw & Jemal, 2021). It involves ordering, receiving, storing, issuing and reordering a limited list of products. Poor inventory management in pharmaceutical businesses has leads to waste of financial resources, shortages or averaging of essential medicines resulting into expiration and decline in quality of healthcare given to patients (Jobira et al., 2021).

Inventory management is the process of efficiently controlling and monitoring the flow of goods, raw materials, and finished products through a company's supply chain. (Mbugi & Lutego, 2022). It entails managing inventory acquisition, storage, tracking, and utilization in order to meet customer demand while reducing costs and increasing operational efficiency (Sinha & Shunmugasundaram, 2021). Effective inventory management aims to strike a balance between keeping enough stock to meet customer demand and avoiding excess inventory, which can tie up capital and incur carrying costs (Mohamed, 2024). Companies that use inventory management techniques and strategies can improve their overall supply chain performance and profitability (Cao, 2023).

According to Gizaw and Jemal (2021) and Jobira et al (2021), inventory management is done through various inventory control techniques to optimize the operating efficiency of warehouse operations and the cost of investment. The commonly described inventory control techniques are the ABC analysis (follows the Pareto principal of 80/20 of 80/20 rule where items are classified based on sales value; VED (Vital, Essential and Desirable), FNS (Fast, Normal, and Slow-moving),

XYZ (based on value of items on storage), SDE (Scarce, Difficult, and Easy to obtain), and HML (High, Medium, and Low unit price of the material) categorization methods.

According to Tusher et al., (2021), inventory management is very useful to the pharmaceutical business through ensuring profitability, increasing productivity, aids in planning, forecasting, reduces stock-outs and expiries and ensure the customers demand is met leading to satisfaction of the customers. It ensures that the right amount of stock is available at the right time.

## **2.3 Theoretical Review**

This section discusses the theoretical underpinnings of the study, including the Technology Acceptance Model (TAM) and Theory of Competency (TC).

### **2.3.1 The Technology Acceptance Model (TAM)**

This study is grounded on the Technology Acceptance Model (TAM) developed by Davis, (1985) and it is widely used to study user acceptance of technology. According Chuttur (2009) this model is intended to explain and predict the acceptability of an information technology system, analyzing and exploring factors influencing the acceptability of a certain information technology system. TAM is based on the theory of reasoned action (TRA) which states that beliefs influence intentions and intentions influence one's actions. Various researchers have applied TAM in different studies like email use, e-learning, short messages and teleconferencing, among others. Davis (1985) argues that users' motivation can be explained by three factors; perceived usefulness, perceived ease of use and attitude towards system use. TAM explains that perceived usefulness (PU) and perceived ease of use (PEOU) influence one's attitude toward system usage, which impacts an individual's behavioral intention to use a particular system and also determines actual system usage.

According to Mohd Amir et al. (2020) perceived usefulness is the degree to which a person believes that using a particular system would improve their performance at work. Automation of distribution operations has produced positive changes and achievements observed like timely distribution, reduction of errors and arrears, timely inclusion in the system among others (CSBAG, 2016). This theory, however, ignores the fact that some users may fail to recognize the effect of the new technology. As such, it is imperative to ascertain whether perceived usefulness of the technology.

While the Technology Acceptance Model (TAM) effectively explains user adoption of technology based on perceived usefulness and ease of use, it lacks emphasis on individual competency and performance outcomes. TAM does not account for variations in user expertise, learning processes, and the ability to apply technology effectively in a work environment (Gizaw & Jemal, 2021). The Theory of Competency (TC), on the other hand, focuses on knowledge, skills, and motivation as determinants of job performance, making it a valuable complement to TAM. By integrating TC, the study can address the gap in TAM by considering how users' competency and experience influence the effectiveness of technology adoption, particularly in the automation of distribution operations at Joint Medical Store.

### **2.3.2 Theory of Competency**

Campbell's (1990) model clearly differentiates between components of performance, determinants of performance, and the factors that lead to those determinants. Performance components represent various dimensions that make up overall job performance. Campbell identified three key performance determinants: declarative knowledge, procedural knowledge and skills, and motivation (Campbell, 1990; Campbell et al., 1993). Declarative knowledge encompasses facts, principles, goals, and self-awareness, influenced by a person's abilities, personality, interests, education, training, experience, and aptitude interactions. Procedural knowledge and skills involve cognitive and psychomotor abilities, physical skills, self-management, and interpersonal skills, with predictors similar to those of declarative knowledge, plus the element of practice. Motivation relates to the decision to perform, the intensity of effort, and the persistence of that effort, though Campbell does not specify its predictors. These elements are considered the direct determinants of performance for this study.

Campbell et al. (1996) found that job performance can be categorized into two main types: "job-specific" factors reflecting technical competencies and "non-job-specific" factors that are generally applicable across different jobs. Each category is multi-dimensional, with the latter including aspects like teamwork, self-development, adherence to organizational norms, and perseverance (Campbell et al., 1990). To ensure effective service delivery in university libraries, critical components include knowledge, interpersonal competence, administrative skills, communication abilities, and leadership. This study focuses on variables such as knowledge sharing, organizational

learning, leadership styles, personnel competence, and service delivery, emphasizing that service delivery is a direct outcome of job performance. Similarly, factors like teamwork, self-development, compliance with norms, and perseverance are essential for effective service delivery in university libraries (Campbell et al., 1990).

The study integrates the Technology Acceptance Model (TAM) and the Theory of Competency (TC) to analyze the automation of distribution operations at Joint Medical Store. While TAM explains user adoption based on perceived usefulness and ease of use, it overlooks the role of individual knowledge and skills in effectively utilizing technology (Gizaw & Jemal, 2021). TC fills this gap by emphasizing competency, motivation, and performance determinants, which influence how employees adapt to automated systems. By merging these theories, the study examines both technological acceptance and the necessary competencies for successful automation, addressing challenges in implementation and proposing strategies to enhance efficiency in distribution operations at JMS.

Although both TAM and TC offer valuable insights, this study adopts the Theory of Competency (TC) as its primary theoretical lens. TC provides a more comprehensive framework for understanding how individual knowledge, skills, and motivation influence the effective use of automated systems. Given the operational challenges at JMS, including inconsistent uptake of technology and performance gaps, TC offers a stronger foundation for analyzing the human factors that shape automation outcomes in distribution operations.

## **2.4 Empirical Review**

This section discusses the literature related to the three objectives of the current study.

### **2.4.1 Automation practices in distribution operations within healthcare supply chains.**

Automation in healthcare supply chain distribution plays a crucial role in improving efficiency, minimizing errors, and ensuring timely delivery of medical supplies. Automation practices are discussed below

#### **2.4.1.1 Automated Inventory Systems**

In enhancing operations for Echopharm Pharmacy, automated inventory is very crucial because such a system provides real-time tracking and advanced analytics that enhance this sort of management. According to Smith et al. (2023), these systems allow for the monitoring of stock levels accurately and hence can predict future needs based on historical data and patient prescriptions, which is important in a market that faces fluctuating demand. Johnson and Lee (2024) observe that these systems enhance demand forecasting because of the sophistication of the algorithms in analyzing the trends, therefore allowing Echopharm to derive valuable insights to make better purchasing decisions with minimal risk of overstock or stockouts. Automation enhances inventory accuracy through actionable insights by comprehensive reporting, Williams observes (2023), which allows Echopharm to optimize inventory levels and minimize expired medication waste, ensuring that essential drugs are available for purchase. Generally speaking, automated inventory systems streamline operations, improve financial performance, and enable Echopharm to offer better quality services.

#### **2.4.1.2 Radio-Frequency Identification (RFID)**

Radio-Frequency Identification (RFID) offers a significant advancement in tracking medical supplies, equipment, and blood products within healthcare supply chains. When integrated into hospital logistics, RFID enables automated identification and data capture, improving inventory accuracy and operational efficiency. Abugabah et al. (2022) developed an integrative adoption framework that highlights organizational, technological, and user-related factors affecting RFID implementation. Their model demonstrates how these dimensions influence the successful deployment of RFID systems for medical equipment management and error reduction. They emphasize the importance of considering individual user factors alongside traditional organizational and technological variables in dynamic healthcare environments (Abugabah et al., 2022).

In the domain of transfusion medicine, Coustasse, Cunningham, Deslich, Willson, and Meadows (2015) conducted a literature review on RFID's application in tracking blood products—from donation through transfusion. Their findings revealed that RFID adoption significantly improved provider productivity, reduced work time, and decreased errors in blood management processes, thereby enhancing both efficiency and patient safety. Nonetheless, they identified high

implementation costs and concerns regarding data security and patient privacy as major barriers to widespread adoption (Coustasse et al., 2015).

#### **2.4.1.3 IoT Tracking for Real-Time Visibility**

The Internet of Things (IoT) enables real-time visibility in healthcare logistics by connecting sensors, devices, and systems across the supply chain. IoT tracking allows for continuous monitoring of temperature-sensitive products, location data, and inventory status, which is especially critical for cold chain management and emergency medical supplies. When paired with RFID, IoT enhances traceability, responsiveness, and decision-making in distribution operations. However, successful implementation requires robust infrastructure, data integration capabilities, and user training to ensure system reliability and value realization (Abugabah et al., 2022; Coustasse et al., 2015).

#### **2.4.1.4 Barcoding Technology**

Barcoding technology significantly enhanced inventory accuracy and operational efficiency within pharmacy settings. By automating the data recording process, barcoding systems minimized human errors and streamlined inventory tracking. Anderson and Thompson (2023) emphasized that barcoding reduces manual entry mistakes and accelerates the identification and verification of pharmaceutical items. According to Poon, Keohane, and Gandhi (2010), barcoding systems in hospital pharmacies improved medication safety by ensuring correct drug dispensing and reducing adverse drug events. Similarly, Flynn et al. (2002) found that integrating barcoding into inventory workflows led to better stock control, reduced discrepancies, and improved accountability in pharmaceutical management. These benefits collectively contributed to more reliable inventory systems and enhanced patient care outcomes.

#### **2.4.1.5 Pharmacy Management Systems (PMS)**

Pharmacy Management Systems (PMS) offer a comprehensive approach to managing various aspects of pharmacy operations, including inventory. Nguyen and Lewis (2024) discuss how PMS platforms integrate inventory management with other pharmacy functions, such as prescription processing and patient records, providing a centralized data hub. Martinez (2023) emphasizes that

PMS facilitates better inventory oversight through advanced analytics and reporting capabilities, helping pharmacies make informed decisions and optimize stock levels.

Advanced analytics refers to the use of sophisticated data analysis techniques including predictive modeling, machine learning, and statistical algorithms to extract actionable insights from large and complex datasets. In pharmacy inventory management, advanced analytics enabled pharmacies to forecast demand, detect patterns in medication usage, and identify inefficiencies in stock handling. According to Davenport and Harris (2007), advanced analytics transformed decision-making by moving beyond descriptive statistics to predictive and prescriptive insights. Chen, Chiang, and Storey (2012) emphasized that analytics tools allowed pharmacies to anticipate shortages, reduce waste, and improve service delivery by aligning inventory with patient needs. Similarly, Raghupathi and Raghupathi (2014) noted that in healthcare settings, advanced analytics supported real-time monitoring and strategic planning, enhancing operational efficiency and patient safety. These capabilities made analytics a critical component of modern pharmacy systems

#### **2.4.1.6 Cloud-Based Inventory Management**

Cloud-based inventory management solutions provide scalable and accessible inventory management options for pharmacies. Baker and Harris (2024) note that cloud-based systems offer the advantage of scalability, allowing pharmacies to manage inventory across multiple locations from a single platform. Lee (2023) adds that these systems also enhance data security, ensuring that sensitive inventory information is protected against breaches and unauthorized access.

In addition to scalability and security, cloud-based inventory systems demonstrated significant potential in enhancing forecast accuracy and operational efficiency through integration with machine learning algorithms. Chebet and Mbandu (2024) found that cloud-enabled platforms, particularly those leveraging AWS PaaS and XGBoost models, improved inventory forecast accuracy by 65% and reduced stock-outs by the same margin. Their study, conducted across 100 pharmacies in Nairobi County, revealed that cloud-based systems facilitated real-time data analysis, enabling pharmacies to respond swiftly to fluctuations in demand and supply. This predictive capability was especially valuable in managing essential medications and minimizing financial losses due to expired or excess stock (Tan et al., 204). Furthermore, the combination of cloud computing and machine learning supported continuous system optimization, allowing

pharmacies to refine inventory strategies based on historical trends and consumption patterns. These findings underscored the transformative role of cloud-based technologies in modernizing pharmacy inventory management and improving patient care outcomes.

#### **2.4.1.7 Regular Audits**

Regular audits are essential for effective inventory management, particularly in healthcare supply chains where accuracy and accountability are critical. Adams and Wilson (2024) underscore the importance of conducting routine physical counts and reconciliation audits to identify discrepancies between actual and recorded inventory levels. These audits help prevent stockouts, overstocking, and inventory loss, thereby contributing to improved financial performance and regulatory compliance (Fleexy, 2024). By systematically reviewing inventory records, organizations can enhance transparency, reduce operational risks, and ensure that supply chain decisions are based on reliable data.

#### **2.4.1.8 Staff Training**

Staff training plays a pivotal role in maintaining inventory integrity and operational efficiency. Moore and Clark (2023) emphasize that well-trained personnel are more likely to adhere to standardized procedures, detect anomalies, and respond proactively to inventory challenges. Ongoing training programs ensure that staff remain proficient in using inventory systems, applying audit protocols, and complying with safety and documentation standards (Miller, 2024). These efforts foster a culture of accountability and precision, which is essential for sustaining efficient and compliant inventory operations in dynamic healthcare environments.

#### **2.4.1.9 Just-in-Time (JIT) Inventory**

Hutchins (2019) defines JIT inventory technique as a process that is capable of instant reaction to demand without the need for any over stocking, either in anticipation of the demand being forthcoming or as a result of inefficiencies in the process. Hutchins (2019) also studied that the prime goal of just-in-time technique is the accomplishment of zero catalogue, not just within the confines of a single firm but ultimately on the whole supply chain. It can be applied to the

manufacturing process within any company as it is also being adapted within service organizations (Harrison, 2020).

The Just-in-Time (JIT) inventory technique minimizes stock levels by ordering medications only as they are needed. Brown and Davis (2023) discuss how JIT helps reduce holding costs and lowers the risk of medication expiration. This approach requires strong supplier relationships to ensure timely deliveries and avoid disruptions in inventory. Miller et al. (2024) emphasize that JIT can lead to cost savings and operational efficiencies but necessitates careful coordination with suppliers to maintain an uninterrupted supply of essential medications (Bose et al., 2019).

#### **2.4.1.10 ABC Analysis**

ABC analysis is a strategic inventory management technique used to prioritize inventory items based on their importance and value. This method classifies inventory into three categories to help focus management efforts on the most critical items. Category A items are the most valuable and account for a significant portion of the total inventory value, although they may represent a smaller percentage of the total items. These items often require close monitoring and frequent reordering due to their high value. Stevenson (2022) explains that Category A items are crucial to maintaining optimal stock levels and ensuring smooth operations, particularly in the context of high-cost or critical medications (Peter, 2023).

Category B items are of moderate value and importance. While they do not contribute as much to the overall inventory value as Category A items, they still require regular attention and management. Kumar and Rajan (2023) indicate that these items are essential but not as critical as Category A, necessitating periodic reviews to ensure appropriate stock levels and prevent shortages (Bose et al., 2019).

Category C items, on the other hand, represent the largest number of items but contribute the least to the inventory's overall value. These items are typically low-cost and have a slower turnover rate. Jackson (2024) points out that while Category C items are less critical, effective management is still important to avoid overstocking and excessive storage costs. By focusing on the value and turnover rates of different inventory categories, ABC analysis enables pharmacies to allocate

resources more efficiently, manage carrying costs effectively, and maintain a balance between inventory availability and operational costs (Okeke, 2018).

#### **2.4.1.11 Vendor Managed Inventory**

VMI is a rationalized method to inventory organization and order fulfillment whereby the vendor is accountable for replacement of inventory based on timely point of sale information to the retailers. The VMI concept helps to increase client receptiveness by tumbling the demand and supply gap thus providing fulfillment to final customers by availing the anticipated product when desired. The supply chain associates must share their requirements, vision of demand and constraint to set common objectives (Guillaume et al., 2018). The quality of buyer-supplier relationship and trust, ICT system quality and intensity of information sharing has positive an impact on VMI implementation (Claassen et al., 2018). Before implementing VMI, it is important to analyze the level of uncertainty of customer demand because a high uncertainty in demand negatively influences the performance attained through VMI (Kazim, 2017). Upstream data transferred to supplier's current inventory level and accurate sales forecast is the most important factor for the successful implementation of VMI (Aydin & Porteus, 2018). It also gives benefits to retailers as manufacturers stock more to reduce risk of stock out which in turn reduces retailer holding and shortage cost and increases its profit.

#### **2.4.1.12 Inventory Optimization Algorithms**

Recent advancements in data analytics have led to the development of sophisticated inventory optimization algorithms. White and Patel (2023) describe how these algorithms dynamically adjust reorder points and quantities based on real-time data and predictive analytics, reducing the incidence of stockouts and overstock situations. Garcia (2024) notes that these algorithms help pharmacies optimize their inventory levels by balancing supply with demand, thus ensuring that medications are available when needed while minimizing excess stock.

Moreover, machine learning models are increasingly being integrated into inventory systems to improve forecasting accuracy. These models can analyze historical sales patterns, seasonal trends, and external factors such as public health alerts to predict future demand more precisely. According to Lin and Ahmed (2024), incorporating such adaptive algorithms enables pharmacies to respond

proactively to sudden shifts in demand, leading to more resilient and cost-effective inventory management.

#### **2.4.1.13 Economic Order Quantity.**

The Economic Order Quantity practice is viewed as a conventional method of materials acquisition. It is a measure of material in an order that diminishes the total costs required to order and hold catalogue (Peter, 2020). This approach of placing large size of uncommon orders was conceptualized by Schonberger (2018). Harris' model could be modified to include different price discount schemes to better reflect the practice of the industry (Ray et al., 2024). According to Aydin and Porteus (2018), the assumptions of inventory management model is based on the fact that the firm knows with certainty the number of items of a particular inventory to be used or demanded for a specific time or period. (Globerman and Daniel, 2019) argues that the use of stocks or sales made by a firm remains unchanged throughout the period. This model also assumes that when stocks reach zero level, an order for replenishment should be placed without further delay.

#### **2.4.1.14 Enterprise Resource Planning.**

Enterprise Resource Planning (ERP) systems represent a significant advancement in inventory management for pharmacies and other businesses. ERP is a comprehensive software solution designed to integrate and manage various business processes through a unified system. Lysons and Farrington (2016) define ERP as a system that enables firms to streamline and automate core business functions, including inventory management, product development, manufacturing, sales, and human resources. This integration facilitates better coordination and efficiency across all aspects of business operations. According to Magutu et al. (2015; 2016), ERP systems provide a centralized platform for managing inventory data, which helps in optimizing stock levels and improving decision-making processes. Mose et al. (2023) and Schonberger (2018) highlight that ERP systems also support customization and analysis of data, allowing businesses to tailor their inventory management strategies to meet specific needs. Additionally, Harrison (2021) points out that ERP systems enhance communication and interaction among different business units, fostering a more cohesive and responsive operational environment. This comprehensive approach not only improves inventory accuracy but also contributes to overall operational efficiency and effectiveness in managing pharmacy operations.

## **2.5 The challenges faced in automating distribution operations within healthcare supply chains.**

The integration of automation into healthcare distribution systems has been met with persistent difficulties and the demand for equipment in distribution automation systems is significantly high. These difficulties are often linked to technological gaps, user resistance among others, all of which contribute to inefficiencies. Below are the major challenges that undermine the success of automation distribution operations in healthcare supply chains.

### **2.5.1 Infrastructure Limitations and System Integration**

One of the foundational barriers to automation in healthcare distribution is the lack of robust infrastructure and poor system integration. Many public health systems operate with limited access to stable electricity, reliable internet, and compatible software platforms, making it difficult to deploy and maintain automated tools. Kuteyi and Winkler (2022) emphasized that infrastructural gaps in Sub-Saharan Africa hamper the digital transformation of public institutions. Siddiqi et al. (2022) added that fragmented information systems often operate in silos, leading to inefficiencies and breakdowns in data sharing across procurement, warehousing, and delivery stages. Kanerika (2025) further noted that misaligned data formats and legacy platforms can delay or even stall integration efforts. IBM (2021) concluded that for automation to be effective, institutions must first invest in harmonized, interoperable systems that support real-time inventory visibility and communication between supply chain actors.

### **2.5.2 High Implementation Costs and Limited Funding**

Automation requires significant upfront capital investment in hardware, software, maintenance, and specialized staff. This cost burden is especially pronounced in public sector entities, which often operate under constrained budgets. Baloch and Rashid (2022) observed that healthcare institutions in developing economies frequently defer automation due to competing financial priorities. McKinsey (2025) noted that while automation promises long-term efficiency, the return on investment is often slow, making it less attractive in the short term. Searls (2023) highlighted that organizations, particularly those dependent on donor funding, hesitate to commit funds without guaranteed results or visible benefits. Ahmed et al. (2022) reinforced this concern,

pointing out that many healthcare agencies lack budget flexibility, resulting in delayed or partial implementation of automation technologies.

### **2.5.3 Workforce Resistance and Skills Gaps**

The successful deployment of automated systems depends not just on technology, but also on the human capital that operates and maintains them. However, many healthcare institutions face resistance from employees who fear job losses or are unfamiliar with digital platforms. Khan et al. (2023) found that resistance to change was a prominent challenge, especially where manual processes had been entrenched for years. Yohannes et al. (2022) argued that lack of structured digital literacy programs fuels anxiety and undermines adoption. Deloitte and Stern (2023) advocated for strong change management frameworks to prepare employees, emphasizing that involving staff in early planning stages enhances buy-in and eases transition. Similarly, Kuteyi and Winkler (2022) stressed the importance of tailored training that equips workers with not only technical knowledge but also the confidence to use new systems effectively.

### **2.5.4 Regulatory and Compliance Complexities**

Healthcare distribution systems must adhere to a range of legal and regulatory requirements to ensure patient safety, product integrity, and financial accountability. Automating operations within such a highly regulated environment introduces additional challenges. Abedi et al. (2022) highlighted that automation tools must comply with policies set by international and national drug authorities, requiring careful customization. SpringerLink (2024) underscored that weak or inconsistent regulatory frameworks in low-income countries create ambiguity, making automation implementation more complex. Simbo AI (2025) noted that technologies must include features like real-time audit trails and traceability functions to align with compliance protocols. Packer (2023) further noted that even automated systems in high-income countries face hurdles when dealing with sensitive items, such as narcotics and vaccines, which are subject to strict handling and documentation standards.

### **2.5.5 Supply Chain Disruptions and Data Visibility**

Automation thrives on predictability, and in the dynamic healthcare landscape, disruptions such as pandemics, strikes, and supplier shortages can compromise system efficiency. Rodimushkin (2022) pointed out that lack of real-time inventory data during emergencies hampers timely response and resource deployment. IBM (2021) echoed this by stating that incomplete or outdated data feeds into automated systems can lead to incorrect forecasts and misallocation. OSP (2022) found that healthcare organizations that lacked integrated data dashboards were more vulnerable to disruptions, particularly during COVID-19. Invensis (2025) recommended the adoption of IoT devices and AI analytics to enhance real-time monitoring and predictive decision-making tools that, while promising, still require investment and capacity to operate effectively.

### **2.5.6 Training and Skill Gaps:**

Another significant challenge is the lack of sufficient training and expertise among health care staff in operating and maintaining automated systems. Many employees are not adequately trained in using advanced technological tools for inventory management and distribution automation, leading to errors and inefficiencies in operations (Adepoju & Aigbavboa, 2021). Furthermore, the shortage of skilled workers in areas such as data analysis and system maintenance further exacerbates the difficulty of managing automation systems effectively. This skill gap prevents health care from fully realizing the potential benefits of automation, such as increased accuracy, efficiency, and cost reduction (Peter, 2023).

Peter (2023) emphasized that this skill gap hindered the full realization of automation's benefits, such as improved accuracy, cost reduction, and streamlined workflows. The shortage of personnel skilled in data analysis and system maintenance further exacerbated these issues, limiting the effectiveness of predictive analytics and automated decision-making tools (Badawy, Ramadan, & Hefny, 2023). Moreover, Simbo (2023) highlighted that successful automation required not only the acquisition of technology but also robust staff training programs tailored to diverse learning needs. Without such training, staff often struggled to integrate automation into daily operations, leading to resistance, underutilization, and compromised data integrity. Addressing this gap

through continuous education and capacity-building initiatives was essential for maximizing the return on investment and ensuring safe, efficient, and compliant use of automated systems.

## **2.6 The Strategies for improving the automation of distribution operations within healthcare supply chains.**

Strategic approaches are essential for enhancing automation in healthcare supply chain distribution, optimizing efficiency, minimizing errors, and improving overall operations, as discussed below

### **2.6.1. Leveraging Cloud-Based Inventory Management Systems**

Cloud-based platforms offer flexibility, scalability, and real-time visibility across multiple healthcare facilities. These solutions facilitate seamless coordination in stock management, order tracking, and demand forecasting. Baker and Harris (2024) highlighted how cloud solutions enhance oversight through centralized dashboards, while Lee (2023) emphasized integrated system features such as automated software updates and strong data security protocols. Nguyen and Lewis (2024) further observed that transitioning from on-premise to cloud systems reduces IT costs and improves service reliability. Salih et al. (2023) also demonstrated that although initial implementation may require technical support and staff training, cloud automation improves tracking accuracy and reduces unnecessary holding costs—making it particularly beneficial for small to mid-sized healthcare providers.

### **2.6.2 Investing in Regular Staff Training and Capacity Building**

Automation success depends not only on technology but also on the human workforce managing it. Comprehensive and ongoing training equips healthcare workers to operate automated systems efficiently while adapting to new tools and regulatory changes. Verweij and van Meerkerk (2021) stress that trained personnel are more likely to follow inventory protocols and maintain data accuracy. Moore and Clark (2023) add that knowledge of automation improves operational performance, and Adams and Wilson (2024) advocate for staff development as a long-term investment in system resilience. Martinez (2023) also notes that well-prepared staff reduce system downtime and contribute to a stronger internal culture of innovation in health logistics.

### **2.6.3 Customizing Automation and Software Solutions**

Every healthcare supply chain faces unique operational, regulatory, and logistical challenges. Tailored automation solutions such as configurable dashboards, role-specific access controls, or dynamic order fulfilment tools can meet these distinct needs more effectively than off-the-shelf systems. Vadde and Munagandla (2022) argue that software customization enhances workflow efficiency by aligning system behavior with specific service delivery demands. Personalized automation tools allow organizations to better respond to fluctuating inventory requirements, seasonal demand shifts, or localized health campaigns, all while minimizing waste and reducing turnaround times in supply chain activities.

### **2.6.4. Adopting Intelligent Handling Technologies (AGVs and AS/RS)**

Automated Guided Vehicles (AGVs) and Automated Storage and Retrieval Systems (AS/RS) can modernize warehouse environments by reducing manual labor, improving material flow, and optimizing space utilization. Khan et al. (2023) describe AGVs as adaptable transport tools that minimize errors in handling and support continuous operations. Similarly, Ajiga et al. (2024) highlight that AS/RS systems improve picking accuracy, lower labor costs, and reduce exposure to workplace hazards by automating bulk and small-item retrieval. These technologies are especially effective in large medical stores or centralized pharmaceutical warehouses where high-volume throughput is necessary.

### **2.6.5 Integrating Robotic Picking and Machine Learning Systems**

Advanced robotic picking systems, supported by artificial intelligence and machine vision, improve the speed and precision of inventory selection and packaging. Ajiga (2025) explains that robotic systems operate around the clock, ensuring consistent throughput and reducing human error. By using real-time data and learning algorithms, these systems adapt to shifts in demand and optimize order fulfilment without disrupting other supply chain functions. For health systems managing a wide range of SKUs, from cold chain vaccines to low-cost disposables, robotic picking provides a competitive advantage in responsiveness and accuracy.

### **2.6.6 Integrating Internet of Things (IoT) for Real-Time Monitoring**

The integration of Internet of Things (IoT) technologies into healthcare supply chains enhances operational oversight through real-time data collection and monitoring. Devices such as RFID tags, GPS trackers, and temperature sensors allow for continuous tracking of medical supplies, especially critical for cold chain items like vaccines, insulin, and biological specimens. This real-time visibility improves stock accuracy, minimizes waste from spoilage or expiry, and ensures compliance with storage and handling regulations. Studies like those by Exotec (2024) and FarEye (2024) emphasize that IoT-enabled logistics improve responsiveness by alerting managers to temperature excursions or shipment delays. These tools also support remote monitoring of environmental conditions, ensuring the integrity of sensitive items from warehouse to final destination. As healthcare supply chains become more digitized and patient demands more precise, IoT plays a pivotal role in bridging the physical and digital aspects of inventory control.

#### **2.6.7. Adopting Modular and Scalable Automation Solutions**

Modular and scalable automation technologies offer healthcare organizations the flexibility to expand or adjust their distribution operations without requiring a complete system overhaul. These include mobile racking systems, portable AS/RS units, modular conveyor belts, and scalable robotics that can grow with an organization's evolving needs. Exotec (2024) highlights how modular automation can achieve high-speed order retrieval while using minimal warehouse space, which is especially valuable in urban hospitals and pharmaceutical depots. McKinsey (2024) advises on phased implementation, allowing organizations to automate incrementally as budget and technical capacity grow. Scalable solutions help reduce upfront capital burdens while still achieving gains in efficiency, throughput, and accuracy. Additionally, Gartner (2024) notes that choosing flexible systems improves long-term agility, enabling rapid adaptation to changes in demand, disease outbreaks, or policy shifts in the health sector.

#### **2.7 Chapter summary.**

This chapter explored automation practices in distribution operations within healthcare supply chains, highlighting their transformative impact on efficiency, accuracy, and service delivery. Conceptual TAM and Theory of Competency provide a framework for understanding employee adoption and skill requirements. Empirical review covered automation tools such as automated inventory systems, RFID & IoT, PMS, ERP, cloud-based solutions, and optimization strategies,

while addressing challenges like infrastructure gaps, funding, workforce resistance, and compliance. Recommended strategies include cloud adoption, staff training, intelligent handling technologies, and scalable automation systems. These strategies are critical for ensuring that healthcare distribution systems are not only technologically advanced but also resilient, adaptable, and patient-centered.

The next chapter is research methodology which presents the procedures of how data analysis and methods will be carried out.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

Research methodology refers to the principles and procedures of logical thought processes which are applied to a scientific investigation (Zidane, 2015). This chapter explains the research

methodology that were used in conducting the study. The chapter entails the research design and approaches, the population study, the sampling design, the sample size, data sources, data collection instruments, data validity and reliability, data processing and analysis as well as ethical considerations of the of the study.

### **3.2 Research design**

The research design refers to the overall strategy that researchers choose to integrate the different components of the study in a coherent and logical way, thereby ensuring it effectively addresses the research problem. It constitutes the blueprint for the collection, measurement, and analysis of data (Asenahabi, 2019; Collins, 2018). This study employed a descriptive cross-sectional research design, utilizing quantitative methods to investigate the automation of distribution operations at Joint Medical Store.

The study employed a descriptive cross sectional research design, which combines the strengths of both approaches. This design is particularly effective for capturing a snapshot of a phenomenon at a single point in time while offering a detailed statistical overview of the variables involved. It enables researchers to describe the current state of affairs, identify patterns, and explore potential relationships among variables without manipulating the study environment. Such a design is well-suited for studies that aim to understand and quantify existing conditions within organizational settings (Saunders, Lewis, & Thornhill, 2009).

The descriptive aspect of the design enabled the researchers to systematically characterize the automation processes, while the cross-sectional nature allowed for the collection of data from respondents at one specific time. This approach is advantageous because it can simultaneously measure both exposure and outcome, offering insights into possible associations between variables (Lu et al., 2020; Cvetković et al., 2021).

### **3.3 Research Approach**

The Research Approach refers to the way in which the researcher plans and constructs a research process (Deshmane, & Memchoubi, 2018). The researcher adopted a Quantitative study approach. Quantitative methods involve a process of collecting, analyzing, interpreting, and describing numerical data (Chen et al 2023). Since the main objective of the study is to investigate the automation practices of distribution operations at Joint Medical Store, the challenges faced in automating distribution operations at Joint Medical Store and the strategies for improving the

automation of distribution operations at Joint Medical Store. The quantitative method of analysis was used to examine the study's numerical perspective. Hkansson (2013) informed the use quantitative methods approach, stating that it is a good approach and frequently used in surveys, in addition to being more scientific, fast, focused, and acceptable (Hayashi et al., 2019).

### 3.4 Study population

The study population refers to the entire group of individuals to whom researchers aim to generalize findings related to the phenomenon under investigation (Al-Bahrawy, 2010). This study focused on a purposive sample of 150 staff members employed at Joint Medical Store (JMS), specifically drawn from the departments of Stores Management, Transportation, IT Systems Management, and Procurement. These departments were selected based on their direct involvement in distribution operations and their central role in the automation of logistics and supply chain functions. The selection was informed by internal staffing data obtained from JMS Human Resource Internal Reports (2025), ensuring that the study targeted personnel with operational responsibilities and firsthand experience in implementing and managing automated systems. This focus enhances the relevance and applicability of the findings to the core processes under investigation.

The study specifically targeted staff working in stores management, transportation, and IT systems management—functional areas deemed critical to the drug distribution process. By narrowing the population to these categories, the research aims to generate findings that are both specific and actionable within the operational context of JMS.

Table 3. 1: Population table

<b>Staff Category</b>	<b>Population</b>
Stores Management	50
Transportation	35
IT Systems Management	35
Procurement officers	30
<b>Total</b>	<b>150</b>

Source: JMS Human Resource Internal Reports (2025)

### 3.5 Sample size

Orodho (2012) defined sampling as a means of selecting a given number of subjects from a given population to represent the entire population, and all statements made about the sample must hold true to the population. It is also necessary to ensure that the appropriate number of respondents are obtained for analysis. The sample size chosen influenced the statistical tests that were used, and thus the study's conclusions (Hair, Black, & Babin, 2006).

Omona (2013) defined sample size as a subset or subgroup of the population. Mugenda and Mugenda (2003) argued that studying the entire targeted population is impossible.

**table 3. 2: Sample Size Determination Table**

Population	Sample size computation	Sample Size	Sampling Technique
50	$\frac{108}{150} * 50=36$	36	Stratified Random Sampling
35	$\frac{108}{150} * 35=27$	25	Stratified Random Sampling
35	$\frac{108}{150} * 35=19$	25	Stratified Random Sampling
30	$\frac{108}{150} * 30=15$	22	Stratified Random Sampling
150		<b>108</b>	

JMS Human Resource Internal Reports (2025)

The study used a sample size of 108 staff from JMS, including 36 Stores Managers, 25 Transportation Officers, 25 IT Systems Management personnel, and 22 Procurement Officers. This sample size was determined using Krejcie and Morgan's (1970) table for sample size determination, based on an estimated population of 150.

#### Determination of Sample Size Formula

$$\text{Stratified ratio Formula} = \frac{\text{Total sample size}}{\text{Total population}} * \text{Size of the stratum}$$

**For example, for Stores Management**  $= \frac{108}{150} * 50$

This means that out of the 50 staff in Stores Management, approximately 36 were selected to participate in the study. The formula works by multiplying the total sample size (108) by the proportion of the population in that category (50 out of 150). The result is rounded to the nearest whole number to get the final sample size for that group

### **3.6 Sampling method**

According to Manfreda (2008), a sampling method refers to the strategy employed by a researcher to select representative respondents from the target population. This study utilized a combination of stratified sampling and simple random sampling to ensure both representation and fairness in respondent selection. Stratified sampling involves dividing the population into distinct subgroups or strata based on specific characteristics (Mwangi & Ouma, 2023). In this study, staff categories at the Joint Medical Store were stratified into four functional areas: Stores Management, Transportation, IT Systems Management, and Procurement Officers. This approach ensured proportional representation from each department, enhancing the accuracy and relevance of the findings (Kumar, 2014).

After stratification, simple random sampling was applied within each stratum to select individual participants for the quantitative study. To maintain scientific rigor, each staff member within a stratum was assigned a unique identification number based on the JMS Human Resource database. These numbers were then entered into a computerized random number generator, which selected participants without bias or human interference. This method ensured that every individual had an equal probability of being chosen, thereby minimizing selection bias and promoting statistical validity (Bhardwaj, 2019).

The combination of stratified and simple random sampling is particularly suitable for operational research, where both diversity across roles and randomness within groups are essential for robust and generalizable analysis.

### **3.7 Data Collection and Procedure**

Data collection is a critical phase in research that involves systematically gathering information to answer research questions, test hypotheses, and generate meaningful insights (Kabir, 2016). This study employed structured techniques to ensure the reliability and validity of the data collected from staff at Joint Medical Store.

#### **3.7.1 Data types**

A data type refers to the classification of data based on its nature and format, which determines how it can be collected, stored, and analyzed. In research, data types are typically categorized as primary or secondary, depending on their source and originality (Taherdoost, 2021). Primary data is original information collected directly from respondents, while secondary data is derived from existing sources such as reports, publications, or databases.

This study utilized primary data, which refers to first-hand information gathered specifically for the purpose of this research. Primary data is preferred in operational studies because it offers context-specific insights, minimizes distortion, and ensures the information is current and relevant (Bhardwaj, 2019).

#### **3.7.2 Data sources**

A data source refers to the origin or location from which data is obtained for analysis, reporting, or decision-making. It can be a system, repository, database, or individual that provides the raw information needed for a study (The Knowledge Academy, 2025). In research, data sources are typically classified as primary or secondary. Primary sources involve first-hand data collection directly from respondents, while secondary sources include existing materials such as reports, publications, and archived datasets (Talend, 2025).

In this study, the primary data source was the staff of Joint Medical Store involved in distribution operations. These individuals were selected based on their roles in stores management, transportation, IT systems, and procurement. Data was gathered directly from them using a structured questionnaire, ensuring relevance, accuracy, and contextual depth (Kabir, 2016). By collecting data directly from staff involved in distribution operations at Joint Medical Store, the study ensured high validity and applicability of the findings.

### **3.7.3 Research Instrument**

A research instrument refers to any tool, device, or method used by a researcher to collect, measure, and analyze data relevant to the study objectives (Impactio, 2021). It serves as a structured mechanism for translating abstract concepts into observable and quantifiable information. In this study, the primary research instrument was a structured questionnaire, selected for its efficiency in gathering standardized data from a large group of respondents (Sinaumedia, 2024).

The structured questionnaire was carefully designed to capture both demographic and operational data. It was divided into distinct sections to ensure clarity and focus. Section A, titled Demographic Characteristics, collected background information such as age, gender, department, and years of experience. Section B focused on automation practices. Section C addressed the challenges faced in automation distribution, and Section D explored strategies for improving automation distribution. Items in Sections B, C, and D were measured using a five-point Likert scale, ranging from "Strongly Disagree" to "Strongly Agree" where 1= strongly disagree, 2= disagree, 3 = neutral, 4= Agree and 5 strongly Agree. To ensure reliability and clarity, the questionnaire was pre-tested before full deployment. It was administered in person, which helped improve response rates and allowed the researcher to clarify any ambiguities during the process (Edmondson, 2005).

### **3.8 Data collection methods**

Data collection methods refer to the systematic techniques used by researchers to gather information relevant to their study objectives. These methods may include surveys, interviews, checklists, or tests, depending on the nature of the research and the type of data being gathered (Kusumawijaya & Astuti, 2021). Selecting an appropriate research method is essential for ensuring the data is accurate, reliable, and suitable for analysis, which in turn strengthens the credibility of the study findings. In this study, data was collected from primary source using one main method: a survey specifically a questionnaire. This approach was selected to provide both quantitative insights and contextual understanding of automation in distribution operations at Joint Medical Store (Kabir, 2016).

A questionnaire is a set of questions administered to respondents to gather statistics about a particular subject. When thoughtfully designed and implemented, questionnaires can be a useful

tool for making generalizations about entire populations or specific groups (Grassini & Laumann, 2020). For this study, staff at JMS were randomly selected to participate in the survey and completed the questionnaires. This approach was suitable because it allowed for the rapid collection of diverse data from a large number of respondents (Odongo et al., 2016). The questionnaire employed a 5-point Likert scale. Where 1= strongly disagree, 2= disagree, 3 = neutral, 4= Agree and 5 strongly Agree

### **3.8.2 Data collection procedure**

The data collection procedure refers to the systematic approach used to gather and measure information on targeted variables of interest to answer the research question (Mwangi & Ouma, 2023). This process involves selecting appropriate tools and techniques such as surveys and observation to ensure that the data obtained is accurate, reliable, and relevant to the study objectives (Opiyo & Mwalili, 2020).

The first step was that the research proposal was accepted by your supervisor.

After the study instrument was approved, the researcher obtained an introductory letter from the coordinating office, school of business, which was used to formally request permission from Joint Medical Store to conduct the study. Upon receiving approval from JMS management, the researcher explained the purpose of the study to the staff and distributed questionnaires to selected respondents involved in distribution operations.

Respondents were contacted through physical visits, emails, and phone calls. They were informed about the study's objectives and assured of confidentiality and voluntary participation. Each respondent was given the option to choose between an online or manual questionnaire. A link to the online version was sent to those who preferred digital access, while printed copies were hand-delivered to those who opted for the manual format. Completed manual questionnaires were collected in person after a two-week period.

### **3.9 Data quality and control**

Data quality and control refers to the processes and standards used to ensure that data is accurate, complete, consistent, and reliable. It involves systematically identifying, correcting, and preventing errors or discrepancies in data to maintain its integrity and suitability for analysis and decision-making (Heale & Twycross, 2015). To ensure the quality of research, researchers must

ensure the reliability and validity of the data being collected. The study's reliability and validity are explained below:

### 3.9.1 Data validity

Validity is the ability of the research instrument to measure what it is supposed to measure in order to increase the quality of the study findings (Heale & Twycross, 2015). To ensure the validity of the research instrument (questionnaire), a pilot test was conducted by administering the questionnaire to 20 staff members at Mulago Hospital who did not participate in the final data collection. According to Fink and Koch (2010), the minimum number of respondents for piloting a research instrument in a quantitative study is 10% of the sample size. The pilot participants were excluded from the final study.

The researcher also reviewed the questionnaire with the supervisors. They examined the instrument and provided comments on the questions included in the questionnaire. Questions that were found to be vague, as suggested by the supervisors and experts, were rephrased or removed to eliminate ambiguity in the data collection tool. This ensured that the validity of the research instrument was upheld.

According to Lowe (2019), the pilot study test involves seeking the opinions of respondents on the meaning, clarity, and relevance of the questions to the constructs being studied, and modifications were made where necessary.

Below is Lawshe's method for computing the content validity index

$$\text{Content Validity Ratio (CVR)} = \frac{n_e - \frac{N}{2}}{\frac{N}{2}}$$

where N is the total number of panelists and CVR is the content validity ratio.

The number of panelists who labelled an item as "essential" is known as  $n_e$

A score of 0 implies that half of the panel experts concur that an item is essential, and CVR values can vary from 1 (complete agreement) to 1 (perfect disagreement).

$$\text{CVR} = \frac{n_e - \frac{N}{2}}{\frac{N}{2}} \quad \text{Note; CVI was obtained by computing the average of CVR}$$

$$CVI = \frac{\sum_i^n CVR}{N}$$

The average of the CVR for all retained components makes up the CVI for the entire instrument. The recommended value of 0.7 by Heale and Twycross, (2015) was used to accept the items, thus the instrument was taken to be valid.

**Table 3. 3; Validity results**

<b>Variables</b>	<b>Number of Items</b>	<b>Content Validity Results</b>
<b>The automation practices</b>	9	0.867
<b>Challenges</b>	8	0.724
<b>Strategies</b>	8	0.712

Source: Primary data (2025)

### 3.9.2 Data reliability

Reliability was defined by Golafshani (2003) as the degree to which a measurement tool can consistently yield the same result over a specified amount of time. It suggests that the device can be used again to produce comparable outcomes. According to Taherdoost (2019), reliability refers to the extent to which the results can be reproduced when the research is repeated under the same conditions. It is the consistency of results when the research instrument is used several times with similar respondents. The reliability of the questionnaire in this study was measured using the Cronbach’s alpha coefficient test. The Cronbach’s alpha coefficient was required to exceed the minimum threshold of 0.7 for all variables in the questionnaire to be considered sufficiently reliable.

**Table 3. 4; Reliability results**

<b>Variables</b>	<b>Number of Items</b>	<b>Cronbach Alpha</b>
<b>The automation practices</b>	9	0.786
<b>Challenges</b>	8	0.742
<b>Strategies</b>	8	0.721

Source: Primary data (2025)

### **3.10 Data analysis**

Data analysis refers to the process of organizing and processing raw data to extract meaningful insights (Mugenda & Mugenda, 2008). In this study, the quantitative data collected from the field were first edited to eliminate any errors made during data collection. The cleaned data were then coded and entered into a computer for analysis using Statistical Package for Social Sciences (SPSS) version 23.

Descriptive statistical techniques including frequencies, percentages, means, and standard deviations were used to summarize and interpret the data. These results were presented in tabular form to provide a clear overview of practices, challenges, and strategies for improving distribution operations at Joint Medical Store. The researcher presented the findings in a structured and visually accessible format which enhanced clarity and supported data-driven conclusions.

### **3.11 Ethical considerations**

The objective of ethical considerations in research was to safeguard the rights, dignity, and welfare of study participants (Fahie, 2014). Ethical dimensions in this study were guided by the principles outlined by Pallant (2020) and McCombes (2019), with particular attention to anonymity, confidentiality, informed consent, and intellectual integrity. The researcher ensured that participants were treated respectfully and ethically throughout the data collection process.

Anonymity and confidentiality were prioritized to protect respondents' identities and personal information. Participants were given the right to withhold any data they considered sensitive or private, and their responses were reported without any identifying details (Akaranga & Makau, 2016), which allowed them to voluntarily agree or decline participation. Only those who voluntarily agreed were included in the study, and they retained the right to withdraw at any stage. Although withdrawal was discouraged to maintain data consistency, it remained an option for all participants.

Participation was strictly voluntary. Individuals within the study area who expressed interest were given the opportunity to participate. Those who declined were not coerced, in recognition that unwilling participants might introduce bias and compromise data reliability. The researcher also respected intellectual property rights by adhering to copyright protocols. All sources used in the study were properly cited and acknowledged to avoid plagiarism.

Plagiarism, defined as the unauthorized use or representation of another author's work as one's own, was actively avoided. This included proper citation of ideas, methodologies, findings, and direct quotations. The researcher ensured that all borrowed content, whether textual, conceptual, or graphical, was clearly attributed to its original source in line with academic integrity standards (Walker, 2010).;

**3.11.1 Letter of introduction-** A letter of introduction was obtained from the college to formally present the researcher and the purpose of the study. This letter was used to request permission from JMS, the organization where the study was conducted. Upon approval, questionnaires were distributed and interviews were carried out (Walker, 2010).

**3.11.2 Anonymity** was maintained by ensuring that responses were recorded without any personal identifiers. Respondents were also allowed to conceal any information they considered sensitive or private (Akaranga & Makau, 2016) (Akaranga & Makau, 2016).

**3.11.3 Confidentiality;** was applied to ensure that participants' information was protected. All the data collected were treated with total discretion (Akaranga & Makau, 2016). Information provided by the respondents was used solely for academic purposes. The participants' data were not exposed to any other individuals or shared with other respondents.

**3.11.4 With plagiarism.** Which is the practice where the researcher has to ensure that the authors of any work are cited. All the ideas, processes, results and even words of other authors used in this study were acknowledged (Akaranga & Makau, 2016).

### **3.12 Chapter Summary**

This chapter covered the procedures that were adopted for conducting the study. A descriptive cross-sectional research design with a quantitative approach was used, targeting 150 staff across stores, transport, IT, and procurement, from which a stratified random sample of 108 respondents was selected. Data was collected through structured questionnaires and observations. The structured questionnaire was designed to capture demographic characteristics, automation practices, challenges, and improvement strategies, measured on a five-point Likert scale. These tested for validity through a pilot study and for reliability using Cronbach's Alpha Coefficient. Analysis was conducted using SPSS with descriptive statistics, while ethical considerations such as confidentiality, anonymity, voluntary participation were strictly observed.

The next chapter presents the findings of the study, focusing on the analysis, presentation, and interpretation of the collected data. It provides a detailed examination of key insights and relationships identified in the study, offering an in-depth evaluation of how the findings aligned with the research objectives.

## **CHAPTER FOUR**

### **PRESENTATION, INTERPRETATION AND DISCUSSION OF FINDINGS.**

#### **4.1 Introduction**

The purpose of this study is to investigate the automation of distribution operations at Joint Medical Store (JMS) in Uganda. As such, this chapter presents the response rate, respondent demographic characteristics and the study results based on the following specific research objectives and discussion on the findings.

- To examine the automation practices of distribution operations at Joint Medical Store (JMS).

- To assess the challenges faced in automating distribution operations at Joint Medical Store (JMS).
- To establish strategies for improving the automation of distribution operations at Joint Medical Store (JMS).

#### 4.2 Response Rate

Table 4. 1: *Response rate*

Item	JMS Staff
<b>Target</b>	<b>108</b>
<b>Responded</b>	<b>85</b>
Response rate	78.7%

Source: Primary data (2023)

Table 4.1 above shows that 108 questionnaires were issued, 89 were returned, with 85 being completely filled and 4 were partially filled. Therefore, this indicates that 78.7% of the targeted people responded. In a quantitative study, a response rate of at least 60% is required before data analysis may begin (Fincham, 2008). The high response rate is attributed to the fact that the topic was of high interest to the JMS since many are looking at improving their distribution operations, secondly, the researcher conducted a pre-test to fine-tune the questionnaire before collecting final data, which helped to fine-tune the questions to be more relevant to the study.

#### 4.3 Demographic Characteristics of the respondents

The demographic characteristics of interest included gender, age bracket, level of education, years of experience, frequency of interaction with the automated distribution system, and department.

##### 4.3.1 Gender of the respondents

The study assessed gender representation among staff at Joint Medical Store (JMS) to ensure inclusivity in evaluating automation practices within distribution operations. As shown in Table 4.2, the majority of respondents were male (62.4%), while females accounted for 37.6%. This reflects the broader staffing pattern at JMS, where male employees tend to dominate operational roles. Nonetheless, the inclusion of both male and female perspectives enriches the study's findings by capturing diverse experiences with automated distribution systems.

Table 4. 2: *Gender of the respondents*

<b>Item</b>	<b>Frequency</b>	<b>Percent</b>
Female	32	37.6
Male	53	62.4
<b>Total</b>	<b>85</b>	<b>100</b>

*Source:* Primary data (2025)

#### **4.3.2 Age bracket**

The study examined age representation among staff at Joint Medical Store (JMS) to explore how different age groups engage with automation practices in distribution operations. As shown in Figure 4.1, the majority of respondents fall within the 25–39 age bracket (56.4%), followed by those aged 40–49 (31.76%). The least represented group comprises employees under 25 years (2.3%). This distribution suggests that JMS staff are predominantly mature and experienced, positioning them well to understand, adopt, and contribute to the effective implementation of automated systems.

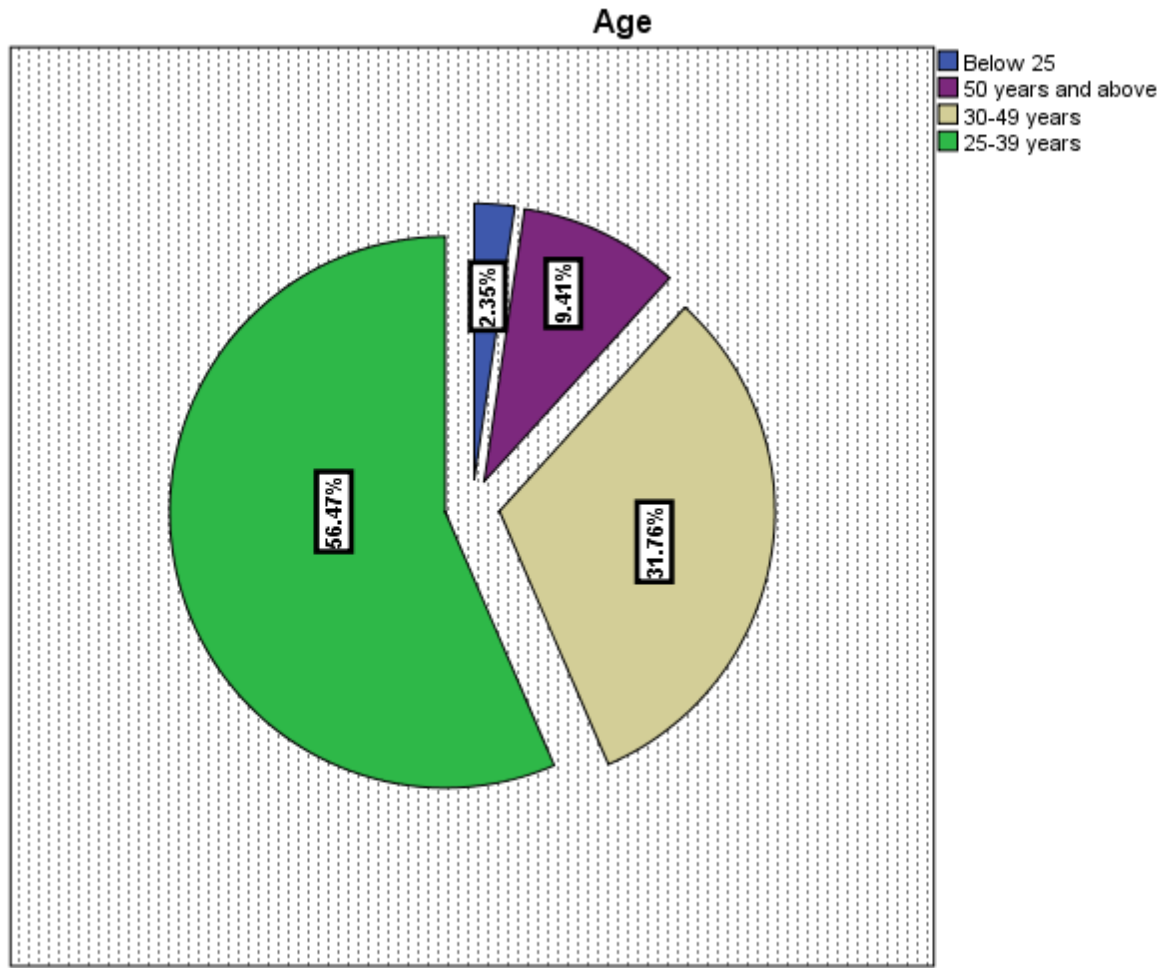


Figure 4. 1; Pie chart showing age bracket distribution of the respondents

**Source: Primary data (2025).**

### 4.3.3 Level of education

The study examined the educational background of JMS staff to understand how academic attainment influences perspectives on automation in distribution operations. As shown in Table 4.3, the majority of respondents (76.5%) held a bachelor's degree, while 23.5% had attained a master's degree. This reflects the organization's recruitment standards, where a bachelor's degree is typically the minimum qualification for entry-level roles, while postgraduate education is often pursued for advancement into administrative or strategic positions. These findings suggest that JMS employs a well-qualified workforce capable of engaging with and supporting the implementation of automated systems.

Table 4. 3: Education levels of respondents

Item	Frequency	Per cent
Bachelor's degree	65	76.5
Master's degree	20	23.5
<b>Total</b>	<b>85</b>	<b>100</b>

Source: Primary data (2025).

#### 4.3.4 Experience of the JMS Staff

The study explored the work experience of JMS staff to understand how tenure influences their perspectives on automation in distribution operations. As illustrated in Figure 4.2, the majority of respondents (67%) have over 11 years of experience, followed by 25.9% with 6–10 years, and only 7.1% with less than 5 years. This distribution suggests that JMS employs a highly experienced workforce, well-positioned to contribute meaningfully to the adoption and optimization of automated systems. It also reflects strong staff retention, which supports continuity and institutional knowledge in operational practices.

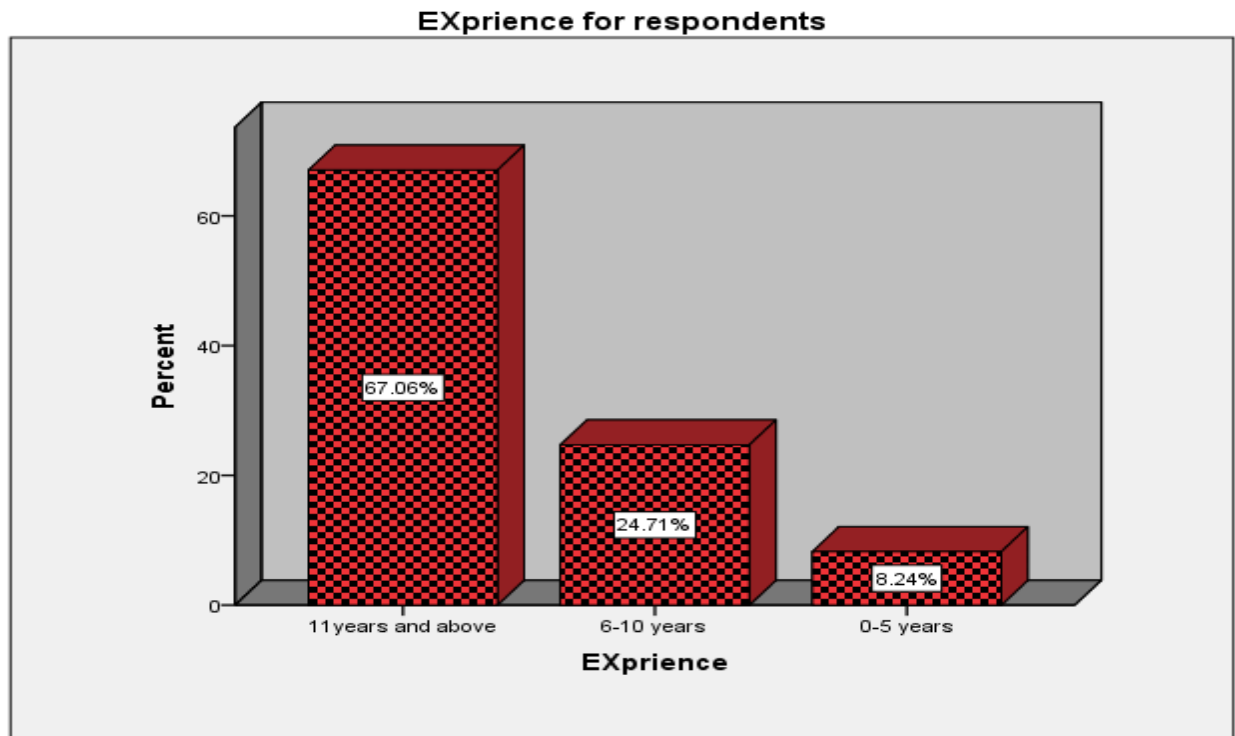


Figure 4. 2: A bar graph showing the experience of the respondents

Source: Primary Data

### 4.3.5 Respondent's Department

The study explored the departmental affiliation of JMS staff to understand how different operational units engage with automation in distribution practices. As shown in Table 4.4, the largest proportion of respondents came from Stores Management (35.3%), followed by Transportation (23.5%), IT Systems Management (22.4%), and Procurement (18.8%). This distribution reflects the staffing structure at JMS, where stores and logistics functions are central to distribution operations. Including perspectives from all key departments ensures that the study captures a comprehensive view of automation practices across the supply chain.

Table 4. 4: *Departments of the respondents.*

Item	Frequency	Per cent
Stores Management	30	35.3
Transportation	20	23.5
IT Systems Management	19	22.4
Procurement officers	16	18.8
Total	85	100

Source: Primary Data (2025)

### 4.3.6 Frequently of interacting with the automated distribution system

The study assessed how frequently JMS staff engage with the automated distribution system, as this reflects both operational exposure and potential familiarity with its functionalities. As shown in Table 4.4, the largest proportion of respondents (34.1%) reported interacting with the system on a monthly basis, followed closely by those who engage with it rarely (30.6%). Weekly users accounted for 23.5%, while only 11.8% reported daily interaction.

This distribution suggests that while automation is present across JMS operations, its usage intensity varies significantly among staff. The relatively low daily interaction rate may indicate that automation is concentrated in specific roles or departments, while others engage with it periodically. These insights are critical for identifying training needs, optimizing system accessibility, and enhancing user engagement across the organization.

Table 4. 5: *Departments of the respondents.*

Item	Frequency	Per cent
Daily	10	11.8
Weekly	20	23.5
Monthly	29	34.1
Rarely	26	30.6
Total	85	100

Source: Primary Data (2025)

#### 4.4 Findings on Objectives of the study

This section provides findings on the three objectives of the study. It provides the descriptive statistic from the responses in form of percentages, mean and standard deviation.

The respondents were requested to rate their opinion on the operational risk management and the responses were measured on the 5-point scale of strongly disagreed, disagree, neutral, agreed and strongly agree.

##### 4.4.1 Objective one; To examine the to the automation practices of distribution operations at Joint Medical Store (JMS).

Table 4. 6: *The automation practices of distribution operations at Joint Medical Store (JMS).*

Statement		Strongly disagree (SD)	Disagree(D)	Neutral (NS)	Agree(A)	Strongly agree (SA)	Mean	SD	Decision rule on the Mean	Rank of the Mean
JMS uses automated systems for managing inventory in its distribution operations.	%	4.7	11.8	16.5	8.2	5.9	3.67	1.38	High	9 <sup>th</sup>
	Count	4	10	14	7	50				
Automated order processing systems are used to handle distribution requests.	%	3.5	3.5	3.5	30.6	58.8	4.33	.750	Very High	1 <sup>st</sup>
	Count	3	3	3	26	50				
Barcode scanners are used to track stock movement in the warehouse.	%	3.5	25.9	5.9	29.4	35.3	4.00	.821	High	2 <sup>nd</sup>
	Count	3	22	5	25	30				
Radio Frequency Identification (RFID)	%	8.2	8.2	16.5	31.8	35.3	3.83	1.47	High	

devices are used to track stock movement in the warehouse.	Count	7	7	14	27	30					7 <sup>th</sup>
Delivery vehicles are equipped with systems that allow real-time tracking.	%	7.1	7.1	2.4	24.7	58.8	3.67	1.38	High	6 <sup>th</sup>	
	Count	6	6	2	21	50					
Staff involved in distribution are trained to use automation tools and systems.	%	2.4	14.1	0	82.4	1.2	3.83	1.35	High	8 <sup>th</sup>	
	Count	2	12	0	70	1					
There are established procedures for integrating automation technologies into distribution workflows.	%	4.7	4.7	3.5	28.2	58.8	4.00	1.42	High	4 <sup>th</sup>	
	Count	4	4	3	24	50					
Regular system updates and maintenance are carried out on distribution automation tools.	%	3.5	7.1	5.9	27.1	56.5	4.00	1.01	High	3 <sup>rd</sup>	
	Count	3	6	5	23	48					
JMS uses automated systems for managing inventory in its distribution operations.	%	2.4	2.4	12.9	41.2	41.2	3.85	.375	High	5 <sup>th</sup>	
	Count	2	2	11	35	35					
Interpretation of mean 1.0 -1.8= very low, 1.8-2.6 =low, 2.6-3.4 =moderate, 3.4-4.2=high and 4.2-5.0 = very high and SD- standard deviation, where disagreed (SD +D), NS-neutral or not-sure and agree = (A+SA)											

Source: Primary Data (2025).

The study investigated the extent to which automation is integrated into JMS's distribution operations. Table 4.5 presents staff responses to key automation practices, revealing varying levels of adoption and engagement across different technological tools and systems.

The highest-ranked practice was the use of automated order processing systems to handle distribution requests, with a very high mean of 4.33 and a low standard deviation (SD = 0.750), indicating strong consensus among respondents. A total of 89.4% agreed with this statement, suggesting that JMS has successfully implemented automated workflows for order handling. This aligns with Valladares (2021), who emphasized the importance of leveraging automation to reduce operational delays and improve accuracy in distribution.

The second-highest ranked practice was the use of barcode scanners to track stock movement in the warehouse (mean = 4.00, SD = 0.821), with 64.7% agreement. This reflects JMS's commitment to real-time inventory visibility and aligns with Girling (2022), who noted that automation tools like barcode systems enhance traceability and reduce manual errors.

Regular system updates and maintenance also scored highly (mean = 4.00, SD = 1.01), indicating that JMS prioritizes the reliability and performance of its automation infrastructure. This is critical for sustaining operational efficiency and minimizing system downtime.

Respondents also confirmed the presence of established procedures for integrating automation technologies into distribution workflows (mean = 4.00, SD = 1.42), suggesting that JMS has formalized its automation strategy. This supports Hughes and Mester (2014), who advocate for structured implementation to ensure consistency and scalability.

The use of Radio Frequency Identification (RFID) devices received a mean of 3.83, indicating a high level of agreement, though with a wider spread (SD = 1.47), suggesting varied exposure or access among staff. Similarly, staff training on automation tools scored 3.83 (SD = 1.35), highlighting JMS's investment in capacity building, though some respondents may have had limited training opportunities.

Interestingly, real-time tracking systems in delivery vehicles scored 3.67, showing moderate to high adoption. The relatively higher standard deviation (SD = 1.38) suggests that usage may vary across departments or roles.

Overall, the findings indicate that JMS has made significant strides in automating its distribution operations, particularly in order processing, inventory tracking, and system maintenance. However, the variability in responses across some items suggests opportunities for further standardization, training, and expansion of automation tools to ensure uniform adoption across the organization.

**4.4.1 Objective Two; To identify the challenges faced in automating distribution operations at Joint Medical Store (JMS).**

*Table 4. 7: The challenges faced in automating distribution operations at Joint Medical Store (JMS).*

Statement		Strongly disagree (SD)	Disagree (D)	Neutral (NS)	Agree (A)	Strongly agree (SA)	Mean	SD	Decision rule on the Mean	Rank of the Mean
There is limited funding available to support automation of distribution operations at JMS.	%	5.9	12.9	15.2	36.5	29.4	3.43	0.987	high	2 <sup>nd</sup>
	count	5	11	13	31	25				
Inadequate technical skills among staff hinder the adoption of automation technologies.	%	15.3	16.5	16.5	23.5	28.2	3.21	1.537	moderate	3 <sup>rd</sup>
	count	13	14	14	20	44				
Network interruptions often affect the use of automated systems.	%	3.5	12.9	23.5	30.6	29.4	3.57	.750	high	1 <sup>st</sup>
	count	3	11	20	26	25				
Some staff members resist the use of automation due to fear of change or job displacement.	%	30.6	36.4	0	16.5	16.5	2.33	1.255	low	7 <sup>th</sup>
	count	26	31	0	14	14				
There is a lack of specialized personnel to maintain and support automation systems.	%	21.2	23.5	5.9	27.0	23.5	3.12	1.006	moderate	4 <sup>th</sup>
	count	18	20	5	23	20				
Existing infrastructure does not fully support advanced automation technologies.	%	29.4	54.1	0	8.2	8.2	2.17	1.352	low	8 <sup>th</sup>
	count	25	46	0	7	7				
Procurement processes for automation tools are bureaucratic.	%	17.6	15.3	4.7	27.0	35.3	2.83	.691	moderate	5 <sup>th</sup>
	count	15	13	4	23	30				
There is limited training provided to staff on how to use new automation system	%	25.9	23.5	0	4.7	44.7	2.83	1.221	moderate	6 <sup>th</sup>
	count	22	20	0	4	38				
Interpretation of mean 1.0 -1.8= very low, 1.8-2.6 =low, 2.6-3.4 =moderate, 3.4-4.2=high and 4.2-5.0 = very high and SD- standard deviation, where disagreed (SD +D), NS-neutral or not-sure and agree = (A+SA)										

**Source:** Primary Data (2025)

The study explored the key barriers affecting the adoption and sustainability of automation in JMS's distribution operations. Table 4.6 presents staff perceptions of these challenges, revealing a mix of financial, technical, infrastructural, and organizational constraints.

The most prominent challenge identified was network interruptions, with a high mean of 3.57 and a low standard deviation ( $SD = 0.750$ ), indicating strong agreement and consistency among respondents. This suggests that unstable connectivity significantly disrupts the functionality of automated systems, undermining efficiency and reliability in distribution workflows.

Limited funding emerged as the second-highest challenge (mean = 3.43,  $SD = 0.987$ ), reflecting budgetary constraints that hinder the acquisition, upgrading, and maintenance of automation tools. This aligns with broader public sector realities where resource allocation for technology investments is often limited.

Inadequate technical skills among staff was also notable (mean = 3.21,  $SD = 1.537$ ), pointing to gaps in digital literacy and system proficiency. This challenge is compounded by the lack of specialized personnel to maintain and support automation systems (mean = 3.12,  $SD = 1.006$ ), suggesting a need for targeted recruitment and capacity-building.

Other moderate challenges included bureaucratic procurement processes (mean = 2.83,  $SD = 0.691$ ) and limited training on new systems (mean = 2.83,  $SD = 1.221$ ), both of which slow down implementation and reduce user confidence.

Low-ranked challenges included staff resistance due to fear of change or job displacement (mean = 2.33,  $SD = 1.255$ ) and infrastructure limitations (mean = 2.17,  $SD = 1.352$ ), indicating that while these issues exist, they are less pervasive or may be improving.

The findings underscore that while JMS has made strides in automating its distribution operations, several systemic and operational barriers persist. The high prevalence of network interruptions and limited funding suggests that infrastructure and financial planning must be prioritized to sustain automation efforts. Moreover, the moderate ratings for technical skills, training, and support personnel highlight the need for ongoing staff development and institutional investment in IT capacity. Addressing bureaucratic bottlenecks in procurement and fostering a culture of digital adaptability will be essential for scaling automation across departments. Ultimately, these

challenges must be tackled holistically to ensure that automation delivers its intended benefits in efficiency, accuracy, and service delivery at JMS.

#### 4.4.3; To establish to the strategies for improving the automation of distribution operations at Joint Medical Store (JMS).

Table 4. 8: The strategies for improving the automation of distribution operations at Joint Medical Store (JMS).

Statement		Strongly disagree (SD)	Disagree (D)	Neutral (NS)	Agree (A)	Strongly agree (SA)	Mean	SD	Decision rule on the Mean	Rank of the mean
JMS should allocate more funding specifically for automation in distribution operations.	%	7.1	9.4	0	34.1	49.4	3.83	1.055	High	1 <sup>st</sup>
	Count	6	8	0	29	42				
Staff training programs should be enhanced to improve skills in using automation tools.	%	4.7	2.4	11.8	34.1	47.1	3.78	1.352	High	3 <sup>rd</sup>
	Count	4	2	10	29	40				
Recruitment of technical personnel specialized in automation should be prioritized.	%	3.5	7.1	5.9	45.9	37.6	3.67	1.352	High	4 <sup>th</sup>
	Count	3	6	5	39	32				
Infrastructure upgrades are needed to support automation.	%	15.3	20.0	15.3	21.2	28.2	2.67	1.255	Moderate	8 <sup>th</sup>
	Count	13	17	13	18	24				
Regular refresher courses should be provided to keep staff up to date with automation technologies.	%	5.9	8.2	2.4	17.6	65.9	3.80	1.383	High	2 <sup>nd</sup>
	Count	5	7	2	15	56				
JMS should develop a clear strategic plan for automating distribution processes.	%	8.2	21.2	3.5	20.0	47.1	3.33	1.352	Moderate	6 <sup>th</sup>
	Count	7	18	3	17	40				
Engagement and change management strategies should be used to reduce staff resistance to automation.	%	8.2	21.2	3.5	20.0	47.1	3.34	1.214	Moderate	5 <sup>th</sup>
	Count	7	18	3	17	40				
Faster and more flexible procurement procedures should be adopted for automation tools and systems.	%	12.9	23.5	12.9	47.1	3.5	3.02	1.383	Moderate	7 <sup>th</sup>
	Count	11	20	11	40	3				
Interpretation of mean 1.0 -1.8= very low, 1.8-2.6 =low, 2.6-3.4 =moderate, 3.4-4.2=high and 4.2-5.0 = very high and SD- standard deviation, where disagreed (SD +D), NS-neutral or not-sure and agree = (A+SA)										

Source; Primary data (2025)

The study explored practical strategies that could enhance the adoption and effectiveness of automation in JMS's distribution operations. Table 4.7 presents staff perceptions of these strategies, revealing a strong consensus on several priority areas.

The highest-ranked strategy was the recommendation that JMS should allocate more funding specifically for automation, with a high mean of 3.83 and a standard deviation of 1.055, indicating broad agreement among respondents. This reflects the recognition that financial investment is foundational to acquiring, upgrading, and sustaining automation technologies.

Closely following was the need for regular refresher courses to keep staff updated on automation tools and systems (mean = 3.80, SD = 1.383). This suggests that continuous learning is essential to maintain user competence and confidence, especially as technologies evolve.

Staff training programs also ranked highly (mean = 3.78, SD = 1.352), reinforcing the importance of structured capacity-building initiatives to improve system usage and reduce operational errors. Similarly, respondents emphasized the need to recruit technical personnel specialized in automation (mean = 3.67, SD = 1.352), pointing to gaps in internal expertise that may hinder system maintenance and optimization.

Moderately ranked strategies included the use of engagement and change management approaches to reduce staff resistance (mean = 3.34, SD = 1.214) and the development of a clear strategic plan for automation (mean = 3.33, SD = 1.352). These findings highlight the need for leadership-driven initiatives that align automation goals with staff buy-in and organizational culture.

Procurement reforms were also suggested, with respondents advocating for faster and more flexible procedures (mean = 3.02, SD = 1.383) to streamline the acquisition of automation tools. The lowest-ranked strategy was infrastructure upgrades (mean = 2.67, SD = 1.255), which, while still important, may reflect either recent improvements or lower perceived urgency compared to other areas.

The findings suggest that JMS staff recognize both technical and organizational levers as critical to improving automation in distribution operations. Financial investment, staff training, and technical recruitment emerged as top priorities, indicating that sustainable automation requires not just tools but also skilled personnel and ongoing support. The moderate emphasis on strategic planning and change management implies that automation must be embedded within broader

institutional frameworks to succeed. Addressing procurement bottlenecks and ensuring infrastructure readiness will further enhance JMS's ability to scale automation effectively. Collectively, these strategies offer a roadmap for strengthening operational efficiency, accuracy, and responsiveness in JMS's supply chain

#### **4.5 Chapter Summary**

This chapter presented and interpreted the findings of the study on automation practices in distribution operations at Joint Medical Store (JMS), organized around three key objectives. The first objective revealed that JMS has adopted several automation tools, particularly in order processing, inventory tracking, and system maintenance, with high levels of staff agreement, although usage of technologies like RFID and real-time tracking varied. The second objective identified key challenges hindering automation, including network interruptions, limited funding, and inadequate technical skills, alongside moderate barriers such as bureaucratic procurement and limited training. The third objective explored strategies for improvement, with respondents emphasizing increased funding, enhanced training, recruitment of technical personnel, and regular refresher courses, while also recommending strategic planning and procurement reforms. Overall, the findings suggest that JMS has made commendable progress in automating its distribution operations, but targeted investments in infrastructure, staff capacity, and organizational alignment are essential to overcome existing challenges and fully optimize automation outcomes

## **CHAPTER FIVE**

### **SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 INTRODUCTION**

This chapter comprises the summary of the findings, conclusion and recommendations. Once data is presented in chapter four and discussed, there is a need to summarize the findings in relation to the objectives and thereafter make conclusions and recommendations.

## **5.2 Summary of the Findings**

### **5.2.1 The automation practices of distribution operations at Joint Medical Store (JMS)**

Objective one sought to examine the automation practices of distribution operations at Joint Medical Store (JMS). Findings from Table 4.6 indicate that JMS has adopted a range of automation tools and procedures, with particularly strong implementation of automated order processing systems (Mean = 4.33, SD = 0.75), barcode scanners (Mean = 4.00), and regular system updates (Mean = 4.00). High mean scores across most items suggest widespread use of technologies such as Radio-Frequency Identification (RFID), real-time vehicle tracking, and inventory management systems. Staff training and procedural integration also received high ratings, reflecting organizational commitment to automation. Overall, the results demonstrate that JMS has made significant strides in automating its distribution operations, with most practices rated as “high” or “very high” in effectiveness and adoption (Primary Data, 2025).

### **5.2.2 The challenges faced in automating distribution operations at Joint Medical Store (JMS)**

The study explored key barriers affecting the automation of distribution operations at JMS, as summarized in Table 4.7. The most prominent challenge identified was frequent network interruptions, which received the highest mean score (Mean = 3.57, SD = 0.75), indicating a significant impact on system reliability. Limited funding (Mean = 3.43) and inadequate technical skills among staff (Mean = 3.21) were also rated as high and moderate challenges, respectively, suggesting resource and capacity constraints in sustaining automation efforts. Other moderate challenges included the lack of specialized personnel (Mean = 3.12), bureaucratic procurement processes (Mean = 2.83), and limited staff training (Mean = 2.83), all of which hinder the smooth integration and utilization of automation technologies. Notably, resistance to change (Mean = 2.33) and infrastructure limitations (Mean = 2.17) were rated as low, indicating that while present, these factors are less influential compared to technical and financial constraints.

### **5.2.3 Strategies for improving the automation of distribution operations at Joint Medical Store (JMS).**

Findings from Table 4.8 indicate that respondents strongly supported increased funding (Mean = 3.83) and regular refresher courses (Mean = 3.80) as top strategies for enhancing automation at

JMS. Other highly rated strategies included staff training (Mean = 3.78) and recruitment of technical personnel (Mean = 3.67). Moderate support was observed for change management, strategic planning, procurement flexibility, and infrastructure upgrades, suggesting that while these areas are important, they require further institutional commitment. Overall, the results highlight a clear preference for capacity-building and resource allocation to strengthen automation efforts (Primary Data, 2025).

### **5.3 Discussion of the results**

This section comprises of a discussion of the findings as per the study objectives in line with other scholars as indicated in the literature review).

#### **5.3.1 The automation practices of distribution operations at Joint Medical Store (JMS)**

The findings on automation practices at Joint Medical Store (JMS) align with recent scholarship emphasizing the transformative role of digital technologies in distribution operations. Araz et al. (2020) argue that automation enhances operational efficiency, particularly in order processing and inventory control, which mirrors JMS's strong adoption of automated order systems and inventory management tools. Similarly, Kirikkaleli et al. (2020) highlight the importance of real-time tracking and system integration in reducing operational delays and improving supply chain visibility—practices that JMS has actively embraced through barcode scanners and RFID technologies. These technologies not only streamline workflows but also support data-driven decision-making, a trend increasingly observed across healthcare logistics.

Further support comes from Valladares (2021), who found that organizations with structured automation procedures and regular system updates experience fewer distribution errors and improved service delivery. JMS's emphasis on system maintenance and integration procedures reflects this best practice. Girling (2022) adds that automation is most effective when paired with staff training and capacity building, reinforcing JMS's investment in training programs to enhance user proficiency. This combination of technology and human capital is essential for sustaining automation benefits and minimizing resistance to change.

Moreover, East (2022) emphasizes the role of automation in fostering resilience and adaptability in distribution networks, particularly in resource-constrained environments. JMS's adoption of real-time tracking and automated inventory systems demonstrates a proactive approach to

managing operational risks and ensuring continuity. Hughes and Mester (2023) also underscore the value of automation in healthcare supply chains, noting that tools like RFID and barcode scanning improve traceability and accountability—key concerns for institutions like JMS that handle sensitive medical supplies.

Collectively, these scholarly perspectives affirm that JMS's automation practices are consistent with global trends and evidence-based strategies for improving distribution efficiency. While the study revealed some variability in staff responses, particularly around training and technology usage, the overall pattern suggests that JMS is well-positioned to deepen its automation efforts. Continued investment in infrastructure, staff development, and system integration will be critical for maximizing the impact of automation and aligning with emerging best practices in healthcare logistics and supply chain management.

### **5.3.2 The challenges faced in automating distribution operations at Joint Medical Store (JMS)**

The challenges identified in automating distribution operations at Joint Medical Store (JMS) are consistent with findings from several recent scholars who have examined barriers to digital transformation in logistics and healthcare supply chains. Araz et al. (2020) emphasize that network instability and unreliable connectivity are among the most disruptive factors in automation, particularly in low-resource settings, aligning with JMS's top-ranked challenge of network interruptions. Similarly, Valladares (2021) highlights that limited funding remains a persistent obstacle to scaling automation, especially in public health institutions where budget allocations often prioritize immediate service delivery over long-term technological investments.

Girling (2022) underscores the importance of technical capacity in automation adoption, noting that inadequate skills and lack of specialized personnel can stall implementation and reduce system effectiveness. This mirrors JMS's moderate challenges related to staff competence and technical support. East (2022) adds that without continuous training and up skilling, automation tools risk underutilization, reinforcing JMS's findings on limited training and bureaucratic procurement processes. These organizational constraints not only slow down adoption but also affect staff morale and confidence in using new systems.

Kirikaleli et al. (2020) argue that resistance to change is often rooted in fear of job displacement and unfamiliarity with digital tools, which corresponds with JMS's lower-ranked but still relevant challenge of staff resistance. Hughes and Mester (2023) further assert that infrastructure limitations—such as outdated hardware and fragmented systems—can hinder the integration of advanced automation technologies, a concern also reflected in JMS's findings. Both scholars advocate for holistic planning that addresses not just technology acquisition but also the readiness of the operating environment.

Taken together, these scholarly insights affirm that JMS's automation challenges are not isolated but part of broader systemic issues faced by similar institutions. Addressing these barriers requires a multi-pronged strategy that combines infrastructure investment, staff development, streamlined procurement, and change management. By aligning its efforts with global best practices, JMS can enhance the sustainability and impact of its automation initiatives.

### **5.3.3 Strategies for improving the automation of distribution operations at Joint Medical Store (JMS).**

The top three strategies identified for improving automation in distribution operations at Joint Medical Store (JMS)—namely increased funding, regular refresher courses, and enhanced staff training—are strongly supported by recent peer-reviewed literature. Kwak, Kim, and Lee (2025) emphasize that financial investment is a foundational enabler of automation in healthcare logistics, particularly for organizations managing complex inventories and high order volumes. Their study found that institutions with dedicated automation budgets were more likely to adopt advanced systems such as automated storage and retrieval systems (AS/RS) and autonomous mobile robots (AMRs), which directly improve distribution efficiency. Similarly, Valladares (2021) argues that without sustained funding, automation efforts often stall at pilot stages, limiting scalability and long-term impact.

The importance of regular refresher courses is echoed by Girling (2022), who found that continuous training significantly boosts staff confidence and system utilization in automated environments. His research highlights that automation tools are only as effective as the people operating them, and that periodic training helps bridge skill gaps, especially in dynamic logistics settings. East (2022) adds that refresher courses also mitigate resistance to change by reinforcing the relevance and benefits of automation, particularly among long-serving staff who may be less

familiar with emerging technologies. This aligns with JMS's emphasis on maintaining user competence and adaptability through ongoing learning.

Enhanced staff training programs were also highly rated at JMS, and this strategy is widely validated in the literature. Araz, Choi, and Olson (2020) stress that workforce readiness is critical to successful automation, especially in healthcare logistics where precision and responsiveness are paramount. Their study recommends structured onboarding and role-specific training to ensure that staff can effectively interact with automated systems. Hughes and Mester (2023) further argue that training should not only focus on technical skills but also on process understanding and data interpretation, enabling staff to make informed decisions and troubleshoot issues proactively.

Together, these scholarly insights affirm that JMS's prioritization of funding, refresher courses, and training reflects global best practices in automation strategy. By investing in both technology and human capital, JMS can strengthen its distribution operations, reduce inefficiencies, and enhance service delivery. These strategies also lay the groundwork for broader organizational transformation, positioning JMS to scale automation sustainably and equitably.

#### **5.4 Contribution of the study**

This study makes significant contributions both practically and theoretically to the field of distribution automation in healthcare logistics. Practically, it provides evidence-based insights into the current automation practices, challenges, and improvement strategies at Joint Medical Store (JMS), offering actionable recommendations for enhancing operational efficiency, staff capacity, and system reliability. These findings can inform managerial decisions, guide resource allocation, and support policy development aimed at scaling automation in similar institutions. Theoretically, the study enriches existing literature by contextualizing automation within a Ugandan healthcare supply chain, bridging global scholarship with local realities. It validates and extends models of technology adoption, organizational readiness, and operational risk management by applying them to a public health distribution setting. Furthermore, it contributes to the discourse on digital transformation in emerging economies, highlighting the interplay between infrastructure, human capital, and institutional frameworks in shaping automation outcomes.

## **5.5 Conclusion**

In conclusion, the study found that Joint Medical Stores (JMS) has embraced key automation practices such as order processing, inventory management, and real-time tracking, aligning with global trends and scholarly recommendations for improving distribution efficiency in healthcare logistics. Despite notable progress, JMS faces persistent challenges including network interruptions, limited funding, inadequate technical skills, and bureaucratic procurement procedures, which hinder full automation adoption. The study identified strategic interventions—particularly increased funding, regular refresher courses, and enhanced staff training—as critical levers for overcoming these barriers. Supported by recent literature, these strategies underscore the importance of integrating technology with human capacity and organizational readiness. Overall, JMS is well-positioned to deepen its automation efforts, provided it invests in infrastructure, staff development, and system integration to maximize operational impact and ensure sustainable service delivery.

## **5.6 Recommendations**

5.5.1. The study recommends allocating dedicated funding for automation initiatives to ensure consistent investment in technologies that enhance distribution efficiency, such as inventory management systems, barcode scanners, and real-time tracking tools.

5.5.2. The study recommends enhancing staff training programs to build technical competence and confidence in using automation tools. This includes structured onboarding, role-specific training, and continuous learning opportunities tailored to operational needs.

5.5.3. The study recommends recruiting specialized technical personnel to support the maintenance, troubleshooting, and optimization of automation systems. This will reduce reliance on external support and improve system reliability.

5.5.4. The study recommends implementing regular refresher courses to keep staff updated on evolving automation technologies and best practices. This will help sustain user engagement and reduce resistance to change.

5.5.5. The study recommends streamlining procurement procedures for automation tools by reducing bureaucratic delays and adopting more flexible, responsive systems. This will accelerate technology acquisition and deployment across departments.

## **5.6 Limitations**

This study was primarily quantitative in nature, relying on structured survey responses to assess automation practices, challenges, and improvement strategies at JMS. As a result, it did not incorporate qualitative insights that could have provided deeper contextual understanding of staff experiences, perceptions, and organizational dynamics. Additionally, the study was limited to Joint Medical Store and did not include other medical distribution entities or regional facilities, which restricts the generalizability of the findings across Uganda's healthcare logistics sector. The scope was further confined to selected departments within JMS, potentially overlooking perspectives from other operational units that interact with automation systems in different ways.

## **5.7 Areas for Future Research**

Future studies should consider adopting a mixed-methods approach that integrates both quantitative and qualitative data to capture a more holistic view of automation in healthcare distribution. Expanding the research to include multiple medical supply organizations or regional warehouses would enhance the representativeness of findings and allow for comparative analysis. Researchers may also explore longitudinal designs to assess how automation practices evolve over time and what long-term impacts they have on efficiency, staff performance, and service delivery. Finally, future inquiries could focus on the role of leadership, change management, and policy frameworks in shaping successful automation adoption across Uganda's public health supply chains.

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## APPENDICES

### APPENDIX 1: ROBERT V. KREJJCIE AND DARYLE W. MORGAN (1970) SAMPLE SIZE ESTIMATE TABLE

N	S	N	S	N	S
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

## APPENDIX 2: QUESTIONNAIRE

My name is Bridget Abamushaba, a student at Makerere University pursuing a Master of Business Administration. I am currently conducting a study titled "Assessing Automation of Distribution Operations at Joint Medical Store in Uganda." You have been selected to participate in this study because your insights are highly valued.

I kindly request you to take a few moments to respond to the questions and statements openly, honestly, and independently. Your responses will remain confidential and anonymous, as this research is being conducted solely for academic purposes.

Thank you for your time and participation.

### SECTION A: Demographic characteristics

Please answer all questions and indicate your responses by ticking (√) in the appropriate box as requested.

#### A1 What is your Gender?

Male		1
Female		2

#### A2 What's your age bracket?

18-29		1
30-39		2
40-49		3
50-59		4
60 years and above		5

#### A3 What is your highest Level of education?

Ordinary level certificate		1
Advanced level certificate		2
Diploma		3
Bachelor's degree		4
Master's degree		5
PHD		6
Other, please specify below:		7

**A4 Which department are you in?**

Stores and Operations		1
Transportation		2
ICT		3
Procurement & disposal unit		4

**A5 How long have you been working with Joint Medical Store Uganda?**

Less than a year		1
Between 1 and 4 years		2
Between 5 and 10 years		3
More than 10 years		4

**A6 How frequently do you interact with the automated distribution system??**

Daily		1
Weekly		2
Monthly		3
Rarely		4

**Section B: Automation practices of distribution operations**

Please indicate the extent to which you agree with the statements where (1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; and 5 = Strongly agree).

	<i>Statements relating to the automation practices of distribution operations at Joint Medical Store (JMS).</i>	1	2	3	4	5
B1	JMS uses automated systems for managing inventory in its distribution operations.					
B2	Automated order processing systems are used to handle distribution requests.					
B3	Barcode scanners are used to track stock movement in the warehouse.					
B4	Radio Frequency Identification (RFID) devices are used to track stock movement in the warehouse.					
B5	Delivery vehicles are equipped with systems that allow real-time tracking.					
B6	Staff involved in distribution are trained to use automation tools and systems.					
B7	There are established procedures for integrating automation technologies into distribution workflows.					
B8	Regular system updates and maintenance are carried out on distribution automation tools.					
B9	Automation is used to generate reports or documentation in the distribution process.					

**Section C: Challenges faced in automation distribution operations**

Please indicate the extent to which you agree with the statements where (1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; and 5 = Strongly agree).

	<b>Statements relating to the challenges faced in automating distribution operations at Joint medical store.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
C1	There is limited funding available to support automation of distribution operations at JMS.					
C2	Inadequate technical skills among staff hinder the adoption of automation technologies.					
C3	Network interruptions often affect the use of automated systems.					
C4	Some staff members resist the use of automation due to fear of change or job displacement.					
C5	There is a lack of specialized personnel to maintain and support automation systems.					
C6	Existing infrastructure does not fully support advanced automation technologies.					
C7	Procurement processes for automation tools are bureaucratic.					
C8	There is limited training provided to staff on how to use new automation system					

**Section D: Strategies for improving the automation of distribution operations**

Please indicate the extent to which you agree with the statements where (1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; and 5 = Strongly agree).

	<i>Statements relating to</i> <b>Statements relating to strategies for improving the automation of distribution operations at Joint Medical Store.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
D1	JMS should allocate more funding specifically for automation in distribution operations.					
D2	Staff training programs should be enhanced to improve skills in using automation tools.					
D3	Recruitment of technical personnel specialized in automation should be prioritized.					
D4	Infrastructure upgrades are needed to support automation.					
D5	Regular refresher courses should be provided to keep staff up to date with automation technologies.					
D6	JMS should develop a clear strategic plan for automating distribution processes.					
D7	Engagement and change management strategies should be used to reduce staff resistance to automation.					
D8	Faster and more flexible procurement procedures should be adopted for automation tools and systems.					

### APPENDIX 3: APPROVAL LETTER FROM JOINT MEDICAL STORE



Our ref: JMS/HRA/F/07

9<sup>th</sup> September, 2025

Assistant Coordinator, Graduate Programs and Research  
Makerere University  
0782757734/0704904492  
Kampala Uganda

Dear Sir / Madam,

**RE: MS. BRIDGET ABAMUSHABA**

Reference is made to your letter dated 1<sup>st</sup> September 2025 introducing Ms. Bridget Abamushaba to conduct research.

The purpose of this letter therefore, is to inform you that Ms. Abamushaba has been granted permission to conduct her research at Joint Medical Store.

For any further inquiries, please do not hesitate to contact me on +256 777 386 717 or MawandaM@jms.co.ug.

Yours sincerely,

Mawanda Michael  
**MANAGER HUMAN RESOURCES & ADMINISTRATION**

**ISO 9001 - 2015 CERTIFIED**

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