

**THE EFFECT OF SUPPLY CHAIN APPROACHES ON PROFITABILITY IN  
PHARMACEUTICAL SUPPLY CHAIN OF HEALTHCARE PROVIDERS**

**Chibuye Angel Chelwa**

GSB150996

Supervisor: **Dr. Eng Kasongo Richard Mwale**

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## DECLARATION

I declare that this dissertation has been composed by myself and it has not been submitted at any other learning institution for any other degree in part or in full. I, therefore, certify that this is my own work, except for referenced literature which is indicated. This research was done under the supervision of Eng. Dr. Kasongo Richard Mwale.

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Chibuye Angel Chelwa

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Date

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Eng. Dr Kasongo Richard Mwale

.....  
Date

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## APPROVAL

This dissertation by Chibuye Angel Chelwa, is approved as fulfilment of the requirements for the award of Master of Business Administration Management strategy degree

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Examiner 1	Signature	Date

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Examiner 2	Signature	Date

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Examiner 3	Signature	Date

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Chairperson – board of Examiners	Signature	Date

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Supervisor	Signature	Date

## ABSTRACT

Healthcare supply chain is plagued by misalignment, high costs for healthcare providers and heavy dependence on third parties, distributors and manufacturers. In contrast to traditional supply chain models, Vendor Managed Inventory (VMI) can be used to gain a competitive advantage through effective supply chain. A VMI approach can improve supply chain performance by decreasing inventory-related costs and increasing customer service. This study aimed at understanding the effects of traditional and VMI strategies on profitability in private health care facilities. Using a mixed methods approach, the study compared financial statements of two healthcare facilities who used only traditional supply chain and of two additional facilities both for when they used traditional supply chain methods and when they used a VMI model. The analysis reviewed changes in gross profit margin and cashflow margin from 2016 to 2017. In-depth interviews were conducted to provide insights of the health care providers who work in VMI facilities a total of 8 staff members were interviewed. Data collected from financial statements and in-depth interviews was analysed using SPSS and Excel. Facilities that used VMI saw a combined growth in revenue from drug sales of 37% in contrast to 12.3 for those that used traditional models. A strong positive linear relationship was found to exist between VMI adoption and Gross profit margin with correlation values at 0.978 and 0.88 for VMI facilities. While no significant correlation was found between cash flow margins and VMI adoption, 87.5% of staff members interviewed said they would recommend VMI suppliers to their peers. Findings showed that both the facilities that implemented VMI in 2017 experienced significant revenue growth as compared to the hospitals that maintained a traditional model. In addition to this VMI hospitals had higher growth profit margins in 2017 than the traditional supply chain ones. However, the cases have been conducted over a short period of time, which may affect the generalization of the findings. Wider empirical evidence from more facilities over a longer period of time will be beneficial.

**Keywords:** Vendor Managed Inventory, Hospitals, Supply chain, Profitability

## **DEDICATION**

To my parents Jevason and Eunice Chelwa who have always put the needs of their children far before their own, your love, dedication and innumerable sacrifices made this possible.

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## ABBREVIATIONS AND ACRONYMS

<b>3MIS</b>	3rd Party Managed Inventory Services
<b>3RI</b>	3rd Party Replenished Inventory
<b>3P</b>	3rd Party
<b>COGS</b>	Cost of Goods Sold
<b>EMA</b>	Emergency Medical Assistance
<b>EOQ</b>	Economic Order Quantity
<b>FEFO</b>	First Expired First Out
<b>FIFO</b>	First in First Out
<b>GNP</b>	Gross National Product
<b>HIS</b>	Health Information System
<b>ITN</b>	Insecticide Treated Mosquito Net
<b>MDGs</b>	Millennium Development Goals
<b>OPD</b>	Out Patient Department
<b>PHC</b>	Primary Health Care
<b>SCM</b>	Supply Chain Management
<b>SPSS</b>	Statistical Package for Social Sciences
<b>TCE</b>	Transaction Cost Economic Theory
<b>USAID</b>	United States Agency for International Development
<b>VMI</b>	Vendor Managed Inventory
<b>VMR</b>	Vendor Managed replenishment
<b>WHO</b>	World Health Organisation

## DEFINITION OF KEY TERMS

**Cash flow margin** is a cash flow ratio which measures cash from operating activities as a percentage of sales revenue in a given period

**Cost** is the required the payment of (a specified sum of money) before it can be acquired.

**Cost distribution** is defined as any cost incurred by a wholesaler, retailer, or distributor.

**Gross profit margin** is a financial metric used to assess a company's financial health and business model by revealing the proportion of money left over from revenues after accounting for the cost of goods sold

**Gross margin** is a company's total sales revenue minus its cost of goods sold (COGS), divided by total sales revenue, expressed as a percentage

**Financial information** refers to the nonpublic information concerning an individual's assets, liabilities, credit, account numbers and balances, transactional information, and codes, passwords, social security numbers, tax identification numbers, driver's license or permit numbers, and state identification card numbers.

**Narrative inquiry** is an umbrella term that captures personal and human dimensions of experience over time, and takes account of the relationship between individual experience and cultural context

**Regression analysis** is a set of statistical processes for estimating the relationships among variables

**Revenues** refers to income, especially when of an organization and of a substantial nature

**Revenue distribution** is the sharing of the total amount of income generated by the sale of goods or services between the stakeholders or contributors

**Supply chain management** is the management of the flow of goods and services and includes all processes that transform raw materials into final products

**Vendor Managed Inventory (VMI)** is a business model where the buyer of a product provides information to a vendor of that product and the vendor takes full

responsibility for maintaining an agreed inventory of the material, usually at the buyer's consumption location.

## CHAPTER ONE

### INTRODUCTION AND BACKGROUND

#### 1.1. Introduction

The purpose of this chapter is to provide insight in to Vendor Managed Inventory and its effect on profitability as compared to traditional supply chain models. Healthcare has become a key everyday resource to provide an improved quality of life but requiring extensive training and resources to achieve effective delivery and outcomes. To meet these requirements providers must be trained, equipped and ready, in part through maintenance of adequate stocks of supplies. Vendor Managed Inventory (VMI) can be a part of this reconfiguration of responsibilities, freeing up employees to focus on core competencies and ensuring availability of supplies in hospitals and healthcare facilities.

Accordingly, the historical background relating to the topic is discussed. This discussion provides valuable insights into the pharmaceutical industry as a whole, as well as the effect of traditional and vendor managed inventory (VMI) approaches on profitability in the pharmaceutical supply chain of health providers. The research problem was developed from this analysis together with an explanation of the significance of this research. Further, the width, breadth and underlying assumptions of the research are also considered. Finally, the chapter ends with a discussion on the subsequent sections of the research report.

#### 1.2 Background

Since the 90s, the world has seen many rapid technological changes and the healthcare sector has not been spared. These changes require the healthcare sector to adopt the management strategy principles applied by the other sectors in order to be successful and stay ahead of the curve. One such management strategy emphasizes that the significant competitive advantage and cost reduction resulting from good supply chain management (SCM) practices can have a huge impact on a company's bottom line, more so in healthcare industry where, “Right product must be in the right place at the right time” (Gutierrez & Villalobos, 2004).

A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers (Kaihara, 2003). The International Center for Competitive Excellence (Liu et al., 2005) defined it to be “the

integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders”. Effectively integrating the information and material flows within the demand and supply process is the main concern for Supply Chain Management (SCM). Effective coordination between units in a supply chain has come to play a key role in focusing on the innovation, flexibility, and speed that serve as the sources of competitive advantage necessary for survival in global competition (Lee, 2002: 40-41).

Supply chain is the network created among different companies that produce, handle, and distribute a specific product (Susarla & Karimi, 2012); in the current study, the product being investigated is pharmaceutical medicine. Supply chain is essential to getting medicine to market and generating revenue from the process. There was a knowledge gap about effective SCM in third world countries with a high incidence of medical need. In a global marketplace, managing the supply chain was a significant challenge, because of continually changing demands of shorter product lifecycles, industry consolidations, variable conditions on the ground.

SCM is vital for companies, as a successful SCM strategy can lower expenses and increase sales for the company. SCM practices enable the world's leading organizations to realign their supply chain to the distinct set of concepts by providing functioning solutions for enterprise needs in supply and demand planning and forecasting, sourcing and procurement, and supply chain execution (Susarla & Karimi, 2012). The connections and nodes in a supply chain achieve functions that contribute to the value of the goods transported through the chain. Any connection that does not work well reduces the overall effectiveness of the whole supply chain (Assey, 2012:195). Effective and efficient supply chain processes are vital to reduce the product cost while maintaining quality and ensure the availability of inventory. To succeed, companies that distribute medicine must practice effective SCM to ensure their competitiveness in the market.

Healthcare supply chain management differs from other applications in terms of key elements. The healthcare supply chain is plagued by misalignment, high costs for healthcare providers and heavy dependence on third parties, distributors and manufacturers. However, healthcare

providers are still expected to control costs while increasing the quality of services (USAID, 2011).

Vendor Managed Inventory (VMI) is an example of a supply chain strategy that can be used to get competitive advantage through effective supply chain. In VMI, the vendor or supplier is given the responsibility of managing the customer's stock based on the shared information between them. Vendor-managed inventory (VMI) approach can improve supply chain performance by decreasing inventory-related costs and increasing customer service. Unlike a traditional supply chain wherein each member manages its own inventories and makes individual stocking decision, VMI is a collaborative initiative where a customer, shifts the ownership of inventories to its supplier and allows the supplier to access its demand information in return. The key characteristics of VMI are short replenishment lead times, and sufficient and punctual deliveries that optimize production and transport planning (Gutierrez & Villalobos, 2004).

The concept of VMI has far reaching implications for supply chain participants. Since it transfers responsibility for managing a consuming firm's inventory to the supplier (Disney and Towill, 2003) the consuming firm or customer is no longer required to place an order with the supplier, this eliminates one aspect of decision making for the consumer. In the case of health care providers, this provides them with better opportunity to focus on their core competencies which are providing healthcare services. In addition to this, in a VMI model, the customer no longer has to track inventory or place orders, which is likely to result in a reduction in their administrative costs. On the other hand, as a result of this increased demand visibility and greater supply chain integration, suppliers have adequate time and data necessary for replenishment planning and delivery planning which results in reductions in transportation costs (Lee, 2004, Waller et al., 1999), potentially reducing the cost of the inventory further.

In this study, we investigated the effect of Traditional and Vendor Managed Inventory approaches on profitability in pharmaceutical supply chain of Healthcare providers. The paper was structured as follows, this chapter, includes the background to the study, the problem statement and the main objectives. It also presents the specific objectives, research questions and the significance of the study, justification and structure of dissertation. In the following

chapter two, Literature related to VMI implementation and characteristics of hospital pharmaceutical supply chain are then considered. In chapter three, theoretical and conceptual framework for the research were discussed. In Chapter four, Research Methodology which included; research design, study population and sampling method, exclusion and inclusion criteria, the study process, data collection methods, data analysis, ethical considerations and time scale of the study. Subsequently, presentation and interpretation of findings were presented in chapter five, followed by the discussion of the findings in Chapter six and finally conclusions, limitations and recommendations of the study were discussed in chapter seven.

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

Since its adoption, the VMI concept has received a lot of attention, as the model differs significantly from the traditional practice in that the chain members seemingly structure their relationships is a mutually beneficial strategic partnership. The studies by Lee et al. (2005) conclude that VMI is an effective approach for implementing initiatives, which are critical and imperative to improve the entire supply chain's financial performance. Similarly, Waller, Johnson, and Davis (1999) indicate further that the VMI method can improve inventory turnover and customer service levels at every stage of a supply chain. Although, there exists some literature and research that compares various aspects of traditional supply chain and those of VMI, there is very little that reviews VMI operations in the healthcare sector and even less so reviewing its effects on profitability within the pharmaceutical sector in the Zambian context. With the backdrop of existing research on the topic of VMI it is important that we explore the financial benefits, or lack thereof resulting from implementation in the Zambian context so as to provide the necessary information for business owners, members of academia and the general public wishing to adopt or review this supply chain model.

### **1.4. Research Objectives**

Study objectives define the specific aims of the study and how the study is going to answer the specific research question. They are important because they not only help guide the development of the protocol and design of study but also play a role in sample size calculations and determining the power of the study (Hanson, 2006). Every study has objectives and therefore this study has both general and specific objectives.

### **1.4.1. Aim / General Objective**

To investigate on how operating VMI in pharmaceutical inventory supply chain affects the profitability of healthcare facilities in Zambia.

### **1.4.2 Specific Objectives**

- i. To describe the effect of VMI on private health care providers earning potential over a period of time
- ii. To describe the effect of VMI on the ability of private health care providers to convert sales into cash
- iii. To describe the effects of VMI adoption on profitability from the perspective of members of private healthcare facilities

## **1.5 Research Questions**

A research question is a question that the research study sets out to answer. These questions are important since they are the focus of the research and must be accurately and clearly defined (Meltzoff, 1998). Thus, the research questions will provide focus for the study, determines the methodology, and guides all stages of inquiry, analysis, and reporting.

### **1.5.1 Primary Research Question**

How does the operating of VMI in pharmaceutical inventory supply chain affect the profitability of healthcare facilities in Zambia?

### **1.5.2 Secondary Research Questions**

- i. What is the effect of a VMI approach on a private health care providers gross margin?
- ii. What is the effect of a VMI approach on a private health care providers cash flow margin?
- iii. What are the perceived effects of VMI adoption on profitability of private health care providers?

## **1.6 The Hypothesis**

On the basis of an initial literature review some assumptions regarding requirements for VMI success were identified. These assumptions are pronounced as hypotheses that form a fundamental proposition of the research question.

H1: VMI adoption has no effect on the gross margin of private healthcare facilities

H2: VMI adoption has no effect on the cash flow margin of private health care facilities

H3: There are no perceived effects of VMI adoption on profitability for Health Care providers

### **1.7 Delimitation**

This study is focused on private healthcare facilities in Zambia who have adopted the vendor managed inventory model as a means of securing their pharmaceutical inventory.

The delimitations of this study are related to the novelty of the concept of VMI in the pharmaceutical arena. As such there isn't a very large population to sample from, which may make it difficult to use the research findings to explain the effects of profitability in other facilities. Delimitations are design parameters which are within the control of the researcher, such as the study site location (Marshall & Rossman, 2011).

### **1.8 Purpose of the study**

The purpose of the study on the effect of Traditional and Vendor Managed Inventory approaches on profitability on pharmaceutical supply chain of Health care providers will help to explore the Traditional and Vendor Managed Inventory approaches that Zambian business leaders have used in the healthcare industry to reduce the high costs associated with SCM. Furthermore, the research study results will be significant because they will have the potential to enhance companies or organizations' supply chain effectiveness and their reputation for on-time delivery and reducing organizations' operational costs. Results of this study will also reveal the nature or strengths and weaknesses of VMI adoption and changes in profitability ratios in private healthcare providers in Zambia, which will allow companies focused on supply chain an opportunity to improve of their weaknesses and capitalize on their strengths. In addition, the results from this study could benefit the public by extending the knowledge on the effect of VMI on the ability of private health care providers to convert sales into cash. Most important, the findings from the study will provide further insights that could be instrumental in describing the processes through which VMI can be used to improve profitability for healthcare facilities in Zambia.

### **1.9 Justification of the study**

The purpose of the study is to investigate on how operating VMI in pharmaceutical inventory supply chain affects the profitability of healthcare facilities in Zambia. Despite VMI

approaches being the most popular approaches to collaboration within the supply chains, their level of adoption is still far from the expected, primarily due to the difficulty in identifying the benefits and assessing their economic value. However, in the Zambian healthcare industry this has been traditionally considered as an area of low value. Recent studies have shown that tremendous cost savings and potential revenue can be generated with the enhanced management of distribution and inventory, it was estimated that a hospital could reduce its total expenses by at least 2% of total expenses through better inventory management and distribution of finished medical materials. This represents a percentage of total expenses, not just the amount providers spend on supplies and pharmaceuticals (Schneller, 2006).

To this effect this study measured factors that gave rise to this experience. The cardinal question that needs answers is how does the operating VMI in pharmaceutical inventory supply chain affects the profitability of healthcare facilities in Zambia.

The situation prevailing currently needs concerted efforts aimed at finding out the process through which VMI can be used to improve profitability for healthcare facilities in Zambia thereby contributing to the development of healthcare facilities.

#### **1.10 Structure of dissertation**

Following the introduction and background of the study, statement of the problem, aim of the study, research objectives, scope and delimitation, limitation of the study as well as justification of the study, the report is organized as follows. In Chapter 2, a brief literature review critically evaluated on the Vendor Managed Inventory, and this showed some discrepancy or gaps in the study that prompt for this study. This is followed by identified theoretical and conceptual framework which the study was based on in Chapter 3 to give the reader a sense of its enormity and implications on the well-being of society.

In Chapters 4 describes the research methodology that included; research design, study population and sampling method, exclusion and inclusion criteria, the study process, data collection methods, data analysis, reliability and validity, ethical considerations and time scale of the study. The presentation and salient discussion of the finding was presented in Chapter 5 and lastly Chapter 6, comprised some conclusions and recommendations of the study.

## **1.11 Conclusion**

This Chapter has presented an extensive review of the process involved in developing the research instrument, the definitions of the variables that were used and the methods by which the data collected was analysed in order to draw the conclusions required to support the research hypotheses that were formulated.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Introduction

Literature review is an important component of any research for it puts the current endeavour into a broader perspective. By reviewing literature, researchers demonstrate that they do not exist in a vacuum. They acknowledge or notice the work that has been done elsewhere and on a particular topic.

The literature of Vendor Managed Inventory as a specific method began in the mid-1990s. Vendor Managed inventory is also known as continuous replenishment (Sari, 2007). The concept of VMI radically changes traditional inventory management where the customer makes an inventory replenishment decision. The VMI concept implies that the responsibility in the replenishment process is reallocated from the customer to the suppliers (Elvander et al., 2007). This approach encourages collaboration and information sharing among trading partners. Many potential advantages, gained from the adoption of VMI approach, include reduced lead times, improved service quality, reduced bullwhip effects, lower costs and reduced administration (Sari, 2007). It is no surprise then that bearing this in mind, many companies in different industries attempt to adopt this approach. However, different industries and different stages of a supply chain require different approaches in order to be successful (Elvander et al., 2007; Wallin et al., 2006). The right inventory management approach for one particular industry or item may not be the right approach for another item or industry. So, the impact of VMI implemented in different industries and at different stages of supply chain is expected to differ (Elvander et al., 2007; Pohlen and Goldsby, 2003; Waller et al., 1999).

#### 2.2 Characteristics of Hospital Pharmaceutical Supply Chain

Distributors and wholesalers play an important role in hospital pharmaceutical supply chains. Many manufacturers tend to outsource distribution to a third party distributors and wholesalers, allowing the manufacturer to concentrate on their core business while the third party can leverage its warehouse and distribution infrastructure to provide benefits through economies of scale. Various factors affect the demand characteristics of pharmaceutical products including a hospital's size, its geographic location, specializations and government regulations. In addition, demand from each ward or department in the hospital may differ

depending on their specialization. Thus, a hospital's pharmaceutical demand comprises a wide variety of high and low volume items, perishable and durable items, critical and non-critical items, and high and low value items (DeScioli, 2001). It also has to cope with unpredictable demand patterns. Maintaining high inventory levels is the simplest way to ensure product availability in the hospital.

Within the healthcare industry, the supply chain associated with pharmaceutical products is critical in ensuring a high standard of care for patients and providing adequate supplies of medication for pharmacies. In terms of cost, it is estimated that supply accounts for 25-30 percent of operational costs for hospitals (Roark 2005). Therefore, it is essential that this is managed effectively to ensure both service and cost objectives are met. Various issues existing at the distribution element, particularly from the wholesaler to the hospital are as follows:

- Product life cycle: Once the active ingredient is patented, it may take eight years to develop the product into something that can be marketed. Once the patent expires, alternative products may enter the market, or companies may reduce the product price (Lauer 2004). New technology is shortening life cycles creating new pressures on the distribution channels. Profit margins: Despite pharmaceutical products having a high value per unit, operating margins are small in the wholesaler sector particularly. One cause of this is the control over pricing held by hospitals, retailers and manufacturers (Lauer 2004).
- Forecasting: It is difficult to predict the exact demand for medicines. One of the issues is the availability of accurate data on consumption. However, the lack of standard nomenclature for healthcare products, plus the preferences of clinicians creates further uncertainties (Lauer 2004).
- Lack of supply chain education: Awareness of the concept of supply chain management, particularly within hospitals, is low (Lauer 2004). Therefore, managers are not properly equipped to control the supply of medication. Given this context, a number of initiatives have been undertaken over recent years with a view to reducing supply chain costs and improving customer service. However, there is a requirement for improved information and communication technology (ICT) systems to support this, along with automated processing of orders and suppliers (mainly wholesalers) close to the hospital to enable rapid replenishment.

### **2.3 VMI in the Life Science and Pharmaceutical industry**

Pharmaceutical supply chains are strictly regulated and require an extraordinary degree of oversight. These necessary controls can obscure supply chain visibility, thus making it difficult to anticipate inventory levels, and also lessens a customer's ability to respond to fluctuating order volume. When conducted with full transparency and proper expertise, VMI solutions offer the ability to anticipate demand in real-time and adjust supply levels accordingly. This presents an opportunity for the pharmaceutical area, since many products are either costly or outdate quickly. Despite this advantage, the life sciences and pharmaceuticals industry has experienced a significantly lower rate of adoption than the retail area (Whewell, 2010).

Supply chain executives struggle with five primary challenges: inventory visibility; risk (such as contaminated or expired inventory); cost containment (such as paying only for consumed inventory and not for supplied/expired inventory); internal customer demands; and globalization. In order to address these challenges, the pharmaceuticals industry needs a supply chain with the following attributes:

- Transparency: The latest technologies are used to digitally track and gain greater visibility into goods across the supply chain.
- Integration: All supply chain actors (such as vendors and customers, either internal or external) can share information and make decisions collaboratively.
- Intelligence: Based on the latest advanced analytics, simulation and modeling tools, pharma companies can evaluate increasingly complex and dynamic risks and constraints and manage the supply chain more scientifically.

Pharmaceutical companies are increasingly realizing that VMI is critical and, given the aforementioned attributes, can help them transform their supply chains into lean, efficient and value inducing machines. Prime motivating factors include moving from the traditional purchase order process (which offers minimal information exchange) to a full-blown vendor collaboration model that involves digitally transmitting accurate forecast and stock information to vendors that then facilitate just-in-time replenishment. To do this, they must arm vendors with the requisite value chain visibility and trust them to flexibly supply inventory within agreed-upon threshold levels. While the adoption of VMI remains exceptionally low in the pharmaceuticals industry, this is beginning to change. For instance,

major pharmaceuticals players such as GSK have started to experiment with VMI. In the 1990s, the company began using EDI to exchange replenishment information. It later introduced VMI to address rapidly changing customer needs and the obvious lack of visibility into actual inventory throughout the network, which was undermining operational efficiency and effectiveness. GSK extended VMI into its upstream and downstream networks to allow more timely and effective information sharing and empowered its supplier network to automatically satisfy customer requirements. Other players are following suit. For example, we are helping a top-10 pharma company expand its deployment of VMI (Gutierrez & Villalobos, 2004).

#### **2.4 VMI within Healthcare Supply Chain & Information Technologies**

Since its adoption in the arena of supply chain management in early 1980s, the VMI concept has received a great deal of attention, as the model differs significantly from the traditional practice in that the chain members shift their relationships from an arm's length to a strategic partnership. The studies by Vergin and Barr (1999) and Lee et al. (2005) conclude that VMI is becoming an effective approach for implementing the channel coordination initiative, which is critical and imperative to improve the entire chain's financial performance. Waller, Johnson, and Davis (1999) indicate further that the VMI method can improve inventory turnover and customer service levels at every stage of a supply chain. Disney and Towill (2002) find that the main goal of VMI chains, which is minimizing the channel cost while simultaneously satisfying some degree of customer service levels, is achieved primarily by sharing demand and inventory information. However, the studies about the implementation of VMI model in the pharmaceutical industry are limited.

#### **2.5 A Case for VMI Adoption in the Hospital Supply Chain**

Retail giant Wal-Mart revolutionized the concept of VMI as a cost-saving inventory management technique. Since then, retail companies have scrambled to adopt this model. However, pharmaceuticals industry has been slower to adopt this fluid management practice for several reasons, including:

- The pharmaceuticals industry lacks the driving force seen in retail. As a product's velocity increases, so does the need for a VMI solution. Hospitals don't produce fast-

moving product, which means they might not readily recognize the cost-savings VMI solutions offer.

- The pharmaceuticals industry is historically slower to adopt emerging trends. This reluctance is due to the sensitive nature of the pharmaceuticals, as well as strict biological regulations.
- Incompatible inventory management systems make it difficult to achieve the necessary level of transparency. The ability to seamlessly exchange information electronically is a crucial component of successful VMI solution.

However, an experienced and knowledgeable vendor can help pharmaceuticals customers overcome these hurdles and adopt VMI as a supply chain management practice. There are several benefits to be recognized as a result of this solution:

- Supply chain visibility Integrated systems and consistent oversight allows for real-time analysis of inventory levels. With this information, vendors can quickly and efficiently anticipate needs and customers have unprecedented insight into their supply chain.
- Reduce unnecessary overstock or stock out situations Overages and shortages hurt the bottom line. By constantly monitoring order volume and projecting anticipated demand, suppliers can mitigate these costly inefficiencies.
- Efficient product rotation Careful inventory oversight allows suppliers to quickly move product that will soon outdate, while keeping stock levels fluid and responsive to demand.
- Minimizing risk precision is key when handling sensitive and expensive pharmaceuticals. Through transparency and careful analytics, suppliers utilizing VMI solutions maximize order precision, thus preventing unnecessary handling and overstock of these expensive pharmaceuticals (Sari, 2007).

Most studies have examined the large scale implementation between sizable vendors and retailers. There are a great number of smaller settings where VMI, in limited fashion and with limited expense, may be implemented to best serve a larger number of customers, while taking advantage of a supplier's expertise in this area. In healthcare, particularly in high cost, high velocity items, sizable acquisition, inventory and carrying costs may be reduced as a high profile example of the benefits of the program.

Follow up is required. Case studies of various configurations of hospitals, healthcare conglomerates, healthcare cooperatives and regional buying consortiums should be examined as the customer of single vendors under a VMI construct to determine the best product mix and service levels to achieve parity and lower costs where possible. Following identification of successful and unsuccessful implementations, empirical research should be conducted to provide a starting point for further refinement of VMI acceptance and processes in the healthcare industry. Findings should be provided to practitioners through journal and magazine publication as well as through conference presentations. Feedback from these venues can help focus further modification for improvements.

## **2.6 The Suitability of Vendor Managed Inventory**

Letinkaya and Lee (2000) believe that VMI is an important coordination initiative. It can be used as one of the initial steps in a supply chain streamlining exercise or as a stand-alone process between trading partners. Vendor managed inventory relationship can be harder to enter into with manufacturers that have a lot of customers. Snaros et al. (2003) shed some light on the problem in their investigation of the vendors. They claim that one major challenge for pharmaceutical companies is that usually only part of their customer base is involved in vendor managed inventory. This means that the vendors need to set up their customers in a way that both VMI and non-vendor managed inventory customers simultaneously can be efficiently served; this is both hard and costly.

## **2.7 Vendor Management Inventory Maturity Stages**

Results by Claassen et al. (2008) suggest that VMI maturity stages are a grey area in the theories as many of the VMIs are in fact only vendor managed replenishments (VMR). However, a noteworthy factor is that they did not measure this in their studies. VMI maturity stages are defined by Claassen et al. (2008) as follows:

1. In the first stage the supplier takes responsibility of ordering, inventory management, and replenishment. In this phase the increases are seen in service quality but usually the total cost benefit is not yet achieved. In contrary, the total cost may even increase at this point.
2. In the second stage the supplier takes control of the full pipeline. Only in this stage noteworthy cost reductions can be achieved without compromising service levels.

## **2.8 VMI Vendor-Buyer Relationship**

Maybe the biggest change in VMI when comparing to traditional inventory management practices is its more collaborative nature. It is important to be in constant contact with the client in order to reduce deviations between forecasts and actual consumption. Compared to the traditional way in VMI both the supplier and the customer are forced to work more proactively. (Gardner 2004, 99.) In a traditional relationship both the buyer and the supplier are trying to get advantage over another; in VMI however, the relationship is more based on mutual benefit. (Gardner 2004, 103.)

The role of customer changes from inventory management to one that provides all the relevant information it thinks may help the supplier to make optimal decisions. (Claassen et al. 2008, 407). When VMI is implemented for strategic products the buyer is expected to be highly involved in the process; however, for commodity products the supplier is expected to take full control of the supply chain without much participation from the buyer. (Claassen et al. 2008, 408).

## **2.9 Related studies**

### **2.9.1 Global perspectives**

The economy demands companies to find new ways to grow and increase shareholder value. Companies that are not developing or finding competitive advantages are eventually being pushed out of the global competitive environment. One of the ways to gain an edge over the competition is to reduce inventory without negatively impacting operating costs or customer service. With this backdrop, Gutierrez, A and Villalobos, J (2004) performed an experiment to understand implementation of a vendor managed inventory system in a two-level supply chain. A model for calculating replenishment quantities is presented, and problems such as incentives to deviate from optimal inventory levels and imbalanced savings were addressed. Under the VMI business model, popularized by Wal-Mart, the vendor receives data from the customer regarding sales and stock levels, and thus it can decide when to initiate the replenishment procedure. By receiving timely information directly from the customer, the overall inventory requirements are reduced because the vendor's need for excess stock to buffer against uncertainty is eliminated. In their research, they analysed the impact of using a VMI system in a two-level supply chain in which material flows in both directions. They focused on two facilities in Mexico which were working under the traditional supply chain model and

hypothesized that the implementation of a VMI system in both facilities would reduce their overall supply chain costs. A mathematical model was developed to calculate the ordering quantities from one plant to another based on their demand forecasts, safety stock levels, and a fixed ordering frequency. Experimental data collected showed that by implementing a VMI system, the facilities were able to reduce their inventory levels by 40% on average. The research also addressed common problems faced by VMI systems such as deviation from optimal inventory levels and imbalanced savings. The experiment concluded that for the considered problem a VMI system in conjunction with consignment would reduce the facilities overall costs and also eliminates the incentive of the vendor to deviate from the overall optimal behaviour. In the case of imbalanced savings, we consider the possibility of transfer payments. We also consider the possibility of counterbalancing savings by using VMI for SKUs of both facilities. In this way, both plants can enjoy from the benefits of having their inventory managed and owned by the vendor (Gutierrez & Villalobos, 2004).

#### **2.9.4 Regional perspectives**

In 2008 the USAID DELIVER PROJECT and the Supply Chain Management System (SCMS) project implemented a VMI project in Zimbabwe called the Delivery Team Topping Up (DTTU) system. This is a logistics system which manages various commodities such as test kits and medicines. In the DTTU system, facility staff does not place orders; rather, every facility is visited once per quarter by a delivery truck, which acts as a rolling warehouse. On the truck is a delivery team leader, who works with facility staff to collect basic logistics data, including physical inventories, any days out-of-stock, and any losses or adjustments. This data is entered into customized software the software calculates resupply quantities, and facilities are “topped up,” or re-supplied, to their maximum level. Upon return from a delivery, data from the laptops are synched to the TOP Up software at the central level. The TOP Up software generates national-level stock status and other program management data.

Evaluation of the VMI system shows that it reduces the burden on healthcare providers, ensures reliable data is speedily available at any time it’s needed at the central level, and minimizes stockouts. A costing study conducted in 2010 compared different logistics systems in Zimbabwe to determine the most cost-efficient approach. This study found that the DTTU system was shown to be less costly than a pull system. Furthermore, this evaluation found that

in a vendor managed inventory system such as DTTU, shifting inventory tasks away from facility staff to a delivery team has enabled facility staff to have more time to spend with clients rather than completing logistics responsibilities. Also, automating data collection has significantly reduced the calculation errors that procurement teams make, and has reduced the amount of time that must be spent at each facility. Data collected from the facility level is automatically migrated into the national level database. No data entry is required, and national level consumption and stock on-hand data rapidly available for decision-making. This study concluded that as a VMI system DTTU yields positive results in increasing the availability of health commodities in challenging environments by guaranteeing direct delivery to health facilities (USAID, 2011).

#### **2.9.4 VMI in Zambia**

A research and subsequent paper by Milambo, D and Phiri, J (2019) articulates the challenges faced in the Supply Chain Management (SCM) of aircraft spares in the Zambian Aviation Industry. It was discovered that some of the challenges faced in SCM were due to unreliable lead times, non-adherence to service level agreements between buyers and suppliers and the unavailability of local players in the industry among others. The study population targeted employees in the Zambian aviation sector in various departments including both public and private institutions involved in the aviation industry in the country and included the staff from various departments in the aviation industry from Finance, Supply Chain Management, Aeronautical Engineering and Stores Management.

The researcher adopted a sample size using purposive sampling method. The main goal of purposive sampling is to focus on particular characteristics of a population that are of interest, which will best enable you to answer your research questions. The sample being studied is not representative of the population, but for researchers pursuing qualitative or mixed methods research designs, this is not considered to be a weakness. Rather, it is a choice, the purpose of which varies depending on the type of purposive sampling technique that is used. For example, in homogeneous sampling, units are selected based on their having similar characteristics because such characteristics are of particular interest to the researcher (Lund Research, 2012). Based on the findings, it was concluded that the Supply Chain Operations Reference (SCOR) Model which is a significant component of VMI operations can be adopted to eliminate delays in procurement and delivery of spare parts and solve many other challenges

found in the aviation industry in the Country. This can be ironed out using the model's five management practices of plan, source, make, deliver and return. The model structure also provides four major components (People, Practices, Processes and Performance) to assess the status of any given situation. These elements ensure a smooth supply chain for products as they incorporate demand management, inventory management, and freight management among others. The study recommended the need to employ Enterprise Resource Planning for supplier-vendor management and the need to adhere to service level agreements. Furthermore, it stressed on the need to use supply chain techniques in improving efficiency in the SCM function to reduce costs (Milambo & Phiri, 2019).

#### **2.9.4 Conclusion**

The analysis of the literature identifies several research gaps. Firstly, VMI implementation varies in different industries due to different characteristics within that industry. Even in the same industry, VMI also varies in the different contexts of the supply chain. Although there is some relevant previous literature in the healthcare sector, research specifically related to VMI implementation for the supply of medicines to hospitals is still very limited. Based on the review of the existing literature it appears that a number of theories suggest that VMI is viewed as an effective approach and it is an important strategy to improve the entire chain's financial performance. It is important to note that it is possible that there are other variables or factors not considered in the current research. However, the key factors of research interest relate to the effect of VMI strategies versus traditional strategies on profitability and how the VMI approach is experienced or perceived by hospital members of staff.

## CHAPTER THREE

### THEORETICAL AND CONCEPTUAL FRAMEWORK

#### 3.1. Introduction

In this chapter the theoretical and conceptual frameworks were discussed. Eisenhart (1991) defined a theoretical framework as “a structure that guides research by relying on a formal theory. It is constructed by using an established, coherent explanation of certain phenomena and relationships”. A conceptual framework is defined as an analytical tool with several variations and context.

#### 3.2. Theoretical framework

This presents review of the relevant theories on inventory management. The theories covered are; transaction cost economic theory, trade-off theory and operating and operating cycle theory.

##### 3.2.1. The Bullwhip effect and demand visibility

The Bullwhip effect is an old phenomenon but the new term, Bullwhip, was introduced by Lee et al. (1997) in an article describing the effect of information distortion in a supply chain. The Bullwhip effect is the phenomenon where orders to upstream suppliers have larger variance and lower frequency than sales to downstream customers giving an unlevelled upstream information and downstream material flow (e.g. Lee et al. 1997, Childe 1998, Disney & Towill 2003a).

Lee et al. (1997) present four sources of bullwhip effect in a supply chain. These are includes

- Demand signal processing or the Forrester effect which is the delay of demand signals when real time information is unavailable and old demand information is used to update forecasts.
- Order batching or the Burbidge effect where the real demand is hidden because orders are adjusted to suit other conditions like full truck loads or economic order quantity.
- Price variations or the promotion effect which moves sales intentionally. Promotions usually cause periodic high sales followed by periodic low sales, causing variation in demand, and
- Rationing and gaming or the Houlihan effect which occurs when supplies are uncertain and customers place strategic orders to safeguard against anticipated supply shortage.

All these effects are likely to occur in a traditional supply chain and all together they can give a significant distortion to upstream demand.

Demand visibility is known to reduce the bullwhip effect (e.g. Smáros et al. 2003). When upstream suppliers can view end demand and base their replenishment planning on advance demand data they reduce uncertainty and can maintain a high service level without jeopardizing the cost level.

Disney and Towill (2003) simulated the four different sources' effects on the manufacturer's production ordering activities in a two tier supply chain. They concluded that with a successful VMI program both the Burbidge effect and the Houlihan effect may be completely eliminated. They also found that the effect of price induced variations will be reduced and that VMI has a positive effect on high volume products suffering from the Forrester effect.

### **3.2.2 Average inventory holding**

Economic Order Quantity (EOQ) is a theoretical concept that has formed part of inventory management literature as early as 1915 (Sarkar, Saren, & Wee, 2013). The EOQ is a model which suggests that with the constant level of demand for a good there is an order point which minimises the holding costs and reorder costs associated with that product and, as a result, maximise the profit (Drury, 2004). For entities that experience low profitability, or in the case of pharmacies whose profitability is controlled by "price ceilings" regulated by the government, operating at the lowest possible cost is important for continued survival. The holding costs include items such as insurance and warehousing. They also include a cost known as opportunity cost. This cost is not a physical cash cost that needs to be settled, but rather an economic cost. The opportunity cost is the cost incurred by the entity by tying up its cash and cash equivalents in inventory that does not generate a return, rather than placing them in other assets that do generate a return. The more inventories held by an entity the higher their total costs as there is a positive relationship between holding inventory and the costs incurred.

The other type of cost associated with inventory is what is known as ordering costs. The costs that are normally related to ordering costs include costs related to placing the order and delivery. These costs also include those that may not actually be quantifiable, such as lost sales resulting from not having the necessary stock on hand. The two costs must be offset until the

optimal balance is achieved. At this point total costs will be the lowest. This is known as the economic order quantity. Owing to the uncertainty of demand during the lead time, that is, the time between the actual order and the delivery of the stock, entities usually hold safety stocks to ensure that they do not lose sales.

As the pharmaceutical industry has become more deregulated, the pharmacist has had to focus on remaining competitive. In this regard, it has been suggested that inventory management is key to retail financial success. Controlling the inventory of an entity efficiently requires an understanding of the number of products, the size of the store and the operating hours of the entity (Dubelaar et al., 2001). In a competitive industry, such as the retail pharmaceutical industry, if a pharmacy does not have the appropriate stock available customers will simply go to another pharmacy. The owner of the store thus needs to make decisions relating to how much safety stock he should maintain and how much stock to order, as well as the lead time relating to delivery of this stock (Dubelaar et al., 2001) versus the demand for the stock.

### **3.2.3 Transaction Cost Economic Theory**

This theory is based on the work of two authors, Oliver Williamson (1975) and Ronald Coase (1937) who argued that a firm can make a more efficient allocation of resources than a market (a bargaining system). According to TCE the fundamental role of a firm is to minimize costs and understanding of these costs will enable firms to grow and incorporate additional activities. This theory references to a transaction as the fundamental unit of evaluation and maintains that the knowledge of strategies to cut back on transactional cost will be important for the success of a firm.

Transaction costs consist of costs incurred in searching for the best supplier or customer, the cost of establishing a contract, and the costs of monitoring and enforcing the implementation of the contract. This theory can be enforced both to the decisions of an effective relationship as exists between firms and the market and the arrangement of internal transactions. For example the determination of a maximum degree of inventory should be done based on an exchange between the costs and advantages connected with the degree of inventory. The cost of ordering costs and the carrying costs are comprised in the holding cost of inventory. The ordering costs is connected to purchase of inventory, which is inclusive of the preparation of a purchase form, reception, examination and registering the products accepted.

Additionally, the cost of carrying includes the maintenance of inventory and comes about because of the cost of storing inventory and other opportunity cost. A number of reasons exist for the high and low degrees of inventory and this reason is dependent highly on the type of business the firm is in. One of the simplest reasons for the management of inventory is the cost, which is established on theory of transaction cost economics (Emery & Marques, 2011). For the companies to have a competitive advantage, they must reduce their costs, and they can achieve this through maintaining the costs of inventory as low as possible.

#### **3.2.4. Trade-Off Theory**

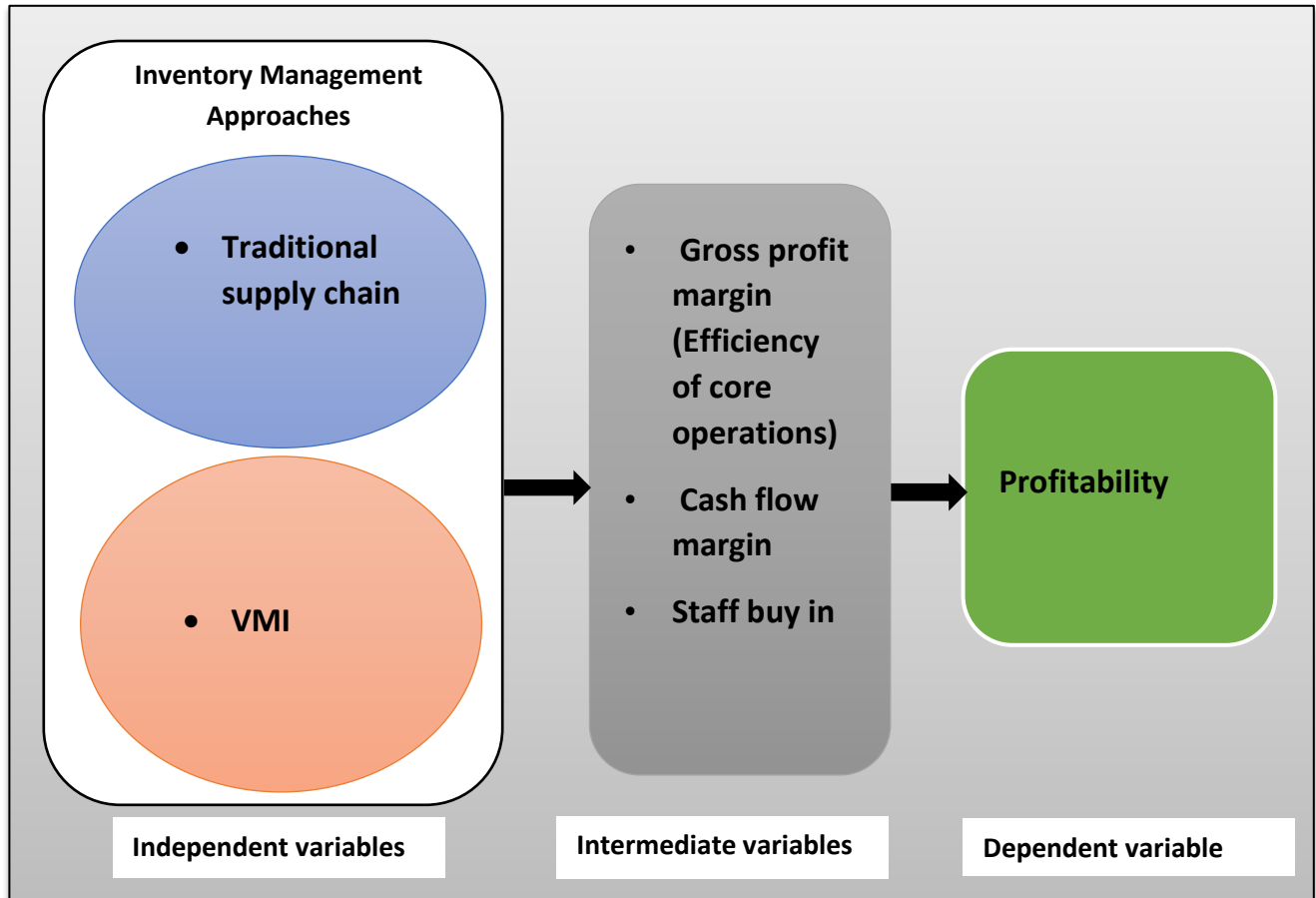
This theory was proposed by Myers (1984). Trade-off model shows that a firm determines its optimal level of holding cash based on a comparison of the marginal costs and the benefits of holding cash. Over investing in current assets will likely translate to low return on assets since over investing might result in a firm's inability to cover other operating costs. The most crucial goal of a firm is to maximize profits, but it also has to ensure that it maintains favorable liquidity at all times. An attempt to increase profits by writing down liquidity can result in detrimental results to the firm (Shin & Soenen, 1998).

The firm must settle on the level of current assets to maintain on all factors that are involved in its daily operations. In such a case, the firm can either choose to adopt the conservation risk-return trade-off which entails lower risk and lower return or choose the aggressive working capital policies which entail higher risk and higher returns (Carpenter & Johnson, 1983). Given that rank correlation of profitability has inverse relationship with the rank correlation of liquidity, therefore be concluded that a rise liquidity causes the level of profitability to decrease (Pandey, 2010). Managing the trade-off between profitability and liquidity is crucial and key to the inventory management decision.

### **3.3. Conceptual Framework**

The objective of this study is to investigate how the inventory management approach (the independent variable) affects profitability (the dependent variable) under traditional and VMI operating conditions in hospital pharmaceutical supply chains through the intermediate variables. The conceptual framework is presented in the Figure 1. The study has a particular focus on the effect that the model employed has on a hospital's efficiency in core operations (gross profit margin) and its ability to convert sales into cash (cash flow). The study also takes

a further step to understand from the perspective of staff of the hospitals which model they believe improve the operations of the hospital.



**Figure 1: A conceptual framework of the perceived relationship between a supply chain model and the profitability ratios.**

### 3.4 Conclusion

This chapter reviewed a number of theories pertaining to costs that are incurred in pharmaceutical supply chain. Like transactional cost theory that posits that transaction costs consist of costs incurred in searching for the best supplier or customer, the cost of establishing a contract, and the costs of monitoring and enforcing the implementation of the contract. If such costs can be reduced by streamlining the supply chain process, then businesses can reduce their costs and increase their profits. Its assumptions like these that led to the

formulation of the conceptual framework where increase in adoption of VMI has a resultant effect on profitability.

## CHAPTER FOUR

### RESEARCH METHODOLOGY

#### 4.1 Introduction

The components discussed under this included the, research philosophy, study design, study population and sampling method, the exclusion and inclusion criteria, study process, sample size. Data collection method, data analysis, ethics consideration and time were addressed.

#### 4.2 Research Philosophy

A research philosophy is a belief about the way in which data about a phenomenon should be gathered, analysed and used. The term epistemology means what is known to be true and it encompasses the various philosophies of research approach. The purpose of science, then, is the process of transforming things believed into things known. Three major research philosophies have been identified in the Western tradition of science, namely positivist, interpretivist and pragmatic (Galliers, 1991). Understanding research philosophy is necessary for adapting to a particular perspective or paradigm, if is an important first step in setting other research parameters and choices to a study (Kagioglou et al., 1998).

Research philosophies have ontological and epistemological assumptions, these are different assumptions which will influence the way in which the research proceeds and will provide a route to understanding the way to approach research in various field of exploration. Ontology is concerned with nature of reality and the way the world operates and two major aspects of ontology are objectivism and subjectivism. Objectivism posits that social entities exist in reality external to social actors concerned with their existence and that to explore social phenomena one must strive to find the single reality that needs to be measured and measure it in isolation. On the other hand, subjectivism, holds that social phenomena are created from the perceptions and consequent actions of those social actors concerned with their existence. This is a continual process in that through the process of social interaction these social phenomena are in a constant state of revision (Saunders et al., 2009).

According to Hallebone (2009) Epistemology concerns what constitutes acceptable knowledge in a field of study. Specifically, epistemology is concerned with possibilities, nature, sources and limitations of knowledge in the field of study. In research philosophy there are many different sources of knowledge and they can be divided into the following four categories:

- Intuitive knowledge is based on intuition, faith, beliefs etc. Human feelings plays greater role in intuitive knowledge compared to reliance on facts.
- Authoritarian knowledge relies on information that has been obtained from books, research papers, experts, supreme powers etc.
- Logical knowledge is a creation of new knowledge through the application of logical reasoning.
- Empirical knowledge relies on objective facts that have been established and can be demonstrated.

A research process may integrate all of these sources of knowledge within a single study. For example, intuitive knowledge can be used in order to select a specific problem to be explored within a selected research area, whereas authoritative knowledge is gained during the process of literature review. Moreover, logical knowledge is generated as a result of analysing primary data findings, and conclusions of the research can be perceived as empirical knowledge.

Epistemology has many branches that include essentialism, historical perspective, perennialism, progressivism, empiricism, idealism, rationalism, constructivism etc. Empiricism and rationalism can be specified as the two major constructing debates within the field of epistemological study that relates to business studies. Rationalism accepts personal experiences associated with observation, feelings and senses as a valid source of knowledge, whereas empiricism relies on empirical findings gained through valid and reliable measures as a source of knowledge. Each epistemology employs specific associated research methods (Hallebone, 2009).

The philosophical approach adopted in this research is Pragmatism. Pragmatism research philosophy accepts concepts to be relevant only if they support action. Pragmatics “recognise that there are many different ways of interpreting the world and undertaking research, that no single point of view can ever give the entire picture and that there may be multiple realities” (Saunders et al., 2009).

As earlier outlined; positivism and interpretivism are two extreme mutually exclusive paradigms about the nature and sources of knowledge. Pragmatism seeks to understand the

nature of knowledge as a continuum. According to pragmatism research philosophy, the research question is the most important determinant of the research philosophy. Pragmatic research can combine both, positivist and interpretivism positions within the scope of a single research according to the nature of the research question (Hallebone, 2009).

As it is illustrated in Table 1 below, unlike positivism and interpretivism research philosophies, pragmatism research philosophy can integrate more than one research approaches and research strategies within the same study. Moreover, studies with pragmatism research philosophy can integrate the use of multiple research methods such as qualitative, quantitative and action research methods (Collis, 2014; 54).

**Table 1. shows positivism and interpretivism research philosophies and pragmatism research**

	<b>Research approach</b>	<b>Ontology</b>	<b>Research strategy</b>
<b>Positivism</b>	Empiricism	Objective	Quantitative
<b>Interpretivism</b>	Rationalism	Subjective	Qualitative
<b>Pragmatism</b>	Empiricism and/or Rationalism	Objective or subjective	Qualitative and/or quantitative

This research is Pragmatic in nature because it recognizes that there are many different ways of interpreting the world and undertaking research and that no that no single point of view can ever give the entire picture and that there may be multiple realities. It is for this reason that a mixed methods approach was chosen. The methods chosen in this study are the ones most likely to provide an answer to the research question and to solve the problem of inefficient and costly supply chain techniques.

### **4.3. Research Design**

A case study method with triangulation in data collection through in-depth interviews and financial analysis to enhance reliability and validity. This method has been selected since it enables a more explanatory, descriptive and exploratory approach allowing for more rich insights into the subject.

### **4.4. Study Population and Sampling method**

The study population comprised of private healthcare facilities who currently employ VMI for pharmaceutical inventory in Lusaka and private health care facilities who manage their own supply chain. The Sample frame for this population was obtained from mPharma Zambia, a company employs VMI in its supply chain and from the Health Professions council of Zambia (HPCZ) register. The cases in this study were from 4 health care facilities categorised as such: 2 medium and 2 large sized facility. In each category one facility was a VMI facility and the other used traditional supply chain methods. Non probability purposive sampling was used to enlist typical clients who fit the inclusion criteria. This is also necessitated by the nature of the documentation required for the research. Not many businesses were open to sharing their financial information.

### **4.5. Exclusion and Inclusion Criteria**

For document analysis and comparison of VMI vs Traditional supply chain, facilities with annualized revenues over K15million were excluded for large facility sampling and facilities with annualized revenues of over K7million were excluded for medium facility sampling. Particularly for the VMI hospitals, any healthcare facility and staff members that had not worked with a VMI vendor for at least a year were not eligible for this study as their financial data may not provide a full picture of the situation. Also, members of staff who did not directly deal with accounting or supply chain were not be eligible for the study.

### **4.6. The Study Process**

Recognizing that the research is utilising a mixed method approach, the research used a narrative enquiry to provide insights on the lived experiences of the health care providers who work in VMI facilities. On the other hand, the study compared income statements of four healthcare providers, two who employed traditional supply chain methods and two when they used traditional supply chain methods and when they used a VMI model. The analysis

reviewed changes in the following metrics to define profitability: Gross Profit Margin, which compares gross profit to sales revenue. This shows how much a business is earning, high gross profit margin ratio will reflect a higher efficiency of core operations, while a low profit margin can be attributed to adverse purchasing policies among other things and Cash flow margins, which express the relationship between cash flows from operating activities and sales generated by the business. It measures the ability of the company to convert sales into cash. The higher the percentage of cash flow means the more cash available from sales to pay for suppliers, dividends, utilities, and service debt, as well as to purchase capital assets. These metrics were measured on a ratio scale due to the fact that they have an absolute zero then compared to the value of inventory purchased through a VMI supplier in a given year as a proxy for VMI adoption.

#### **4.6.1. Interview guide pilot**

In order to ensure that interviewees interpreted and answered questions in the way in which the research intended, a pilot of the interview guide was first carried out. The value of piloting can lead to detecting errors in things such as cross-cultural language relevance and word ambiguity, as well as discovering possible flaws in survey measurement variables. The pilot involved interviewing 3 pharmacists working with VMI suppliers using the guide and then asking them questions for clarity. Answers from these questions provided guidance for any changes made to the guide. Below is a breakdown of the questions asked and answers given

The results of the responses to these questions are outlined in Table 2 below

**Table 2: Interview guide pilot results**

Questions	Response and remarks and actions taken
<b>Did the interview adequately cover the topic?</b>	100% said yes
<b>Are there any questions you expected that weren't asked?</b>	67% said yes. The general thought was that there weren't enough follow up questions to allow the participant to give more detail. As such follow up prompts

	were included
<b>Are there any questions you feel may be too sensitive or that may affect our response rate that should be removed or changed?</b>	100% said no. However, a point was made to ensure that only staff who worked directly in supply and purchasing should be involved as they could provide clearer more expert perspectives
<b>Was the interview too long, too short, or, about right?</b>	100% said the interview was just right.

#### 4.7. Data collection methods

Annual audited financials for the years under review (2016 and 2017) and in-depth interviews were used to collect required data. After financial data has been analysed, members of staff of participating VMI healthcare facilities were enlisted for in depth interviews to understand their perceptions of working with the VMI model.

#### 4.8. Data Analysis

Since data was in two forms, analysis was different. Qualitative data from the in-depth interviews was analysed by picking out and bundling similar emerging themes and coding these themes. These codes and the overall responses from the interview were then illustrated in pie charts and bar graphs developed in excel. For the quantitative data, the first step was to summarize the data to provide adequate background for further analysis. Aspects such as total revenue, revenue distribution and cost distribution for all facilities were analysed in Excel and after this was done, Gross profit margins and VMI adoption figures were analysed for correlation in SPSS using the following formula

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n \sum x^2 - (\sum x)^2][n \sum y^2 - (\sum y)^2]}}$$

#### Equation 1: Pearson Correlation Coefficient

Ordinary least squares regression of data from income statements relating to a time period of 1 year of gross profit margins against VMI adoption was then used to determine whether the relationship determined by the correlation was linear or not. This was further done to obtain

the equation for the slope of the line so that outcomes involving levels of VMI adoption and the profitability ratios could be predicted.

#### **4.9 Validity and Reliability**

When performing research using a questionnaire, the validity and reliability of the data obtained can be threatened. One reason for this is the fact that if the questionnaire is not appropriately designed, it is possible that the data obtained will not be reliable. This can happen when the constructs being used to collect the data are not applied consistently (Wagner et al., 2012). However, if the research instrument is valid, the questions included in the questionnaire addressed the proposed hypotheses (Leedy & Ormrod, 2010). Although there are various types of validity and reliability measures, only those that are appropriate for the research instrument used in this study were considered.

##### **4.9.1 Validity**

Validity refers to the question of whether the study measures or records what it is intended to measure or record (Bryman & Bell, 2003; Yin, 2003). There are different types of validity: face validity, construct validity, content validity, internal validity and external validity.

Construct validity relates to “the question of whether a measure that is devised of a concept really does reflect the concept that is supposed to be denoting” (Bryman & Bell, 2003; Yin, 2003), and refers to the establishment of correct operational measures for the concepts under study (Yin, 2003a). In the quantitative part of this study the construct being studied is the effect of VMI on profitability. By comparing profitability ratios over time periods when VMI was used and when it was not used and by further understanding the relationship between VMI adoption and growth in profits, the requirements for construct validity were met.

Internal validity refers to the issues of causality that is whether the suggested causal relationship holds (Bryman & Bell, 2003; Yin, 2003). In quantitative work, internal validity relates to the validity of interpretation (Mason 2002; Yin, 2003a), and was addressed in the manner that the data was carefully re-read, coded and categorized, following established procedures presented by Miles & Huberman (1994) and Yin (2003a).

External validity refers to question of whether the findings of the study can be generalised beyond a particular research context (ibid). External validity was assessed in the quantitative

part of this study that is a carefully designed selection process was used for the theoretical sample to ensure maximum variation of observations and thereby minimize the possible influence of exogenous factors.

The interview guide in this study has some degree of face validity as the questions were developed from the research questions proposed. The guide also has a level of content validity. In order to attain this validity, certain elements were verified with three pharmacists prior to the guide being used with the main sample below. In order to test the validity of the questions in the pretest, answers to one question were compared to another question measuring the same concept, then this answer was measured to the participant's response to a question that asked for the exact opposite answer. This is summarized in Table 3 below

**Table 3: Interview guide validity test**

Pilot Participant	Question	Response	Remarks
<b>Participant 1</b>	Q9. In comparison which is more profitable to work with? The traditional supplier of the VMI supplier?	Traditional	
<b>Participant 1</b>	Q11. Has your facility benefited financially from working with a VMI supplier?	No	This response shows that this question has convergent validity because the responses even though the questions are different, they measure the same concept as such the response of the candidate should maintain the same theme. In this case its that

			VMI is not more profitable.
<b>Participant 2</b>	Q17. Overall which type of supply chain management is more preferable? VMI or traditional	VMI	
	Q18. Would you recommend working with a VMI supplier to other providers?	Yes	This response shows that this question has convergent validity because even though the questions are different, they measure the same concept as such the response of the candidate should maintain the same theme. In this case its that VMI is more preferable.

Further, a number of the relationships identified are relationships that have been developed in the literature (Dubelaar et al., 2001; Keshavarz et al., 2012; Patel & Pande, 2012; Pauler et al., 2012) as content validity of a tool is obtained when the questions included address the specific area of research.

#### **4.9.2 Reliability**

Reliability refers to the consistency of the results produced by the research instrument. For instance, a test is reliable if the same results are produced for the test when performed by the same people on a different day (Leedy & Ormrod, 2010). This type of reliability is referred to as test-retest reliability. The research tool in this study, however, makes use of an internal measure of reliability. Accordingly, the questions at the end of the questionnaire request percentage data relating to where the pharmacist believes the revenue in the pharmacy is earned and the number of scripts and the value of these scripts. The use of this data, that is,

average turnover of a pharmacy for a year and a month, can be compared to the answers provided in the tick-box questions. Hence, if there is a high correlation this would indicate reliability.

Furthermore, pre-testing of data collection tools and procedures were rehearsed before the study to ensure data quality as well as testing the liability of information obtained. This was done in order to refine phrasing of the questions. The pre-test was conducted to the health facilities and this aided plan for work schedule, estimate how much time taken to administer a questionnaire and eliminate possible errors during interviews. Some questions that were phrased during the pre-test and important highlights were included in the tools. Validity and reliability of results were guaranteed by the process of pre-test.

In addition, in order to enhance the reliability of the tool, it was administered to each participant in the same standard way. Accordingly, it was presented to the pharmacist responsible for its completion who then completed the questionnaire without any help or guidance from the researcher. In addition, the questions were designed so as to ensure consistency in selection, as the pharmacists could only select their answers from a predetermined set.

#### **4.10 Ethical Considerations**

Ethical approval for this research was obtained from the University of Zambia Directorate of Graduate Studies. Several ethical considerations were taken into account to ensure that the study was conducted in an appropriate manner. Specifically, the following principles were adhered to;

- **Informed consent** - to comply with ethical considerations in conducting research all participants provided with a consent form that outlined all the aspects of the research process and what to expect during the interview. The consent form had a certificate of consent that all participants needed to sign before they proceeded with the interview.
- **Voluntary participation** - the purpose of the research was explained to the participants and the participants were told that should they wish to withdraw at any point during the interview they could do so.

- **Confidentiality** - It was further explained to the participants that their information would remain confidential and that the specific content of individual interviews would only be discussed with the supervisor. It was also made clear that all information would be presented in a de-personified manner with specific with all participants being denoted code names where necessary.
- **Coercion free** – Participants in the study were informed that there were no anticipated risks, compensation or other direct benefits for participation in the interview ensuring that they did not feel coerced to participate in the study.
- **Transparency** – In order to ensure transparency, an outline of the research and the purpose for data collection was provided. Participants were informed of how the data collected for the research would be used, stored and how it would be presented. Furthermore, participants were provided with both the researchers and the Ethics committee contact information, to ensure that they were empowered to communicate any matters that would arise.

#### **4.11 Conclusion**

This chapter has presented an extensive review of the process involved in developing the research interview guide, the definitions of the variables - VMI adoption, gross profit and cash flow margin - to be used and the methods by which the data collected will be analysed in order to draw the conclusions required to support the research hypotheses that have been formulated.

## CHAPTER FIVE

### DATA ANALYSIS, PRESENTATION AND DISCUSSION OF RESULTS

#### 5.1 Introduction

This study was an attempt at understanding how the use of specific supply chain models affects profitability in hospitals in Lusaka. As stated in the previous chapter, the study population comprised of private healthcare facilities who currently employ VMI for pharmaceutical inventory in Lusaka and private healthcare facilities who do not for comparison purposes. The Sample frame for this population was obtained from mPharma Zambia, a company who employs VMI in its supply chain. The cases in this study were from 4 health care facilities categorised as such: 2 medium and 2 large sized facilities.

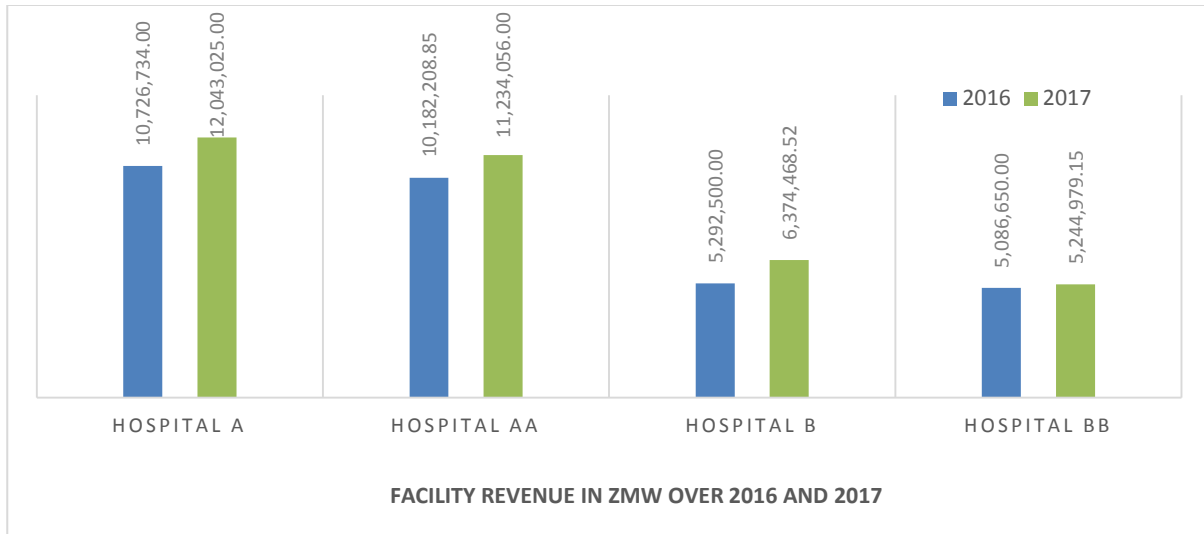
The research used a narrative enquiry to provide insights on the lived experiences of the health care providers who work in VMI facilities. On the other hand, the study compared income statements of healthcare providers when they used traditional supply chain methods and when they used a VMI model. The analysis reviewed changes in the following metrics to define profitability: Gross Profit Margin and Cash flow margins. The results obtained were put through statistical analysis and are presented in this chapter. For the better understanding the results were divided into Financial Information which represents information for the financial statements of the health care facilities and Narrative inquiry which presents information from the interview of some of the members of staff at the facilities using VMI.

##### 5.1.1 Financial information

This section presents the general financial information about the sampled healthcare facilities. They have been denoted as Hospital A and Hospital B for the large and medium facilities that employ VMI and Hospital AA and Hospital BB for the large and medium facilities that do not employ VMI.

##### 5.1.1.1 Revenue

Figure 2 below, depicts the revenues of the respective facilities in the years under review - 2016 and 2017. Facilities in each category were selected due to their similarities in annual revenues as can be seen in Figure 2 below.



**Figure 2: Facility revenue over 2016 and 2017**

In relation to the percentage change in revenue from 2016 to 2017, in Table 4 below outlines the percentage growth in revenue for each of the respective facilities. It can be seen that both Hospital B saw the most significant growth in their revenue from 2016 to 2017 while that of Hospital A, AA and BB was more marginal

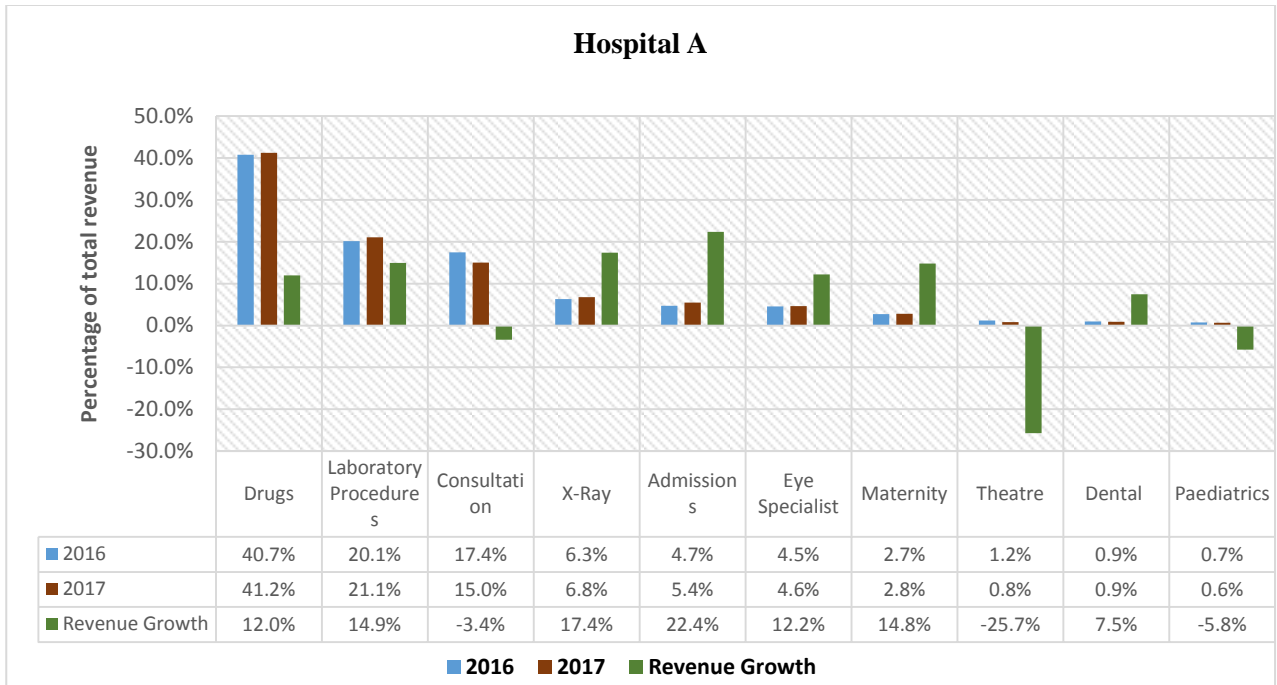
**Table 4. Percentage change in revenue 2016 – 2017**

Facility	2016 to 2017 growth
<b>Hospital A</b>	10.93
<b>Hospital AA</b>	9.36
<b>Hospital B</b>	16.97
<b>Hospital BB</b>	3.02

### 5.1.1.2 Revenue distribution

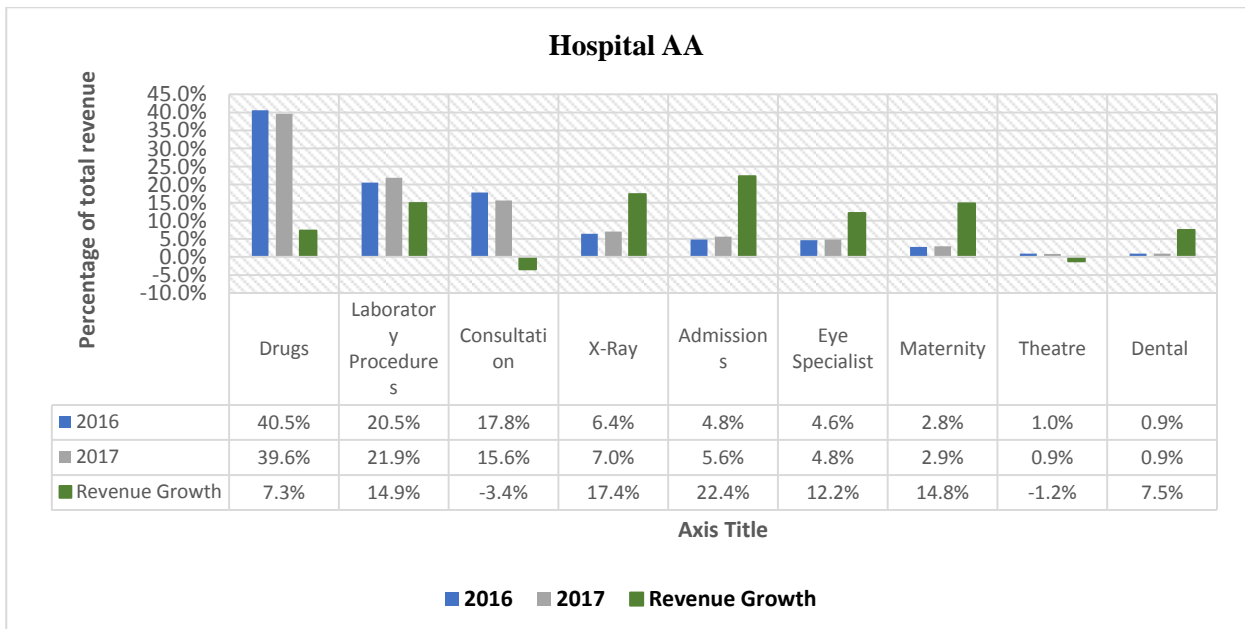
This section illustrates how the revenue is spread across income generators at the facility. This provides insight into the operations of the facilities and outlines which activities have the most impact of the facilities profitability. This is depicted in Figures 3 to 6

As can be seen in Figure 3 Drugs accounted for 40.7% and 41.2% of revenue from 2016 to 2017 respectively, which was the largest contribution. In addition to revenue distribution, the chart also shows the percentage of growth across the activities. It can be seen that there was a 12% growth in revenue from 2016 to 2017 resulting from drug sales at Hospital A.



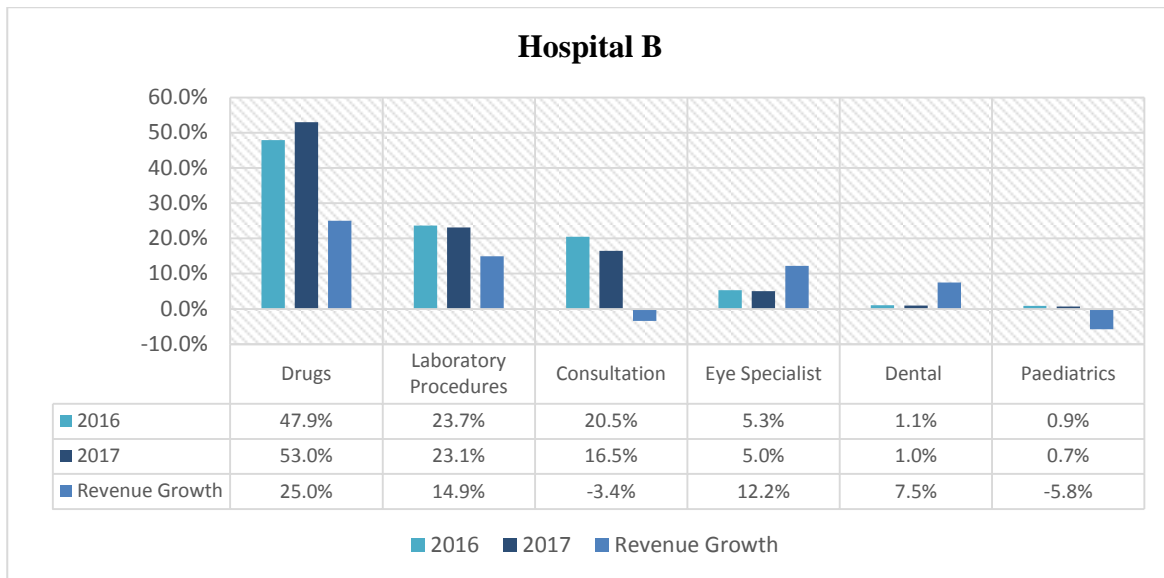
**Figure 3. Revenue distribution for Hospital A**

Similarly, drugs accounted for 40.5% and 39.6% of revenue as seen in figure 4 below. The chart also shows the percentage of growth across the revenue lines. It can be seen that there was a 7.3% growth in revenue from 2016 to 2017 resulting from drug sales at Hospital A.



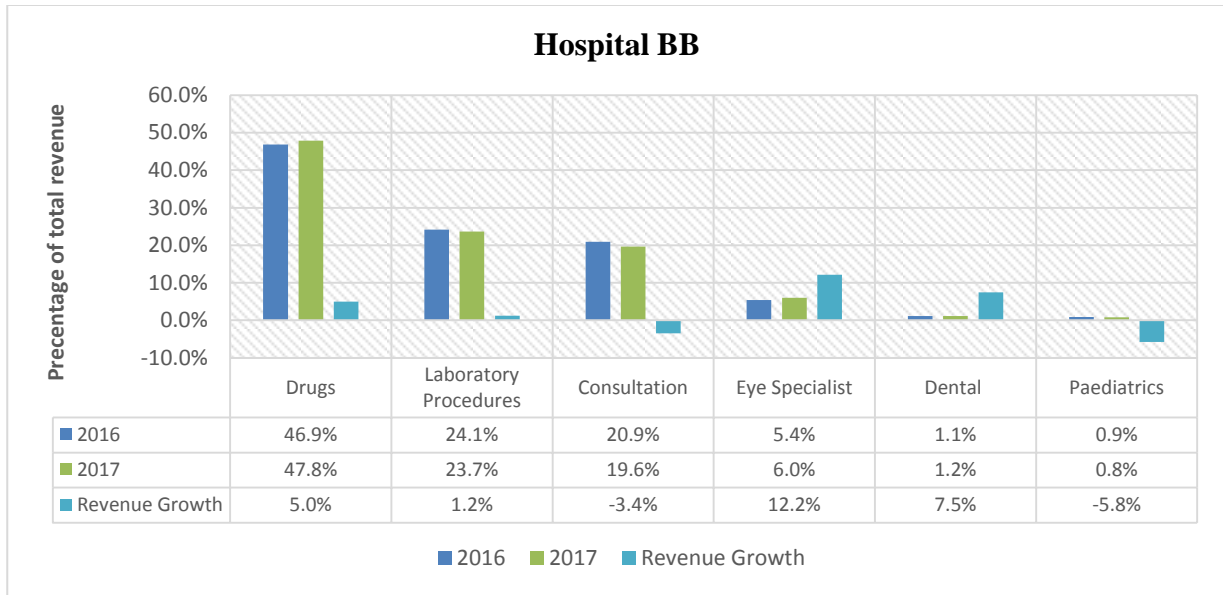
**Figure 4. Revenue distribution for Hospital AA**

In Figure 5 below, Drugs accounted for 47.9% in 2016 and made a 5.9% increase to 53% in 2017. In addition, there was a 25% growth in revenue from 2016 to 2017 resulting from drug sales at Hospital B which accounts for the highest revenue growth across facilities sampled.



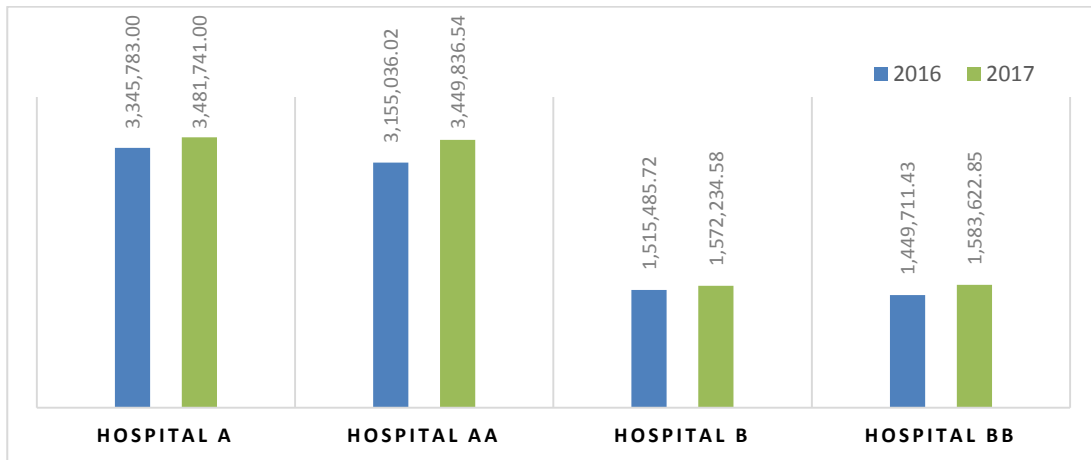
**Figure 5 Revenue distribution and percentage revenue growth per revenue line for Hospital B**

Revenue distribution for Hospital BB is shown in Figure 6 below. As can be seen, Drugs accounted for 46.9% and 47.8% of revenue from 2016 to 2017 respectively. In addition to this, there was a 5% growth in revenue from drugs from 2016 to 2017. From the data outlined below it is clear that drug sales contributed the majority of revenue in these facilities and thus any intervention affected the overall profitability at the facilities is one that impacted drug sales. Of further note, is Hospital B's 25% growth in drug sale related revenue from 2016 to 2017 and a 12% growth from Hospital A in the same period.



**Figure 6 Revenue distribution for Hospital BB.**

### 5.1.1.3 Cost of goods sold



**Figure 7 Outlines the total value of cost of goods sold for the sampled facilities from 2016 to 2017**

Table 5 shows the percentage change in cost of goods sold from 2016 to 2017. Of note here is that even though revenues went up by 10.9 and 16.9 percent for Hospital A and B respectively, their cost of goods sold only went up by about 3 percent each showing that revenue was not as a direct result of increase in costs. On the other hand, revenue growth for Hospital AA and BB

could seemingly be explained by the increase in costs with revenue growth of 9.4 and 3 percent respectively.

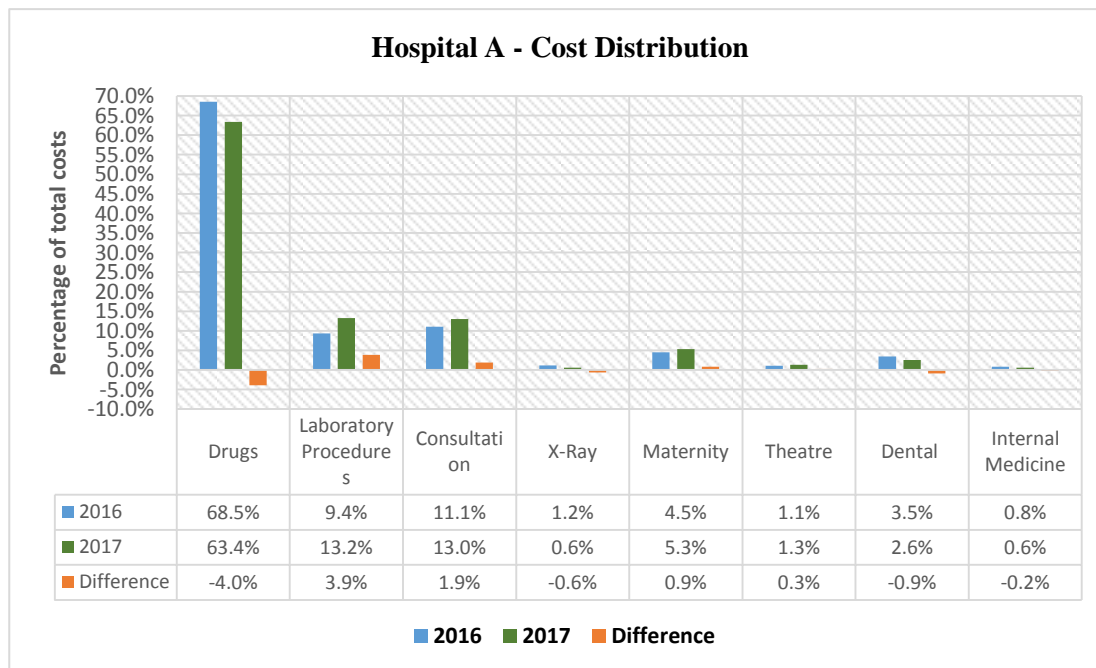
**Table 5 shows the percentage change in cost of goods sold from 2016 to 2017**

Facility	2016 to 2017 difference
Hospital A	3.90
Hospital AA	8.55
Hospital B	3.61
Hospital BB	2.96

#### 5.1.1.4 Cost distribution

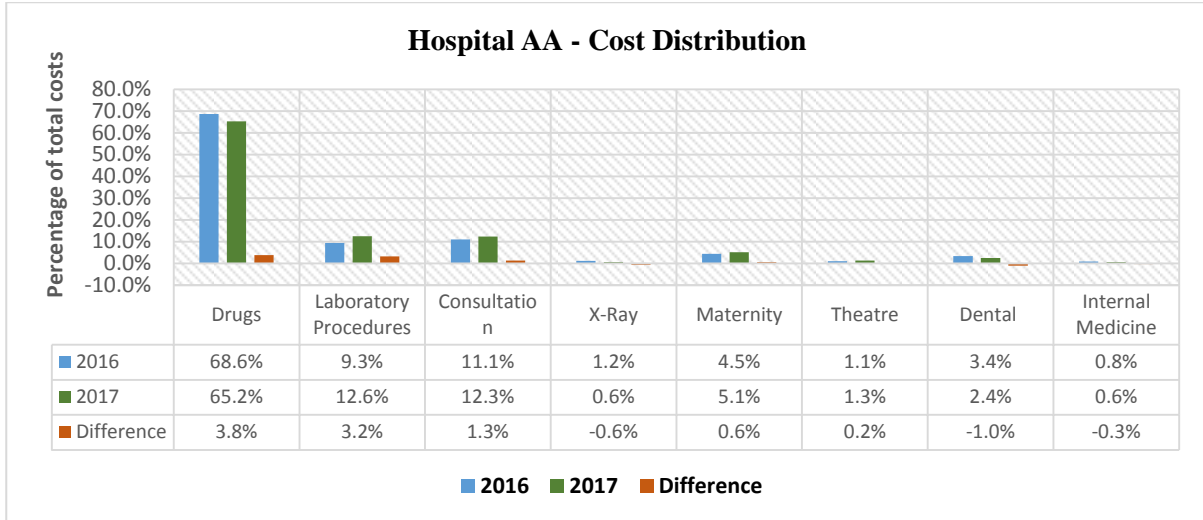
This section illustrates how costs were spread across the different cost centres at each facility. The charts also highlight the percentage increase in costs over 2016 and 2017

As it can be seen below in Figure 8, Drugs accounted for 68.5% and 63.4% of cost in 2016 and 2017 respectively which was the largest contribution. In addition to this, the results shows that there was a decline of 4% in costs associated with the drugs cost centre in 2017.



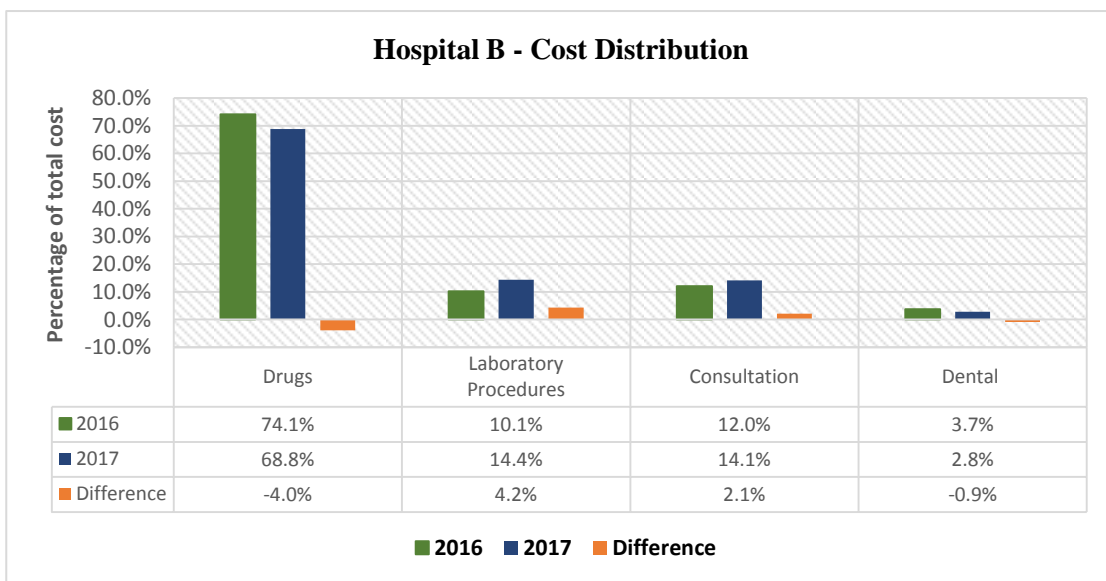
**Figure 8 The Cost distribution for Hospital A**

Cost distribution for Hospital AA is highlighted in Figure 9 below. Drugs accounted for 68.6% and 65.2% of cost in 2016 and 2017 respectively. In addition to this, the results further shows that there was a 3.8% decline in costs associated with drugs from 2016 to 2017.



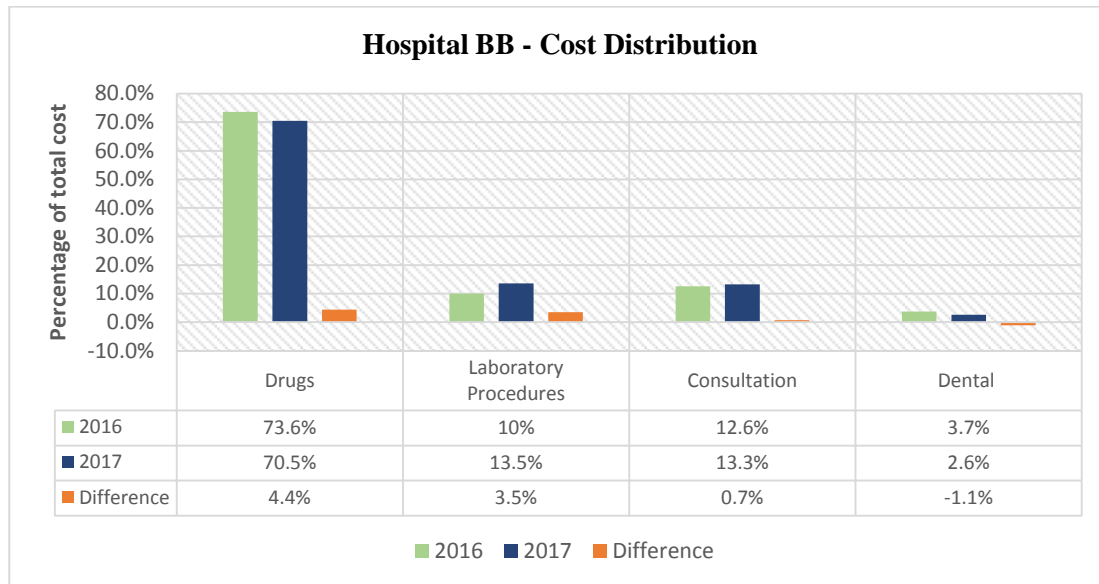
**Figure 9. The cost distribution for Hospital AA**

Figure 10 below gives an illustration for Hospital B. Drugs accounted for 74.1% and 68.8% of cost in 2016 and 2017 respectively. In addition to this, the results also shows that there was a notable decline of 4% in costs associated with the drugs cost centre in 2017.



**Figure 10 The cost distribution for Hospital B**

As it can be seen in Figure 11 below, drugs accounted for 73.6% and 70.5% of cost in 2016 and 2017 respectively at Hospital BB. There was also a percentage increase in cost of 4.4% associated with the drugs cost centre.



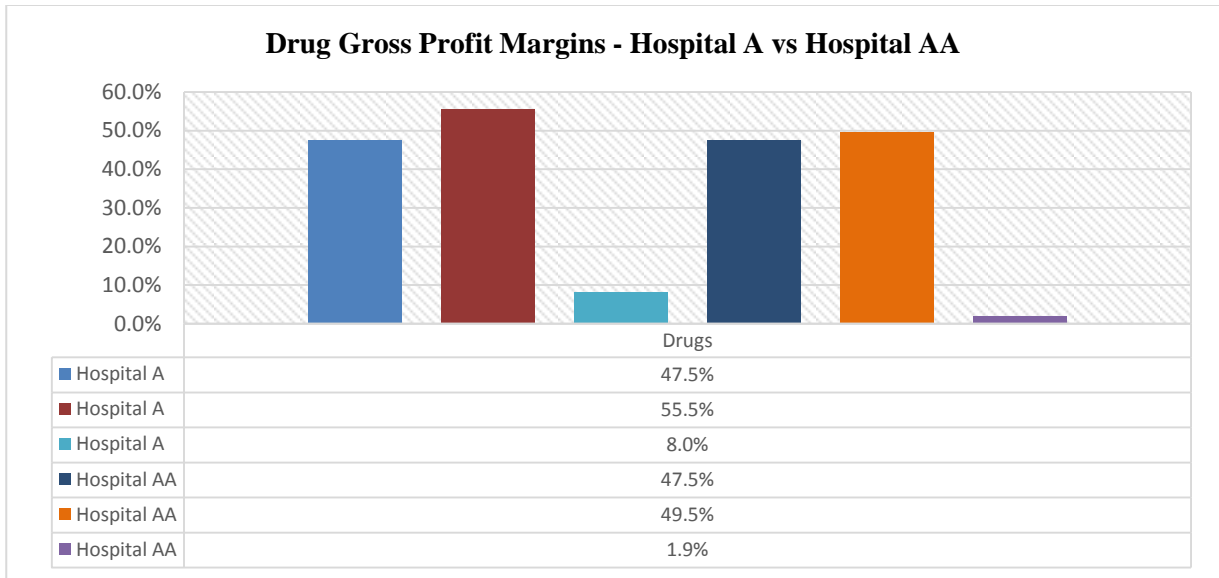
**Figure 11 The cost distribution for Hospital BB**

This financial information section outlines a few key characteristics of the facilities in the sample. First and foremost, drugs constitute a significant portion of both their costs and their revenue and as such was the focus of this study. Second, that even though all facilities saw growth in revenue from drugs, Hospital A and B had a decline in the costs associated with drugs while both Hospital AA and BB increased corresponding to their growth in revenue.

### 5.1.1.5 Gross Profit Margin

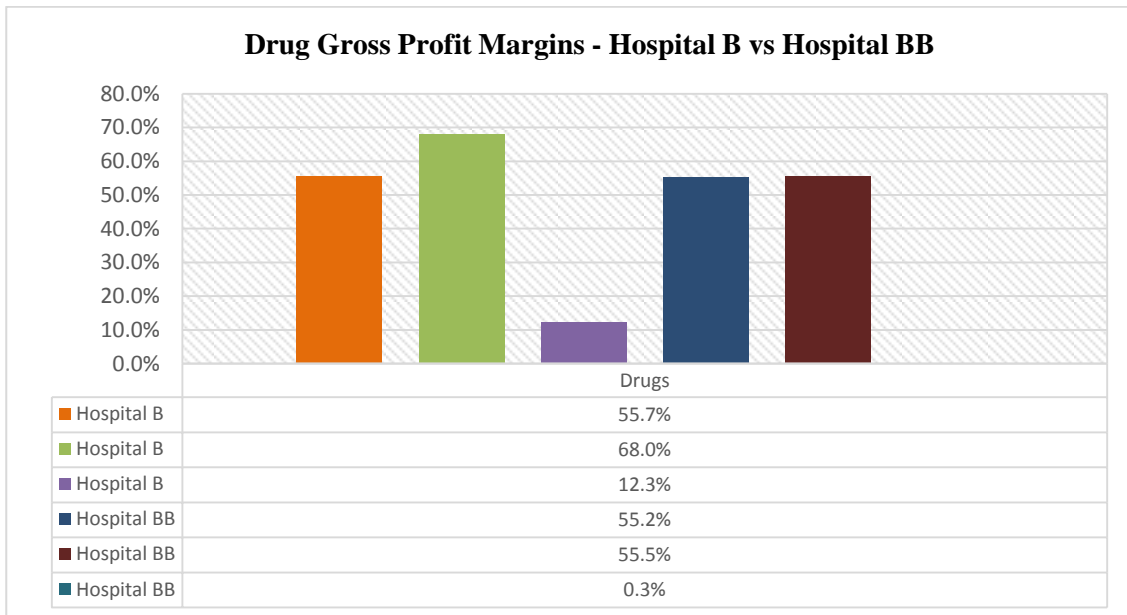
This section focuses on the gross profit margins for all the hospitals in relation to drug sales.

Figure 12 below shows that there was an 8% growth in gross margin at Hospital A and a 1.9% gross margin growth at Hospital AA from 2016 to 2017.



**Figure 12 Compares drug sale gross profit margins for Hospital A and AA in 2016 and 2017.**

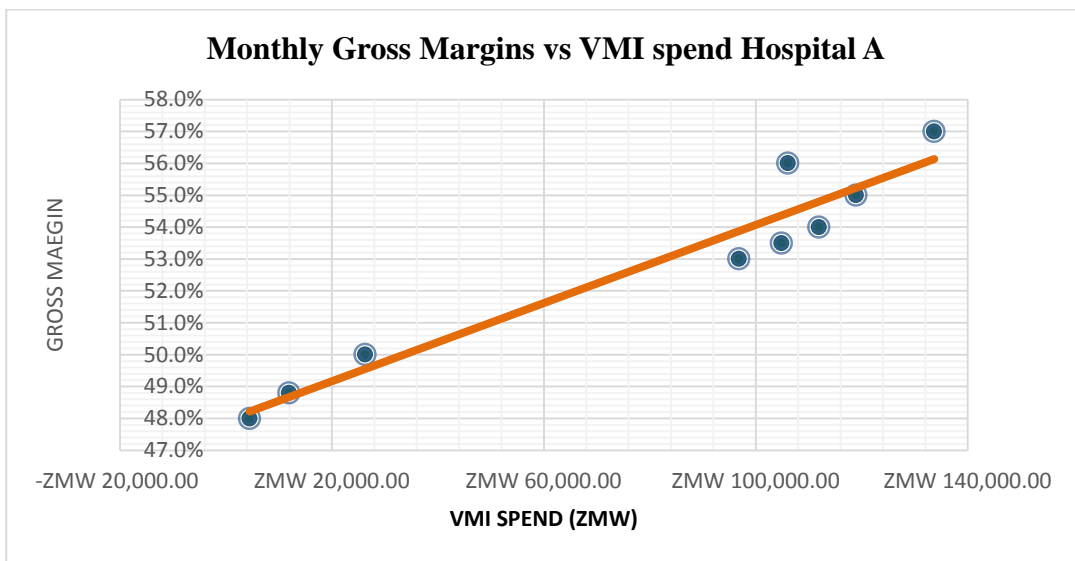
Similarly Figure 13 below compares drug sale gross profit margins for Hospital B and BB in 2016 and 2017. There was a more significant growth of 12.3% in gross margin at Hospital B while Hospital BBs remained mostly unchanged at 0.3%



**Figure 13 Compares drug sale gross profit margins for Hospital B and BB in 2016 and 2017.**

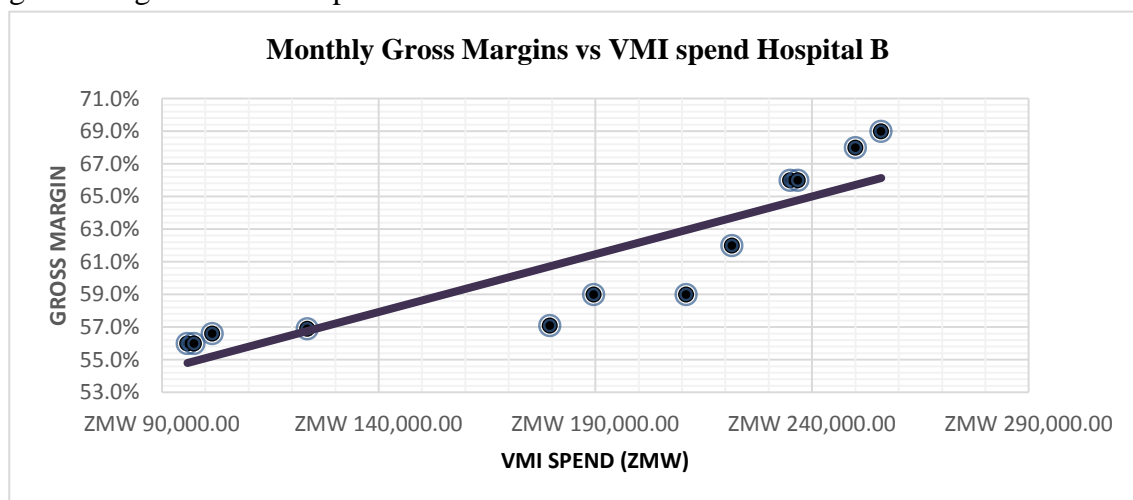
**5.1.1.6. Monthly Gross Margins vs VMI spend per Hospital.**

Focusing on Hospital A and B and 2017, the year that both these hospitals implemented a VMI model for their pharmaceutical supply chain, the following analysis outlines how the monthly gross profit margins at both facilities relate to VMI spend (the value of drugs purchased through VMI) in each month over the whole year. In Figure 14, it can be seen that there seems to have been a positively liner correlation between gross profit margins and VMI spend at Hospital A



**Figure 14. Liner correlation between gross profit margins and VMI spend at Hospital A**

Similarly, Figure 15 shows that there was a seemingly a positive linear relationship between gross margins and VMI spend in 2017



**Figure 15. Linear correlation between gross profit margins and VMI spend at Hospital B**

Results presented in this section show drug sales performed better in relation to gross profit margin in facilities that employed VMI from 2016 to 2017. A closer look at the two facilities showed that as the value of drugs purchased through VMI increased, so did their gross profit margin

#### 5.1.1.7. Cash flow margins

This section compares the cash flow margins for the sampled facilities over 2016 and 2017. As can be seen in Table 6 below Hospital A and AA experienced a decline in cash flow margin while Hospital B and BB experienced growth.

**Table 6. Cash flow margins sampled facilities over 2016 and 2017**

Facility	2016	2017	Difference
Hospital A	6.1%	3.9%	-2.1%
Hospital AA	5.7%	5.2%	-0.5%
Hospital B	6.4%	6.6%	0.3%
Hospital BB	5.8%	6.8%	0.9%

#### 5.1.2. Regression Analysis

Regression analysis was used to test how the uptake of the VMI solutions was driving or affecting gross profit margins for each of the facilities – Hospital A and Hospital AA. Ordinary least squares regression was used, as the variables under consideration are continuous.

In performing the analyses, gross profit margin was used as the dependent variable. This is consistent with the hypothesis presented above, as it suggests that variable use of VMI influences profitability. Gross profit margin was used as a proxy for profitability while VMI invoice value was used as a proxy for VMI uptake.

### 5.1.2.1 Hospital A

From the regression analyses performed, VMI spend and gross profit margin were strongly positively correlated with  $r = 0.9778, p < .00001$ . With coefficient of determination  $r^2 = 0.9561$  the Gross profit margin can be predicted using the following regression equation for Y is  $\hat{y} = 0.00006X + 48.01827$ . Therefore, an invoice value of K500,000 would result in an 80.06% gross margin. This is illustrated in Table 7,

Your Histogram	
Mean	52.81111
Standard Deviation (s)	3.19313
Skewness	-0.39333
Kurtosis	-1.23855
Lowest Score	48
Highest Score	57
Distribution Range	9
Total Number of Scores	9
Number of Distinct Scores	9
Lowest Class Value	48
Highest Class Value	59.9
Number of Classes	3
Class Range	4

Table 7: Hospital A dependent variable descriptive table

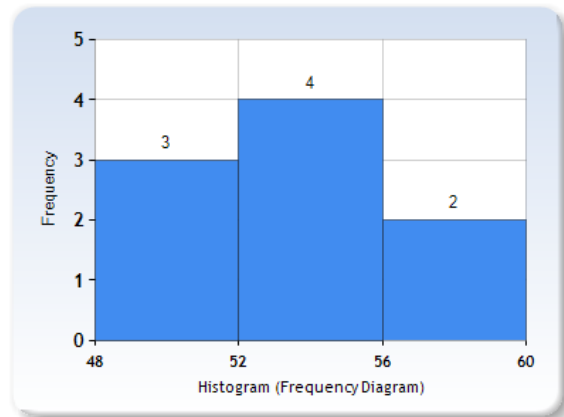
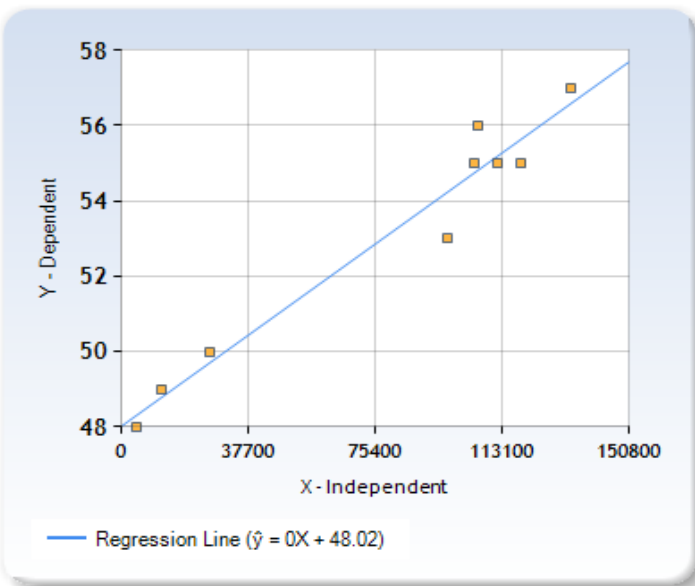


Figure 16 Hospital A dependent variable Histogram

Figure 16 and Figure 17.

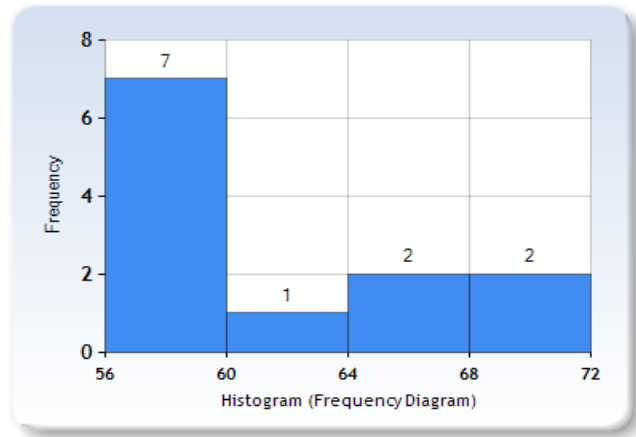


**Figure 17. Regression analyses hospital A**

**5.1.2.2 Hospital B**

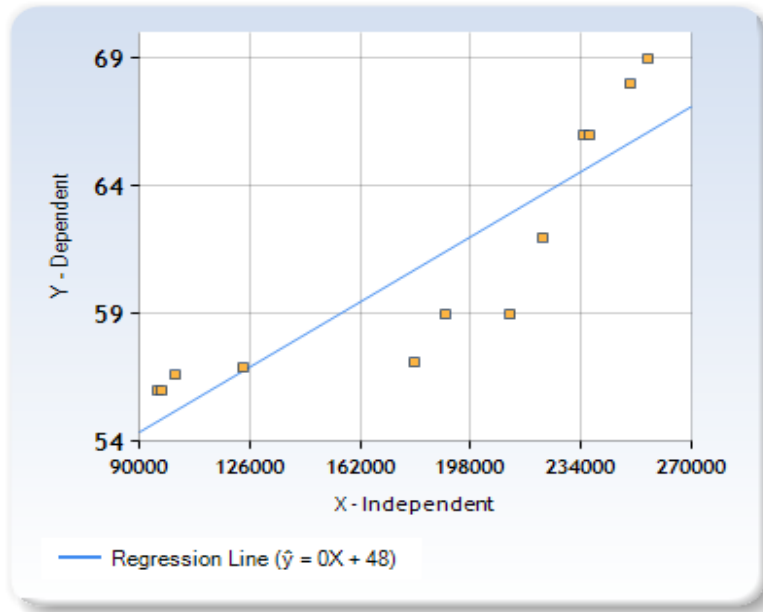
From the regression analyses performed, VMI spend and gross profit margin were strongly positively correlated with  $r = 0.8858$ ,  $p < .000126$ . With coefficient of determination  $r^2 = 0.7848$  the Gross profit margin can be predicted using the following regression equation for Y is  $\hat{y} = 0.00007X + 47.99982$ . Therefore, an invoice value of K500,000 would result in an 83.39% gross margin. This is illustrated in Table 8, Figure 18 and Figure 19.

Your Histogram	
Mean	60.96667
Standard Deviation (s)	4.98513
Skewness	0.57581
Kurtosis	-1.48086
Lowest Score	56
Highest Score	69
Distribution Range	13
Total Number of Scores	12
Number of Distinct Scores	9
Lowest Class Value	56
Highest Class Value	71.9
Number of Classes	4
Class Range	4



**Table 8: Hospital B dependent variable descriptive table**

**Figure 18 Hospital B dependent variable Histogram**



**Figure 19. Regression analyses hospital B**

### 5.1.3. Narrative inquiry

#### 5.1.3.1. General background

Figure 20 below shows that of all the respondents, of the 8 respondents 3 of the respondents were Pharmacists and 2 were Procurement Officer and Finance Officer in each case and only 1 was from Management.

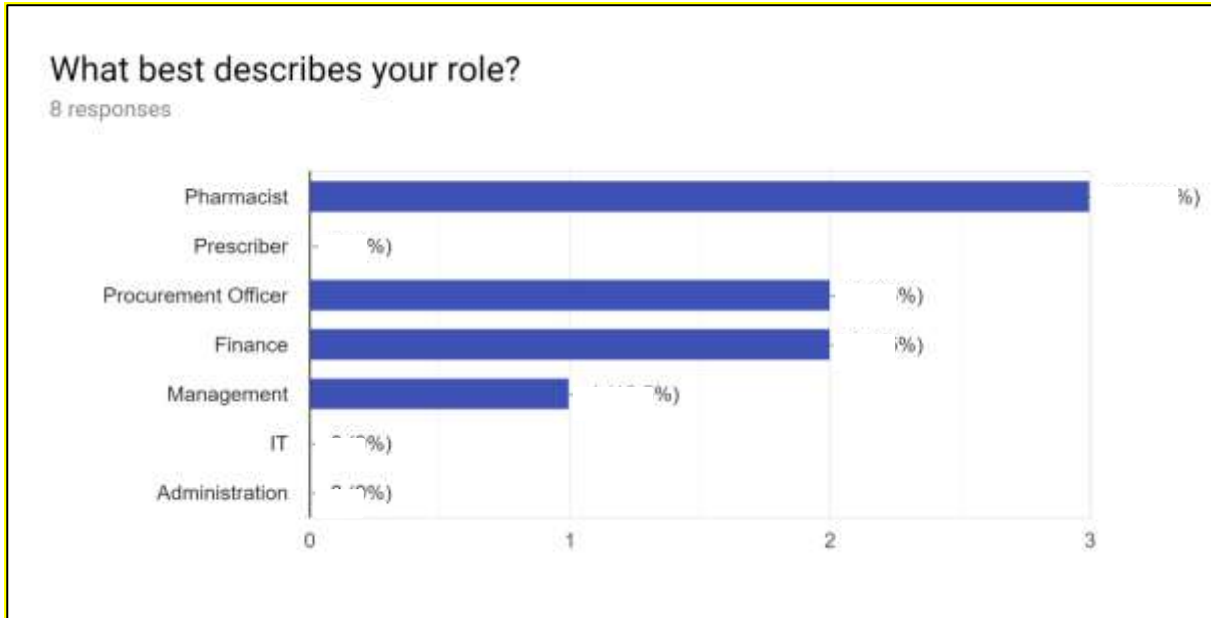


Figure 20. The role of the respondents

#### 5.1.3.2 Operations

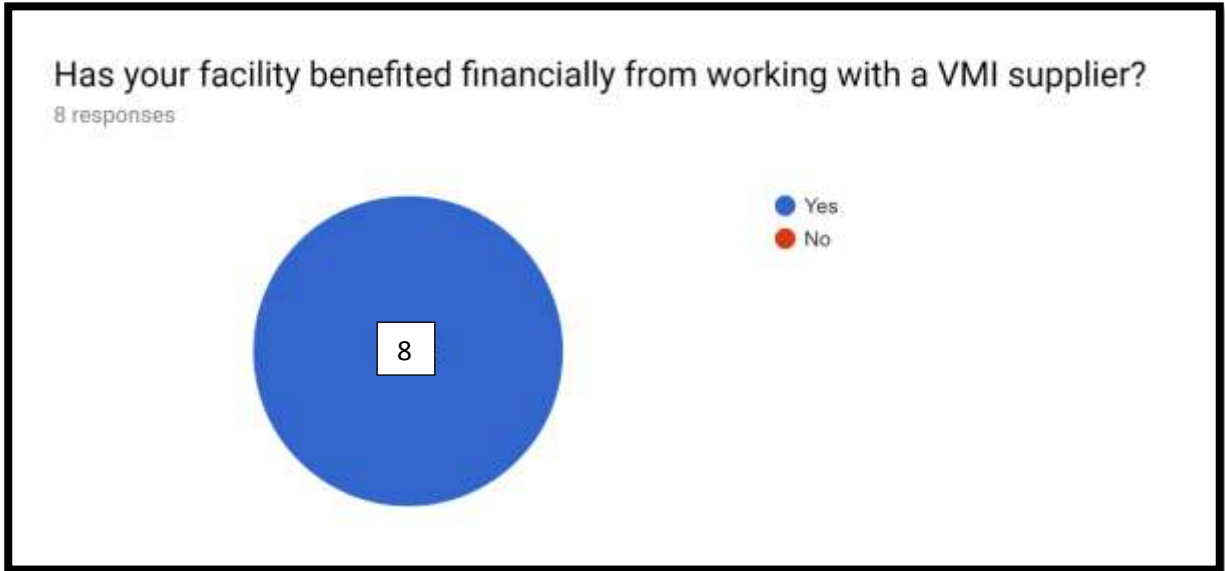
In Figure 21 below shows how respondents indicated when they were asked about the factors that influences the decision to go with one supplier



Figure 21. Important factors in decision making

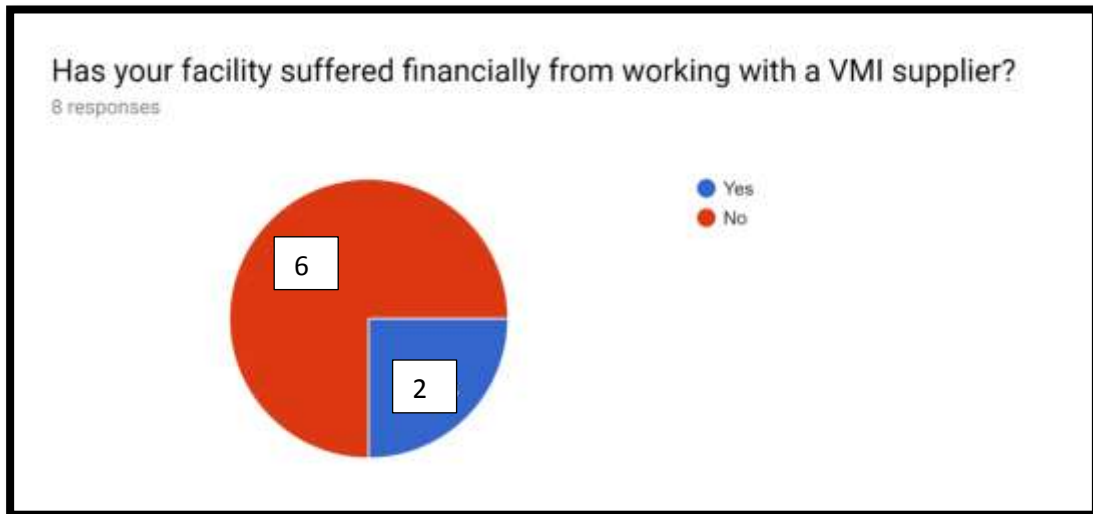
### 5.1.3.3 Perception of effects

In Figure 22 below, the results show that all respondents indicated that the facilities have benefited financially from working with a VMI suppliers.



**Figure 22 Facilities benefited financially**

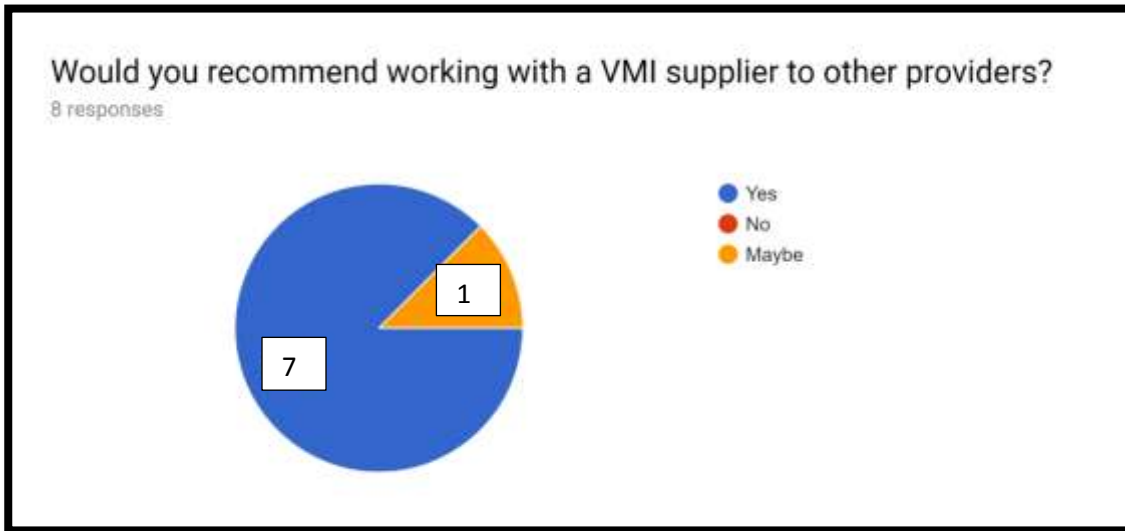
In Figure 23 below, the results show that 6 of the respondents indicated that the facilities have not suffered financially from working with a VMI suppliers while 2 reported to have experienced negative effects.



**Figure 23. Facilities benefited financially**

#### 5.1.3.4 Final comment

Figure 24 shows that 7 of the respondents reported that they would recommend working with a VMI supplier to others providers and only 1 indicated as maybe they may recommend working with a VMI supplier to others providers



**Figure 24. Recommending working with a VMI suppliers to other providers**

## 5.2 Discussion

The results presented in the previous section provide information; however, without an interpretation of these results, usefulness would be limited. The primary question this study sought to answer was how operating a VMI model in pharmaceutical inventory supply chain affected the profitability of healthcare facilities in Zambia. This section will thus provide a deeper explanation of these results by comparing them with the research questions and their corresponding hypotheses as proposed in chapter 1. This comparison will determine whether the results found support the hypotheses proposed or not, with each hypothesis being considered individually. Where the evidence to either support or refute a hypothesis is weak or contradictory, possible reasons will be provided.

### **5.2.1. What is the effect of a VMI approach on a private health care providers gross margin?**

In relation to the effect of VMI on the gross margin of private health care providers, the following hypothesis was developed

H<sub>1</sub>: VMI adoption has no effect on the gross margin of private healthcare facilities

To analyse the first hypothesis, ordinary least squares regression was used. As shown in the previous section it was found that a relationship between VMI adoption and gross profit margin appears to exist and as such VMI adoption has an effect on gross profit margin. With coefficient of determination  $r^2 = 0.9561$  for Hospital A and  $r^2 = 0.7848$  for Hospital B. So around 96% and 78% of the variance in gross profit margin can be explained through its relationship with VMI adoption in Hospital A and B respectively. The Pearson correlation coefficient further suggests that a strong positive linear relationship exists at each hospital with a value of 0.978 and 0.88 for Hospital A and B. There is further support for this relationship in the fact that reviewing financial statements of mirror hospitals AA and BB and comparing gross profit margins, Hospital A and B who adopted the VMI model in 2017 showed significant growth from 2016 to 2017 while hospitals AA and BB seemed more marginal.

Furthermore, as highlighted in the theoretical framework, this would be in line with what would be expected from the drop in transactional costs associated with VMI adoption. Of note is the reduction of costs related to the sale of drugs for both Hospital A and B even though corresponding revenues went up. This could be attributed to falling ‘search and information’ costs which are costs incurred in determining if a required product is available in the market, who has the lowest price, the relative utility and functionality of the product, potential service costs of using the product on an ongoing basis, and other related areas (Emery & Marques, 2011). Since all this information is shared and available through the VMI model (similar to outsourcing the supply chain function) these costs come down and the result is an increase in gross margin.

As such the above data provides adequate evidence to reject H<sub>1</sub>, VMI adoption clearly has an effect of the gross margin of a private healthcare facility.

### 5.2.2 What is the effect of a VMI approach on a private health care providers cash flow margin?

In relation to the effect of VMI on the gross margin of private health care providers, the following hypothesis was developed

H<sub>2</sub>: VMI adoption has no effect on the cash flow margin of private health care facilities

In order to answer this research question financial statements for 2016 and 2017 for Hospitals A, AA, B and BB were reviewed and summarized in Table 9. Cash flow margins were only calculated from annualized statements resulting in insufficient data to run a regression analysis.

**Table 9 Cash flow 2016 to 2017**

Facility	2016	2017	Difference
Hospital A	6.1%	3.9%	-2.1%
Hospital AA	5.7%	5.2%	-0.5%
Hospital B	6.4%	6.6%	0.3%
Hospital BB	5.8%	6.8%	0.9%

As outlined in the previous chapter there seemed to be a percentage drop for the large facilities and a small increase for the medium ones. Therefore, for the purposes of this study, it would seem that there is no clear relationship that exists between VMI adoption and cash flow margin.

One reason for this is there could be other factors in play that affect the cash flows particularly at Hospital A and AA. Due to their size and number of patients they work with, their major clients are 3<sup>rd</sup> party payers who manage reimbursements for services on behalf of their clients. Depending on the credit terms offered to 3<sup>rd</sup> party payers and whether or not they are adhered to, in the worst-case scenario, unpaid accounts receivable would leave the facilities with and adverse or marginal cash flow margin (Kulwer, 2019). Late-paying or slow-paying customers are very common in this industry and even though VMI adoption and its resulting efficiency in inventory management may have a significant effect on the gross margin as shown above, it

seems it would have less or no effect on cash flow margins. Therefore, the above data does not provide adequate evidence to reject  $H_2$ .

### **5.2.3. What are the perceived effects of VMI adoption on profitability of private health care providers?**

The objective of answering this research question was to describe the effects of VMI adoption on profitability from the perspective of members of staff of private healthcare facilities. This was important because staff are the ones who manage the day to day operations are affected by changes in operations. Their perception of the effect of VMI would provide insight into whether there is adequate buy in for the model in the health care industry

In relation to this question the following hypothesis was developed

$H_3$ : There are no perceived effects of VMI adoption on profitability for Health Care providers

Majority of respondents were pharmacists followed by staff in the procurement team and so it can be surmised that the opinions presented are from the true frontline staff who have an opportunity to perceive the effects. When asked if their facility benefited financially from working with a VMI supplier, All 8 of the respondents said yes. The belief when answering this question was that working with the provider had streamlined their processes and resulted in them dealing with less expiries which was a significant saving. According to (Watson, 2017) since VMI is much more streamlined than traditional inventory systems and makes use of automated inventory counts, it removes the need for employees to manually conduct physical inventory counts. Not only are automatic counts more accurate, they also help conserve valuable staff time and company resources.

When asked if their facility had experienced adverse effects financially since adopting VMI, 2 respondents said yes. When asked why, respondent outlined that providing the initial data set to the VMI company had been taxing and resulted in loss of some sales because staff was very busy. This is however compared to 6 respondents who said no.

Finally, when asked if they would recommend a VMI supplier to other people 7 said yes. When probed as to why they chose this response, respondents highlighted having better access

to prices and data and also being able to manage their work more effectively as the reasons they would recommend VMI. With this feedback there is sufficient evidence to reject the  $H_3$

### **5.3. Conclusion**

This chapter presented the results from data collection, analysis and discussion of the results. On the basis of the findings the study identified significant relationship between VMI adoption and gross profit when compared with traditional supply chain. As for perspectives of the members of staff it is clear that that they perceive VMI in a positive light and believe that it has the potential to improve profits for their hospitals. VMI adoption appears not to affect the cashflow margins. This is most likely due to other factors or variables that affect cashflows not considered in this study Thus, there are other factors apart from those tested that affect the profitability of health care facilities and could be potential areas for future research

## CHAPTER SIX

### CONCLUSION AND RECOMMENDATIONS

#### 6.1. Introduction

Since the 90s, the world has seen many rapid technological changes and the healthcare sector has not been spared. These changes require the healthcare sector to adopt the management strategy principles applied by the other sectors in order to be successful and stay ahead of the curve. One such management strategy is cost reduction resulting from good supply chain management practices. As has been seen in the previous chapters, this strategy can have a huge impact on a company's bottom line.

This study reviewed the effect of a VMI on profitability of a health care provider, both from the financial side, and also from the perspective of staff members at the sampled hospitals. For any organisation, profit is defined as income minus expenses. This is no different for a hospital or a pharmacy. Healthcare providers need to look for innovative ways to remain profitable. There is extensive literature relating to the different variables that affect profit. The variables tested by this research study are VMI adoption and its effect on gross profit margin and cash flow margin.

#### 6.2 Conclusion

The aim of this study was to investigate how operating VMI in pharmaceutical inventory supply chain affects the profitability of healthcare facilities in Zambia. Although, there exists some literature and research that compares various aspects of traditional supply chain and those of VMI, there is very little that reviews VMI operations in the healthcare sector and even less so reviewing its effects on profitability within the pharmaceutical sector in the Zambian context. In order to meet this objective, the study reviewed the financial statements of 4 healthcare facilities for 2016 and 2017. The facilities were categorized as outlined in Table 10

**Table 10 outline of sample characteristics**

Hospital A	Large	Adopted VMI
Hospital B	Medium	Adopted VMI
Hospital AA	Large	Traditional Supply chain

<b>Hospital BB</b>	Medium	Traditional Supply chain
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The financial data of the hospitals in each category was compared to see if any trends could be picked.

Findings show that both the large and medium hospitals that implemented VMI in 2017 experienced significant revenue growth from 2016 to 2017 as compared to the hospitals that maintained a traditional supply chain model. In addition to this even though revenue from drug sales went up, costs went down which implies better efficiencies in operations. As a result, the VMI hospitals had higher gross profit margins in 2017 than the ones with traditional supply chain. In addition to this, inquiry into the perceptions of staff members on the benefits of VMI showed that majority of staff believed that working with a VMI hospital was more profitable and the efficiencies brought on by the same resulted in overall effectiveness even on their part. As already stated, majority of respondents also stated that they would recommend working with a VMI facility to their peers. The results indicate that VMI may be able to offer enhanced solutions to support the inventory management of pharmaceutical products, thereby improving operational efficiencies and enhancing profitability.

### **6.3. Recommendations**

This study provides some valuable insight into some of the effects of operation a VMI supply chain model at a health care facility however, implementing VMI does not in itself ensure that organizations will gain the advantages and benefits claimed. There are challenges in introducing, managing and sustaining VMI initiatives that may reduce the benefits or lead to failure in implementation. Based on the scope of this study, a follow up trend analysis after a few more years of VMI operations would build on the insights developed by this study and would result in findings that would be generalized more readily. Further work on potential benefits and disadvantages for pharmaceutical products with different demand characteristics is advocated, as well as studies probing more deeply the risks in VMI from the perspective of the hospital and the supplier. Also, based on the results and literature reviewed there is a potential for the public sector to implement more robust VMI approaches more widely to control the stocks of vital medicines in hospitals so as to ensure the product accessibility to patients. Hence, there is a need for further research to explore how public policy can promote and enable collaborative approach to enhance availability and public health. Lastly, hospitals

typically use the concept of FIFO (First in First out) and FEFO (First expired First Out) to control stock as medicines are often perishable products. Hence, future research should consider how VMI may be able to offer enhanced solutions to support the inventory management of pharmaceutical products in hospitals taking into account the perishable nature of many products used in the industry.

#### **6.4. Limitations**

The scope of the study was limited to private health facilities that have worked with a VMI vendor for at least a year and have been successful in taking advantage of the best practices and VMI knowledge working in Zambia. Thus, a limitation of this research is that all cases have been conducted in one city with a few facilities this influence the results in that it did take into account the costs faced by other private health facilities in other cities.

Furthermore, the nature of the documents that were being requested made the sampling process all the more challenging as very few organizations will be open to sharing their financials for the purposes of research. VMI for private sector facilities in Zambia is still in its early stages and as such there wasn't sufficient data to conduct a trend analysis which would likely provide more in-depth analysis. The study was however intended to start discussion on the subject, and as such, provided a vital initial first step to further exploration

#### **6.5. Areas for future research**

This research found that VMI potentially has a positive effect on profitability within private healthcare facilities. As a result, the following areas of future research are recommended performed in an attempt to close these gaps. Future research should try to further confirm or not the findings of this paper in the context of other hospital departments and units and over a longer period of time. It would also be valuable to address whether and how various factors affect VMI implementation and adoption and how this can enhance profitability. Similarly, it is worth investigating whether or not the benefits of VMI implementation are equally shared among hospitals and vendors and also what are the strategies that could be used to convince vendors and other hospitals into adopting similar initiatives.

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## APPENDICES

### 1. Interview guide

#### Interview Guide

Please ensure that you have read and signed the Informed Consent form before proceeding

The aim of this interview is to understand your view of the effects of working with a supplier that employs Vendor Managed Inventory (VMI) as a supply chain strategy on the overall profitability of your facility. In VMI, the supplier is given the responsibility of managing the customer's stock based on the shared information between them. Your facility has been selected for this study because you currently work with mPharma Zambia which is a VMI company.  
Thank you for your insights.

##### 1. What best describes your role?

*Check all that apply.*

- Pharmacist
- Prescriber
- Procurement Officer
- Finance
- Management
- IT
- Administration
- Other: \_\_\_\_\_

#### General Background

##### 2. How long have you worked with a VMI supplier?

*Mark only one oval.*

- 0-3 Months
- 3-6 Months
- 7-12 Months
- A year or more

#### Operations

##### 3. From how many suppliers do you purchase medicine in a given month?

*Mark only one oval.*

- 1
- 2-5
- 6-10
- >10

**4. What are some of the factors that go into deciding which supplier you can work with?**

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**5. How important are the following factors in your decision to go with any one supplier**

*Mark only one oval per row.*

	Not important at all	Somewhat important	Important	Mandatory
The products I want are always available	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supplier offers products from top manufacturers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supplier offers top-quality products	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supplier offers competitive pricing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supplier offers me a credit line	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supplier has an excellent reputation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supplier makes deliveries on-time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is easy to place an order with the supplier	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**6. Why do you work with a VMI supplier?**

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**Perceptions of effects**

**7. In comparison which makes your work easier? The traditional supplier or the VMI supplier?**

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8. Why do you say that

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9. In comparison which is more profitable to work with? The traditional supplier of the VMI supplier?

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10. Why do you say that?

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11. Has your facility benefited financially from working with a VMI supplier?

*Mark only one oval.*

- Yes
- No

12. Why do you say so?

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13. What other ways has your facility benefited from working with a VMI supplier?

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14. **Has your facility suffered financially from working with a VMI supplier?**

*Mark only one oval.*

- Yes
- No

15. **Why do you say so?**

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16. **What other ways has your facility experienced adverse effects from working with a VMI supplier?**

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### Final Comments

17. **Overall which type of supply chain management is more preferable?**

*Mark only one oval.*

- Traditional supply chain management
- VMI supply chain management

18. **Would you recommend working with a VMI supplier to other providers?**

*Mark only one oval.*

- Yes
- No
- Maybe

19. **Please explain your answer**

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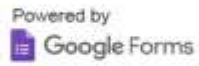
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**20. How likely are you to recommend VMI suppliers to a another facility**

*Mark only one oval.*

	0	1	2	3	4	5	6	7	8	9	10	
Very Unlikely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very Likely



## 2. Informed Consent form

### **The effect of traditional and Vendor Managed inventory on profitability in pharmaceutical supply chain of health care providers**

Dear Participant,

I am a graduate student in the Graduate school of Business at the University of Zambia. As part of my course-work I am conducting a interview the purpose of which is **to understand the effect traditional and vendor managed supply chain methods have on profitability for health care providers**. In VMI, the vendor or supplier is given the responsibility of managing the customer's stock based on the shared information between them.

You are being invited to take part in this research because I feel that your experience working with a health care provider that works with a VMI supplier (mPharma) can contribute much to my understanding and knowledge of the benefits of different supply chain methods.

Your participation in this research is entirely voluntary and the responses you give will be confidential. It is your choice whether to participate or not. The choice that you make will have no bearing on your job or on any work-related evaluations or reports. You may change your mind later and stop participating even if you agreed earlier

Participants will be asked to take part in an interview lasting no longer than 20 minutes. You may answer the questionnaire yourself, or it can be read to you and you can say out loud the answer you want me to write down. If you do not wish to answer any of the questions included in the interview, you may skip them and move on to the next question. The information recorded is confidential, your name is not being included on the forms, only a number will identify you. Your interview will be conducted in your workplace, after you have read this informed consent. Only I will have access to the interview that you fill out. The statistical data collected from your interview and others will be documented in my dissertation.

There are no anticipated risks, compensation or other direct benefits to you as a participant in this interview. By filling out the provided interview, you give me the permission to report your responses anonymously in the final paper to be submitted to my school as part of my course work.

You can ask me any more questions about any part of the research study, if you wish to. Do you have any questions? If you have any further questions about this research protocol, please contact me at +260974814184

Questions or concerns about your rights as a research participant may be directed to the University of Zambia Ethics Committee.

**Certificate of Consent**

I have read the foregoing information. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study

Print Name of Participant \_\_\_\_\_

Signature of Participant \_\_\_\_\_

Date \_\_\_\_\_

Day/month/year

Statement by the researcher/person taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that their participation is voluntary  
I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this ICF has been provided to the participant.

Print Name of Researcher/person taking the consent \_\_\_\_\_

Signature of Researcher /person taking the consent \_\_\_\_\_

Date \_\_\_\_\_

Day/month/year