RMIT

UNIVERSITY

Hospital-Supplier Integration and Hospital Performance in Saudi Arabian Context

A thesis submitted in fulfillment of the requirements for the degree of Doctor of Philosophy

Saad Salem Al shahrani

Master in Executive Business ADM (King Abdulaziz University, KSA) Bachelor of Administrative Sciences in Public Administration (King Khalid University, KSA)

School of Business IT and Logistics

College of Business

RMIT University

August 2019

DECLARATION

I certify that except where due acknowledgement has been made, the research is that of the author alone; the research has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and ethics procedures and guidelines have been followed.

Saad Salem Alshahrani

(August 2019)

ACKNOWLEDGEMENTS

First and foremost, I would like to thank Allah for guiding me through to the completion of my Ph.D. Allah has been faithful to me, He has equipped me with good health and the perseverance to overcome the various obstacles, which have manifested themselves during my work. I believe Allah has led me to make good decisions to foster my career development and, for that, I am forever grateful. I would also like to acknowledge my friends and family for their inspiration. They encouraged me to work hard in spite of the many challenges that I encountered. Therefore, I feel indebted to them for their generosity and support.

My senior supervisor, Professor Shams Rahman Professor of Supply Chain Management at RMIT University, Faculty of Business IT and Logistics, has been impactful throughout the completion of my Ph.D. In particular, he offered valuable ideas in order for me to complete my thesis and has also provided constructive criticism, which enabled me to incorporate his ideas and deliver work of real quality. Indeed, I owe my success to Prof. Rahman since he has guided me and delivered useful opportunities for development. He has given me valuable insights into research study, which definitely altered my worldview and has enhanced my knowledge. Although Professor Rahman is a busy academic, he was generous enough to spare his quality time to guide me throughout my journey. He has been my mentor and has trained me to become self-confident. I would also like to thank my associate supervisor Professor Caroline Chan Head School of Business IT and Logistics at RMIT University, for her moral and intellectual support.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PUBLICATIONS ASSOCIATED WITH THE THESIS

1. Alshahrani, S, Rahman, S & Chan, C 2018, 'Hospital-supplier integration and hospital performance: evidence from Saudi Arabia', *The International Journal of Logistics Management*, vol. 29, no. 1, pp. 22-45 (A – ranked Journal by ABDC).

2. Alshahrani, S, Rahman, S & Chan, C 2016, "Hospital-Supplier Integration: An Assessment of the Driving Factors in the Context of the Saudi Arabia Healthcare System". In A. Ali (Ed), *Proceedings of the 2016 International Conference on Industrial Engineering and Operations Management*(pp.1482-1487). Kuala Lumpur, Malaysia, 8th -10th March 2016.

3. Alshahrani, S, Rahman, S & Chan, C 2016, "Hospital-Supplier Integration as a Predictor of Hospital Performance in the Context of the Saudi Arabia Healthcare System", In K. Pawar& K. Tsai (Eds.), *Proceedings of the 21st International Symposium on Logistics* (pp. 562-574), Taiwan 3rd -7th July 2016.

Abstract

The level of demand in the healthcare sector has increased, hence it has become important for healthcare organisations to build and maintain relationships with suppliers so that they can secure the required quantity of supplies. Therefore, improving hospital supply chain performance has been increasingly essential in the world. Despite this significance, a review of the existing supply chain literature indicates that limited comprehensive studies have been conducted on hospital supply chain performance to date. Within a systematic literature review, this research develops a comprehensive conceptual model based on the impact of hospital-supplier integration on the overall performance of healthcare organisations. Furthermore, exploring the impact of moderating role of lean practices on hospital supplier integration and hospital performance. The context of this study is the Saudi Arabia healthcare sector, a two-tier healthcare system that is comprised of public and private sectors.

To address the research objective, and to test the research hypotheses, this research employs a Structural Equation Modelling (SEM) based on a field survey. The survey was conducted amongst 435 hospitals in Saudi Arabia. A total of 2175 Participants in this study. The results of this study showed that the logistics integration, information sharing, trust, lean practice, and the relationship between hospital supplier integration and hospital performance were positively associated with hospital-supplier integration. In contrast, information technology and hospital size were not positively associated

with hospital-supplier integration.   In addition, the results also revealed that the healthcare in private hospitals was better than that of public hospitals.

This study has several implications for both theory and practice in a hospital-supplier integration. The theoretical implications include developing a robust framework for a hospital-supplier integration and analysing its impact on hospital performance. Furthermore, one of the clear contributions of this study is the moderating role of lean practices between hospital-supplier integration and hospital performance. These are reasons for studying this topic in a developing country to gain more knowledge. In addition, this study examines the validity of the relational view of competitive advantage theory in Saudi Arabia. Moreover, the implications for practices are also far reaching and varied, as the sample comprises of two types of hospitals currently operating in Saudi Arabia: private, and public under the Ministry of Health. These implications include enabling managers and decision-makers to find the best practices to manage relationships with their suppliers, devising a system that enhances hospital performance through the adoption of the right level of lean practices in their hospitals, as well as reducing the overall cost by ultimately enhancing the management of materials and supplies.

CHAPTER 1: INTRODUCTION

1.1 Introduction

This study is based on analysing and investigating hospital-supplier integration (HSI) and hospital performance. Section 1.2 presents the background and overview of this study. In addition, supply management and supplier-buyer integration will be presented in section 1.3. Furthermore, section 1.4 presents the supply chain management in terms of efficiency and effectiveness. This chapter also describes the supply management and the competitiveness in the healthcare service provided. Section 1.6 focuses on the buyer supplier integration in the healthcare sector. The description of the health supply chains uniqueness will also be presented. Sections 1.8 and 1.9describe the identification of the problem and a brief scope of this study. Finally, the research objectives, research questions, and research methodology will be conducted, followed by a summary at the end to provide a brief overview of the research.

1.2 Background of this study

The current major concerns in the healthcare sector is the increasing cost of care together with the need to improve the quality of care for patients to achieve enhanced positive outcomes (Mcbride & Tietze 2018). Healthcare costs are commonly known to occur at three levels: the personal level, the provider level and the national level (Kim & Miller 2013). A major part of healthcare costs occurs at the provider level (hospitals), accounting

for 50-60% of the total healthcare costs. Out of the total US$ 2.9 trillion spent on healthcare in the USA, about half is spent on hospital costs(Kim & Miller 2013). Increasing inflation and innovations in diagnostic and treatment technologies will further increase hospital costs in the future (Dieleman et al. 2018). A report from the Australian Institute of Health and Welfare (2016)revealed that the total expenditure on healthcare in Australia from 2003-2004 was about US$68 billion and it increased to US$111 billion from 2013-2014. Another report done by the Australian Institute of Health and Welfare (2017)revealed that the total contribution on healthcare costs was about US$129 billion in 2016. In Saudi Arabia, there was a sharp increase in total expenditure on healthcare from US$ 6 billion in 2007 to around US$ 18 billion in 2017,that means it increased threefold within ten years (Ministry of Health in Saudi Arabia 2018). In this era, one of the major challenges faced by healthcare organisations in different countries around the world is the need to improve the quality of healthcare services and to reduce operational costs.

Healthcare managers are concerned about the rapidly rising costs and wish to implement management solutions for cost reduction. On the other hand, health care professionals are concerned with reducing medical errors and increasing the quality of care, irrespective of the cost implications. Thus, there is an apparent conflict of interest between hospital managers and clinicians. In most hospitals, health care professionals have the authority to make decisions about supplies. The customers of healthcare (i.e. patients and their families) have minor decision-making powers. Decisions are made by health care

professionals regarding what drugs to buy, where diagnostic tests are carried out, and clinicians decide these matters based on their own judgment.

According to the literature, about 60% of hospital costs are incurred by supplies and materials. These expenses show an escalating trend in the level of hospital expenses (Abdulsalam & Schneller 2017). One of the cost minimisation strategies is the adoption of supply chain management (SCM). Many recent findings have reported the effectiveness of cost reduction using the supply chain management strategy and confirmed that cost reduction is one of the outcomes (Gowrisankaran, Nevo & Town 2015). SCM is known to reduce costs through a variety of mechanisms and effects. Current literature shows that all of these are applicable to hospital supply chains and the SCM, depending on the existence of a prudent HSI.

Many researchers and theorists have suggested that healthcare organisations can reduce costs by focusing on the effective management of supply chains so that the flow of hospital supplies and materials can be organised and managed efficiently (Abdulsalam & Schneller 2017). This can significantly help to reduce operational costs while ensuring that the quality of hospital services are improved for patients and staff members alike. A major challenge facing hospitals is to meet changing healthcare needs by using modern approaches while simultaneously ensuring that costs are managed. Hence, building and maintaining strong long-term relationships with suppliers can effectively contribute to

managing costs in hospitals. It can make healthcare facilities more affordable, while ensuring that high-quality healthcare is maintained throughout.

1.3 Supply management and supplier-buyer integration

Most of the research on SCM and its cost reduction effects have focused on manufacturing industries rather than on service industries. The applicability of these results to hospital contexts depends on several factors. It has been found that only a limited number of studies have been conducted on the factors influencing SCM in the healthcare system context(Salah, Rahim & Carretero 2011). The integration of a supply chain in the healthcare system has become critical, bearing in mind the role of the suppliers in maintaining the quality of services. Suppliers are responsible for providing necessary supplies that can be utilised to facilitate patient care and provide them with quality treatment according to their medical condition. The aim of healthcare organisations is to improve the life of patients by providing them with effective care and treatment to cure their ailments.

The possibility of supply chain alignment as an opportunity for cost reduction has been extensively researched (Yang et al. 2013). Over the years, production costs have reduced, while the costs of distribution and selling have increased. Thus, the savings in production have been lost in distribution. More efficient operations, such as just in time (JIT) production, have simply shifted costs elsewhere in the supply chain by forcing suppliers or customers to carry that stock. This is evident from the Western European automobile scenario discussed by Klug (2013); Saranga, Mukherji and Shah (2015). The majority of the inventory was held at the most expensive finished product stage. Often, this cost was

4

as high as 25% of the total operational budget. Companies are only concerned with the costs they incur and not the end-to-end total cost.

Given that competition is primarily focused among supply chains, economic cost incurred by hospitals is crucial. Therefore, the total cost reduction in the entire supply chain needs to be considered. This requires integration between supply chain partners. Outsourcing merely results in higher costs incurred at the interface of these networks(Paul et al. 2018). Although they are termed transaction costs, their impact is significant. Studies define supply chain integration as the extent to which activities involved in an organisation are connected and integrated (Ali & Salehi 2016). These activities connect the suppliers, customers, distributors, retailers, transporters and customers together. While managing integration, it is important to consider both internal and external integration. Supplier integration is a highly valuable type of external integration, which helps in structuring strategies and formulating activities to build and maintain relationships with suppliers (Wong, Boon-Itt & Wong 2011). Internal integration mostly focuses on cost-containment, which is the best strategy to accomplish reliable supply chain implementation (Won Lee, Kwon & Severance 2007).

However, a lack of transparency and visibility may be caused by poor communication and information sharing between supply chain partners. In hospital contexts, the costs of procuring supplies are increasing. This has necessitated increasing the cost of hospital services to patients too. Although most of the costs are absorbed by insurance coverage,

a sizeable portion of the cost is also incurred by patients. Although the national focus has always been on the reduction of total healthcare costs, individual hospitals try to reduce the costs and, in particular, for themselves too. Recent evidence suggests that this is achievable by integrating with their suppliers (Brot-Goldberg et al. 2017).

The time taken from finances spent on raw materials to the finances realised from sales is known as cash-to-cash cycle time. This refers to the number of days that inventory is in the pipeline, such as raw materials, products in process, goods in transit, time taken for order processing, along with manufacturing time for replenishment orders held in queues and bottlenecks. A reduction in the cycle time results in a quicker return of finances and hence the release of working capital and thus cost. Most of the time spent in the pipeline is non-value adding time or idle time when the inventory does not move (Adebanjo, Laosirihongthong & Samaranayake 2016). These problems are solved when integrated SCM is practiced. In the case of hospitals, the time taken to pay suppliers is determined by the contractual terms. The return of this cash from patients will only be rapid if patient volumes are high. If patient volumes are low, the level of return will be slower. Thus, cycle time is only reduced when patient volume increases. As patient volumes are not under the control of hospitals, they can only manipulate supplier costs through better supplier cost management. Hence, supplier integration is a way to achieve this.

Supply chain mapping is a method used to identify cost reduction opportunities, as demonstrated by literature using an example from the clothing sector (Klug 2013; Saranga, Mukherji & Shah 2015). In this case, both suppliers and their customers carry inventory, resulting in duplication. This is because both parties hold safe stocks or buffer

stocks against uncertainty. The lack of visibility between adjacent parties and the non-sharing of information regarding stocks and usages causes this phenomenon. If this uncertainty is removed, the need for that inventory ceases to exist (Belkoski 2008). Thus, increasing transparency among supply chain partners can reduce total inventory costs along the entire supply chain. This is possible with integration. However, supply chain mapping is rarely practiced, even by other industries (Saranga, Mukherji & Shah 2015).Supplier integration can help to increase connectivity, which helps suppliers to understand the needs of the organisation so that they can provide them with the necessary supplies accordingly.

Thus, strong evidence exists regarding the possibility of cost reduction through integration of the supply chain. However, there is a difference between a simple supply chain and integrated supply chains and this difference has been identified (Youn et al. 2013). Supply chains utilise increasing quantities of resources to meet the increasing level of services and customer needs. The aim of a supply chain integration is to reduce the total amount of resources needed to meet the required customer needs. There is a distinct advantage of cost reduction when supply chain integration is used for inventory reduction. Studies have also differentiated traditional systems and supply chain management systems using a theoretical framework (Belkoski 2008).Within a hospital context, an integrated supply chain in which supplier integration is practiced requires a greater focus.

1.4 Supply chain management to increase efficiency and effectiveness

Cost reduction can be achieved by increasing the efficiency and effectiveness of processes, which can be facilitated by SCM. Traditionally, only material flowing at operational levels were considered by companies. The need for their integration arose as competition placed the survival of the business at stake, when there was no proper control on all flows using appropriate tools and techniques to measure their effectiveness (Ellram & Cooper 2014; Yang et al. 2013). In Saudi Arabia, the Government has given a high priority to the enhancement, development and improvement of healthcare services. Changes are being brought at the primary, secondary, and tertiary levels, which has helped to facilitate patient care more effectively. However, it has been found that healthcare organisations are facing several challenges and complications. In Saudi Arabia, the shortage of healthcare professionals has created a major challenge (Aljadhey et al. 2015) Along with this, there are limited financial resources, which has resulted in creating a challenge for healthcare providers to manage costs as well as meeting healthcare standards. As a result, the quality of care is being adversely impacted. Additionally, healthcare systems are facing concerns since there is no proper national health information system and national crisis management system in place (Economou et al. 2015).

Research indicates that the increased attention being paid to integrated supply chains was due to several negative trends impacting business performance (Adebanjo, Laosirihongthong & Samaranayake 2016). However, previous studies have advocated for

semi-integration rather than full integration considering the trends of current supply chains displaying the pressures of various dimensions and intensities of integration (Klug 2013; Saranga, Mukherji & Shah 2015). This justifies integration only in certain focused areas as required, rather than full integration. Almost in support of this view, another study noted that a holistic and systematic view of a supply chain is an impediment to its more extensive implementation (Youn et al. 2013). In a related aspect, researchers argue that the optimum level of integration and performance declines when there are deviations (Adebanjo, Laosirihongthong & Samaranayake 2016). Thus, focusing on supplier integration out of the total supply chain management evolves into a mode of partial integration in the case of hospitals.

The need to integrate supply chains has increased due to the development of e-business. Literature has proposed an integrated supply chain architecture combining enterprise resource planning (ERP)(Yao 2017). Some essential criteria for integrated supply chains are safety, security, completeness, flexibility, scalability, inter-operability and enabling applications. Research has noted very little improvement in the integration process, but companies have tried to maximise the efficiencies of their global supply chains or virtual organisations (Danese 2013). All the criteria listed above are also relevant to HSI(Morita et al. 2015).

Researchers have revealed that supplier integration is highly influenced by the level of communication and coordination between suppliers and the organisation. Supply chain

integration promotes collaboration and partnership with suppliers so that different problems and challenges can be avoided (Oruezabala & Rico 2012). Some studies have shown that supply chain integration is positively correlated with the optimum performance of an organisation. In addition, these studies argue that the valuable information related to integration can be used by healthcare organisations to reduce the cost of services as well as to improve the overall quality of patient care(Chaudhry et al. 2006).

1.5 Supply management and competitiveness

Most of the research on supply management has focused only on a single supply chain and ignores the existence of competitor supply chains and future emerging ones. Many works on competitive models already assume the existence and structure of a supply chain. Very few papers consider supply management, supply chain design and competition together. Highlighting these problems, researchers have discussed the effect of competition on the design of supply chain networks (Farahani et al. 2014). Another study noted that successful companies align their inter-operational systems with supply management (Saeed, Malhotra & Grover 2011). A two-stage stochastic process for the design of supply chains under various uncertainties was also identified by research conducted by Bidhandi and Yusuff (2011).

In hospital contexts, competitor-supplier integration assumes importance in relation to patient volume management and the prospects of volume increase with better integration. Hospitals with better supplier integration can be expected to attract more patients due to

higher efficiency and effectiveness in terms of improved quality of care and patient outcomes. Group purchasing arrangements nullify many of the aforementioned problems.

1.6 Buyer-supplier integration in the healthcare sector

A hospital supply chain is defined as a collaborative network of suppliers serving the different needs of a hospital to achieve the best patient outcomes and in the most economic manner. Supplier collaboration is stressed here since the topic of this study is supplier integration. Without collaboration, integration cannot be achieved. There is pressure on both the clinical outcome and organisational performance. The definition of supply chain management of hospitals for this study is: The systemic, strategic coordination of the business functions and the approaches across these business functions within a particular hospital and across all the suppliers within the supply chain, for the purpose of improving the long-term performance of individual suppliers and the hospital in terms of the most economical patient outcomes and that of the supply chain as a whole. Here again, supplier integration is stressed. It is noted that nothing is mentioned regarding customer integration in either definition, not because this is unimportant, but because the focus of this study is on the suppliers.

This study focuses on HSI. Hence the role of SCM in supplier integration is the only relevant aspect here. Research states that a supply chain consists of different members and components, which must be integrated and connected with each other (Zhang et al. 2018). Maintaining relationships with supply chain members can help in ensuring that the

overall performance and operations are adequately managed. Hospitals are the buyers while the suppliers include the firms and individuals providing equipment, systems, tools, techniques, drugs, medicines and technology to cater to the patients' needs. Healthcare sectors are undergoing rapid changes and developments, which require attention from analysts and managers to integrate new approaches and methods.

Various studies have observed advantages in terms of financial and market success with selected purchase practices as well as customer relations practices (Prajogo & Olhager 2012; Yang et al. 2013). Focusing SCM on the most critical aspects of the supply chain, yields high performance results. In the case of hospitals, the most critical aspect can be regarded at the supplier end. Thus, integration at this level is more important than wholesale integration.

One aspect related to SCM and supplier integration is the integration of value systems. Research discusses this issue after describing the challenges faced by Rick Calabra at General Motors (GM[1]) to integrate 12000 suppliers to meet the demands of the new initiative of the company (Belkoski 2008). The task of a supply chain integration is never easy. If the complications at GM arose due to the large number of suppliers supplying different automobile components, the challenges for the hospital sector are the varied needs of patient care and the need to handle emergency situations. The importance of supplier integration has been stressed by findings, which revealed that, at low levels of supplier integration, customer integration reduced efficiency (Danese & Romano 2011).

---

[1]General Motors is one of the most popular companies that care about creating a world with high degree of safety and clean environment (Motors 2018).

Thus, there is a relationship between supplier integration and customer integration. The contention is that supplier integration can also increase patient volumes through its effect on improved customer integration.

When considering supplier integration, the need for organisations (buyers) to overhaul their purchasing processes, and integrate supplier teams directly into their decision-making process, was stressed by survey responses obtained by Yao (2017). This is often overlooked by hospitals when they attempt supplier integration. The cost of changing a supplier can be high. Hence, there is a possibility of the purchasing entity becoming captive to its current suppliers presenting possible risks, such as poor supplies, suppliers passing trade secrets to competitors or even suppliers converting their new capabilities to start another venture. The integration of the purchasing and logistics processes with other key operations of the company creates closely linked manufacture and distribution outcomes. For hospitals, this represents service outcomes in terms of quality and efficiency of patient care. An alternative option of strategic alliances between suppliers and distributors to supply chains is also possible. Most hospitals seem to practice this at least by default, thus, it becomes purely a case of supplier integration.

Supply chain integration with lean/just in time and total quality practices provides a synergistic improvement in all three aspects (Yu 2015). This is relevant in the case of hospital supply chains due to the multiple requirements of increasing efficiency, decreasing costs, improving quality care and ensuring that outcomes and meeting

emergency needs are all satisfied when the three operational components are integrated. Researchers believe that the integration of supply chains not only helps in managing their total quality, but also positively influences the outcome and satisfaction levels of the customers (Casey, Brinton & Gonzalez 2009). In the case of hospital supply chains, there are different types of suppliers involved, who are selected based on the supplies required. It is vital to ensure that, overall, supplies are delivered on time so that there is no delay in the delivery of healthcare services and facilities.

In supply chains in China, trust and coercion have acted synergistically to improve supplier integration. With trust, coercive power improved supplier cooperation, contradictory to the general belief. Applying these results, hospitals need to identify some coercion factors to improve supplier cooperation (Yeung et al. 2009). However, the availability of several competitive suppliers should act as a buffer against suppliers exploiting hospitals, leading to improved patient outcomes. Research proposes that the logistic processes of supply chains can be structured and controlled by leveraging coordination and controlling mechanisms (Danese 2013). Based on survey results obtained by Youn et al. (2013), researchers recommend a phase-differentiated approach to supplier integration with various stages of development through varying degrees of integration.

Additionally, other literature has found a negative correlation between the duration of the relationship with suppliers, the performance measures of logistics costs, on-time delivery and the rate of return factors related to cost reduction needs (Bagchi et al. 2005). The effect of performance depends on the extent of integration, which varies across

companies. According to a previous study, the impact of supplier integration depends on the effectiveness and efficiency of schedule attainment, and it may be affected if efforts are not made to structure supply networks to achieve faster delivery times(Chiu & Lin 2004). On the other hand, investments that are limited to faster supply networks without adequate supplier integration may be ineffective or even reduce performance. Thus, there is a strong case for adequate investment in supplier networks by hospitals to achieve a desired level of supplier integration.

It is noted that the prior research referred to in this thesis regarding supply chains and supplier integration is related to different sectors and does not consider the hospital sector. Attempts were made to relate the findings to hospitals. However, there are many difficulties in applying the findings to a hospital context. This is due to the differences between hospitals and other sectors with regards to the nature of business and its impact on society. Hence, this offers sufficient justification for undertaking this study and conveys the uniqueness of health supply chains, which is discussed in detail below.

1.7 The uniqueness of health supply chains

This chapter began with an expression of concern regarding the rising healthcare costs to nations, hospitals and patients. About half or more of the total costs are incurred in hospitals. It was argued that SCM, particularly utilising a supplier integration strategy, would reduce hospital costs. This is because the wide-ranging categories of supplies to hospitals contribute to most of its revenue costs. Supply chain management not only

influences cost reduction, but also the effectiveness and efficiency of patient care and thus elevates quality care with better patient outcomes, all of which can help to attract more patients to the hospital and thus increase business volume to further reduce costs (Salah, Rahim & Carretero 2011). Literature has acknowledged that an integrated approach is utilised by the management and leaders of healthcare organisations to identify and evaluate the impact of different factors in the healthcare supply chain.

The majority of current literature related to supply chain management, targets manufacturing and retail industries, with a lack of research focusing on healthcare contexts. Research estimates that supply chain management practices in the healthcare industry are 10 years behind such practices in other industries, such as retail and manufacturing. There are still very few studies that examine supplier integration and its effect on hospital costs (Burt 2006). Literature shows that healthcare supply chains are different and unique from other supply chains in other industries mainly for five reasons, which are stated and summarised in Table 1.1. Each of these unique points is discussed below concluding with their relevance to the current study's focus on supplier integration to achieve cost reduction.

Table 1.1 The uniqueness of healthcare supply chains

Reason	Description	Authors
Requires accurate and adequate suppliers	According to the diverse clinical needs, supplies and materials must be adequate and accurate.	(Barlow 2010)
The nature of supplied materials	By nature, these materials are of high value and require special handling, which increases the cost.	(Chen, Preston & Xia 2013)
The lack of data standards and synchronisation	Healthcare has not yet developed a universal product number classification that helps identify functionality and equivalent products	(Garvin 2006)(Sargent 2010) (Vanvactor 2008)
Clinically driven	Supplies are often driven by physicians' preferences, where medical training and experience with specific brands play a key role in selecting materials. While this is based on production/sales forecasts and cost considerations.	(Roark 2005)(Stark & Mangione 2004)
Information and knowledge intensive	Due to the rapid technological and medical innovations, hospitals must deal with a large number of suppliers with different specialisations and knowledge	(Chen, Preston & Xia 2013) Chen et al., 2013)

1.7.1 Accuracy and adequacy of hospital suppliers

SCM extends its reach and influence on just about every clinical and operational area among hospitals. The most recent examples include: surgical services, diagnostic imaging, interventional radiology and, to some extent, oncology (Barlow 2010). Furthermore, hospital supplies are very important to the health of the public, as clinical operations require adequate and accurate supplies according to the diverse needs of patients (Hora & Klassen 2013). Hospitals are required to select suppliers that can provide timely supplies according to their needs and requirements. When choosing suppliers, it is important to consider different factors and forces to ensure that the necessary supplies are

available at the right time in order for services to be maintained. A hospital requires different types of suppliers for different goods and materials. Thus, management assesses and analyses the organisation's needs so that the hospital can manage its activities, processes, decisions and actions accordingly(Wang, Kung & Byrd 2018).

1.7.2 The nature of supplied materials

Different supply chain challenges drive from diversification into a new product. A pharma company growing into biotech, for example, numerous find that those products need special handling, such as temperature regulation throughout transport. Shippers must keep the product within the required temperature range, they must also provide evidence to regulators that they have done so (Douglas 2011). This example, and the high value of medical supplies and equipment, indicates that the nature of the supplied materials makes health supplies unique in the sense of combating spoilage or obsolescence. Costly diversifications increase hospital costs and, in turn, costs to patients. Careful cost management between different stakeholders is the only way to streamline costs to manageable levels. However, these aspects have not yet received adequate research attention.

1.7.3 Lack of data standards

Data synchronisation between organisations is a tool that brings consistency of product information directly to the desktop of everyone involved in the supply chain, from catalogue clerk through to the following processes of ordering, purchasing, shipping, receiving and billing(Huang, Sheoran & Keskar 2005). This entire process is increasingly becoming a discriminator in the world marketplace(Garvin 2006). Although data

synchronisation and its related standards have been in use and under consistent development in other sectors—such as the retail sector—its applications in the healthcare industry remain behind. Supplier integration is intimately related with data synchronisation. If data on product standards are synchronised across hospitals, this will facilitate the standardisation of production processes. The resulting scale economy will also decrease costs, but, unless data standardisation is one of such standards, this relationship cannot be studied. Thus, an excellent opportunity to reduce costs in healthcare is denied.

1.7.4 Clinically driven supplies

The drivers of healthcare supplies are different to those in other industries. The clinical needs and requirements are driven mainly by clinicians who receive their medical training with specific preferences in terms of brands and makes. This is in contrast with other industries where purchasing is process and sales driven(Stark & Mangione 2004). The lack of training on process and cost consideration throughout medical education plays a key role in increasing the cost and complexity of health supplied materials (Roark 2005). Conflicts between clinicians, who prefer specific brands, and managers, who prefer to obtain equivalent products at lower prices, are a common phenomenon in many hospitals. When implementing supplier integration, a team consisting of both managers and clinicians should be given the responsibility for decision-making regarding supplies to hospitals.

Literature reveals that, in the healthcare sector, the pharmaceutical manufacturer, hospital, drug retailers, distributors, and suppliers are closely linked with each other. As the demand for high-quality healthcare services increases, this provides increased opportunities for growth and development. As a result, third-party providers are investing in the healthcare sector, which has helped to promote the development of specialised services. In consideration of this, healthcare organisations are paying attention to improving their relationships with suppliers so that they can enhance internal processes and approaches.

1.7.5 Information intensive supplies

The diverse types of healthcare supplies often change as a result of rapidly advancing technology and medical innovations, which makes the management of healthcare supply chain information and knowledge intensive (Vanvactor 2008). Hospitals must deal with a large number of suppliers with different specialisations and knowledge. As such, a hospital SCM is more complex and knowledge-intensive than traditional industry supply chain practices (Chen, Preston & Xia 2013). This necessitates efficient information network systems to keep the knowledge continually up to date. This will ensure that the opportunity to reduce costs using a new product or technology is quickly identified and acted upon through the supplier integration process already in place. However, research in this area is yet to gain momentum. Thus, any efforts to improve HSI properly must bear this uniqueness in mind.

Various factors affecting supplier integration in other industries may be applicable to hospital contexts with some adaptations. As a result, this current study investigates some

factors that are logistics integration, IT integration, information sharing, trust, hospital size along with lean and associated practices. Logistics integration helps healthcare professionals in designing the course of action and responding to the needs of patients. This integration helps to promote a positive and connected environment, where value for stakeholders is maximised (Barlow 2010). In this current era of technology, IT integration has helped to enhance the storage and flow of information, which facilitates timely decision-making and actions so that the purpose and objective of the organisation can be achieved. The information sharing process has a strong impact on the overall services provided by health professionals. Hospital records are kept in relation to patients and service providers so that the overall quality of services can be maintained. The hospital size is dependent on the availability of the resources. Hence, it is important to maintain the availability and maximum utilisation of resources and skills (Preuss 2003).

1.8 Problem identification

Supplier integration—without the associated logistics integration—will not be effective. Unfortunately, there is very little research in the healthcare sector regarding this issue. IT integration and information sharing are inter-related in several ways. However, for IT integration to be able to capture useful information through knowledge networks is another issue. In order for hospital services to be knowledge-intensive, the acquisition of relevant knowledge is possible only with integrated knowledge networks being made available to hospitals. Nowadays, most knowledge distribution occurs through the Internet. Therefore, it is crucial for an IT department to acquire relevant knowledge. This

IT facilitation needs to be integrated both internally and externally to derive useable information from it. As technology rapidly advances, it has become critically important to take advantage of the advanced systems and technology so that the level of services and performance of the organisation can be enhanced accordingly.

The useable information that has been gained needs to be shared with supplier partners to enable them to cater to the needs, which are highlighted by the relationship of knowledge with the improvement of hospital practices. IT and information sharing are related in this manner. This point also highlights the need not only for IT integration, but also its subsequent integration with networks related to supplier integration. Unfortunately, this aspect has received very little research attention in any sector, let alone the healthcare segment. Trust is a very important aspect of building relationships with suppliers in order for supplier integration to be successful. Trust and information sharing are mutually related. If there is trust, information sharing between hospitals and suppliers occurs freely and fairly. The greater the information sharing, the greater the trust levels between the service providers and the customers. Although many studies in other sectors can be cited in this aspect, literature in the healthcare sector is rare.

The size of a hospital is directly related to potential patient volumes and the extent to which patient flows can be managed efficiently. The need for supplier integration becomes greater with an increasing hospital size. Extremely small hospitals may not need supplier integration to be able to manage their supplies efficiently; they are more likely to have and use fewer suppliers. On the other hand, very large corporate hospitals with multiple branches may need a centralised supplier integration and procurement processes.

Although these conjectures are logical, they will remain so in the absence of any research data. In healthcare organisations, the size of the hospital has a strong impact on overall performance. It is critical for hospitals to consider how many patients can be served at any one time while maintaining the quality of services. In such cases, the organisation must possess the required resources and supplies so that they can facilitate patient care and meet the purpose and objectives of the organisation (Bailey et al. 2014).

The lean concept facilitates cost reduction by avoiding wastage of materials and processes. It also avoids non-value-adding processes. Thus, the significant components of the lean concept are favourable for cost reduction. This has prompted many hospitals to adopt lean practices in their management systems. Unfortunately, avoiding wasteful supplies has escaped from the scheme of things in this respect. Wasteful supplies can be avoided using supplier integration. It helps to determine and ensure the delivery of supplies with the right quantity at the required place and at the required time. Thus, the wastage of time, resources and inventory are simultaneously avoided.

There is very little research on the effect of lean practices in the healthcare sector. Hospitals are faced with a need for emergency supplies when patients are in a critical condition. This also necessitates just-in-time (JIT) supplies. If such occurrences are very frequent, regular practices using the JIT approach, along with lean practices, is necessary. The joint requirement of both these systems has never been studied in any sector, including healthcare. Agile practices are also important in ensuring the timely delivery of required supplies at required points. Agility helps to manage inventory well. The

combination of lean and agile is known as leagile. Although there are many reports on the effects of leagile practices in other sectors, healthcare researchers are yet to be drawn into this.

1.9 Scope of this study

The discussions above clearly establish that, although many aspects regarding supply chains have been understood, there exists a real need to understand its integration and management to ensure that companies are able to implement SCM and fully derive its benefits. However, the translation of all these benefits into improved company performance is less certain. The alternative options of collaborative arrangements and partial integration focusing on the components of supply chains are also possible. This will enable the deployment of scarce resources in critical areas. This study focuses on evaluating the different factors and forces influencing HSI. It may help in developing strategies and processes that can enhance the level of integration, so that the functions of the supply chain can be improved.

In light of the above discussion, supplier integration merits separate treatment. This is due to its direct effect on costs. Supplier integration will only be successful when logistics are also properly aligned with it(Christopher 2016). The use of IT for the acquisition and management of knowledge from a large variety of Internet sources, and the identification of useful knowledge and conversion of information into action are associated with IT integration (Prajogo & Olhager 2011). This useable information is then shared with suppliers to ensure delivery of the right product in the right quantity at the right point at the right time. This is one benefit of information sharing. The transparency of

relationships to build trust is a pre-requisite of building partnerships and collaborations with suppliers. Information sharing and involving suppliers in key decision processes of product manufacturing and service delivery are essential for successful supplier integration.

Lean practices involve the avoidance of waste in materials and processes and non-value adding operations. Avoidance of waste material is linked to suppliers. The supply of materials using a pre-determined schedule will help to minimise waste. When this schedule is linked to the impact of customer demand, then the scheduling of materials will automatically be decided according to production that is tailored to customer demand. This will avoid wastage. Supplier integration greatly facilitates this. Research states that the inter-organisational information sharing between primary suppliers and hospitals must be managed by taking advantage of advanced systems and technology (Oruezabala & Rico 2012). This helps in gaining a competitive edge by ensuring that processes are managed using advanced methods and techniques.

Three other concepts related to lean practices are agile, leagile and JIT practices. Agility ensures the efficiency of operations. Without the receipt of correct supplies, operations cannot be agile (Al-Tit 2016). The two terms—lean and agility—complement each other. Lean ensures that only the required quantities of the required materials are received. Agility ensures that, as soon as materials arrive at the correct time, efficient operations utilise them within the scheduled time for timely delivery to customers. JIT minimises inventory and its costs. When materials are received only at the time of requirement, there

is no wastage of space or cost of storage. Thus, in all these cases supplier integration plays an important role.

The current literature on HSI reveals contradictory findings, which will form the basis of discussion in the following chapters. Some of these findings are mere conjecture, based on both theoretical considerations and available research evidence. There are methodological problems associated with many findings. Therefore, generalising the findings to operable actions must be undertaken with caution. To manage the research, the approaches and methods are selected keeping in mind the purpose and objectives. Previous studies have helped in studying the importance of HSI and how this helps in managing the overall performance of the organisation. However, in the current era, organisations are required to focus on new and advanced methods to compete in a challenging environment. Governments and other legal bodies have brought various changes and developments to laws and regulations to influence the healthcare sector. Their aim is to meet the changing needs and enhance the overall health and wellbeing of the people belonging to different segments of the nation (Christopher & Gattorna 2005).

The findings and conclusions discussed above are derived from many research resources. However, most of these are related to the manufacturing sector. There are less frequent reports from service sectors. Still fewer reports are available in the case of the healthcare sector. The findings obtained in other sectors can be extended to healthcare only to a limited extent. This is due to the uniqueness of healthcare supply chains, which have been identified by a few works of literature.

However, even among research studies pertaining to the healthcare sector, those specific to hospitals are few. This chapter began with the search for solutions to reduce healthcare costs in the face of annual increasing healthcare costs. Approximately half of healthcare costs are incurred in hospitals. Thus, any significant cost reduction should also occur in hospitals. Supply chain management was considered as an option. However, there is a case for narrowing down the scope to specific components of the supply chain. The cost of procuring supplies constitutes the major cost for hospitals. Therefore, it is evident that cost reduction should occur at this level. This is the point at which hospitals interact with suppliers and place orders for the required supplies. To reduce costs at this level, hospitals need to adopt supplier integration. This involves logistics integration, IT integration, information sharing, trust and the use of lean/agile/leagile/JIT strategies as discussed above. As very little research has been undertaken on these aspects in any sector, the need to conduct such research is more than apparent. Healthcare is a vital sector affecting human health and life. It is therefore imperative to undertake research in this area. This thesis by health products only refers to medicines and accessories and not to the equipment.

1.10 Research objectives and questions

The aim of this research is to develop a theoretical model that conceptualises the factors affecting Hospital Supplier Integration (HSI) and its impact on hospital performance in both private and public settings, within the context of Saudi Arabia.

In order to address the main objective, the following research questions have been constructed:

RQ1: What is the impact of hospital-supplier integration on the overall performance of hospitals in Saudi Arabia?

RQ2: What are the factors that affect hospital-supplier integration?

RQ3: How does logistics integration, information technology, information sharing, and trust affect hospital-supplier integration?

RQ4: Do lean practices enhance the impact of hospital-supplier integration on hospital performance?

RQ5: Does hospital size make any difference in hospital-supplier integration?

RQ6: What difference do public/private sectors make in determining the impact of hospital-supplier integration on the performance of hospitals in Saudi Arabia?

This study has been designed to take the following steps to answer the research questions:

1. Based on the available literature, identify the factors that are most likely to affect hospital-supplier integration in a variety of contexts. This will enable the choice of independent variables as factors affecting the integration.

2. The second step involves determining which factors are relevant to hospitals in Saudi Arabia and its healthcare system together with the current status of its supply chain integration and HSI. For this purpose, the Saudi healthcare system and the current status of supply chain integration will be reviewed.

3. The third step involves the determination of hospital performance variables from those obtained from the detailed literature review. The limitations of what can be measured are also to be considered. These are to be used as dependent variables.

4. The fourth step was to examine the initial defining of the potential relationship between independent variables (factors of HSI) and dependent variables (hospital performance) and the effect of lean practices as moderating variables—for this the formation of a series of hypotheses was necessary.

5. Finally, the last step involves studying the current status of the relationship, by using suitable methods and analysing the results using suitable techniques. This was expected to result in specific factors relevant to the Saudi Arabia context, which need to be improved to achieve better HSI and thus hospital performance.

A research framework is developed by linking independent factors with hospital performance and moderating the role of lean practices through the proposed hypotheses. Thus, the verification of hypotheses through the findings answer the research questions and fulfils the research aims defined above.

1.11 Organisation of this thesis

The key area of research involves studying the impact that various factors have on HSI, and its effect on efficiency, effectiveness, quality of care, patient outcome and financial performance. Previous works from the healthcare sector and other sectors were used to define the research aim, frame the research questions, set objectives, formulate

hypotheses for testing and finally determining the methodology of the research. In realising the importance of such a study in this chapter, the following steps were taken.

Chapter 1 is the introductory chapter, which presents the background and overview of the overall research. The research objectives and questions are included, along with the scope and limitations of the study. In this chapter, the key concepts are discussed related to supply chain management and supplier-buyer integration.

Chapter 2 presents an in-depth analysis and overview of the healthcare sector of Saudi Arabia. The system has been reviewed considering the current conditions, policies, and expenditure in the health industry.

Chapter 3 presents the literature review, which is based on analysing and evaluating past research carried out by researchers in the field. Only relevant and reliable sources and published articles have been used to maintain the validity and authenticity of the study. The chapter also includes the research framework presenting the variables of the study. Based on the literature analysis, the research hypotheses were developed, which were further tested and verified in the succeeding chapters.

Chapter 4 presents the research methodology and analytical approach. The chapter includes the methods and approaches that were used to carry out the study, so its purpose and objective could be achieved.

Chapter 5 presents the basic analysis and findings, which were based on utilising statistical tools and techniques to analyse and interpret the data. The chapter presents the

results of the statistical tests performed on the primary data gathered from the questionnaires.

Chapter 6 presents the advanced analysis and findings, which were based on the data gathered during the research. The hypothesised model was tested using structure equation modelling (SEM), which includes seven proposed hypotheses (H1 to H7).

Chapter 7 presents the overall discussion of the results and findings of the study. The analysis is based on the theoretical concepts and findings, which helped in answering the proposed research questions.

Finally, Chapter 8 presents the conclusions and implications of the study. It not only summarises the findings but also includes the recommendations and a summary of the results. The chapter also includes the theoretical and practical implications, along with future research directions and limitations of the study. Figure 1.1 summarises the links between the overarching research objective, research questions, findings and thesis chapters.
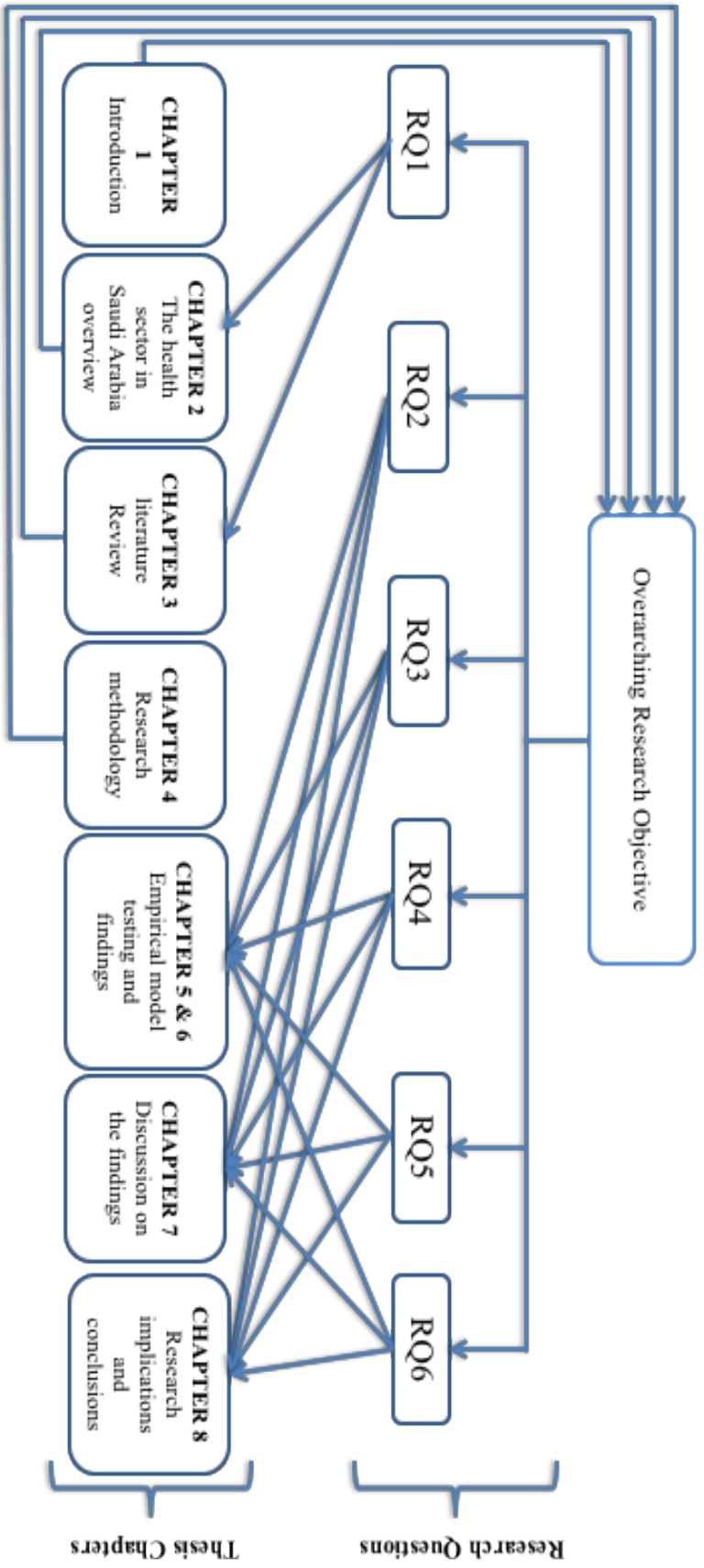
Figure 1.1 The links between the overarching research objective, research questions, findings and thesis chapters.

1.12 Summary

The need for this study arises from the difficulty of balancing rising costs and the necessity of enhancing the positive outcomes from healthcare service delivery through an improved quality of care. The conflicting stance between healthcare managers and clinicians is often a bottleneck for implementation of cost-effective solutions. Healthcare is the only sector where the customer has limited choice on which services to buy and at what cost.

There are many differences between traditional and integrated supply chains. Increased efficiency through reduced resource quantity is achievable through better inventory management and this is accomplished when supply chains are integrated. An increase in the efficiency and effectiveness of processes will automatically lead to improved outcomes. An integrated supply chain is a definite means by which to achieve this. The inefficiencies identified in existing healthcare supply chains are better addressed when an integrated supply chain is practiced. However, the level of integration is very important, as all aspects of the business cannot be freely shared along the supply chain. In this context, e-business seems to play a vital role.

There is evidence that the competitiveness of companies is associated with the success of supply chains. This is why the next level of competition is considered to be between supply chains rather than between businesses. The supply chains consist of different partners and it is vital to ensure that the partners are closely linked with each other. The collaboration and connection can be maintained by enhancing the overall level of communication. Communication is considered to be an important factor, which helps in managing the relationship, the partnership and facilitates the removal of complexities and challenges.

Most of the points discussed arise from studies carried out in other sectors. There exists a scarcity of similar research in the healthcare sector, particularly in the context of hospitals, which represents the gap this study planned to fill. Researchers have previously focused on different aspects of healthcare organisations. However, supplier-hospital integration is not discussed in detail, which results in a gap in the research. Even though researchers belonging to different fields have highlighted the importance of supply chain integration, there is little research in the field of healthcare.

This study is set to bridge this gap by investigating the impact of HSI on overall hospital performance. Additionally, this study aims to tackle the mediating role of lean practices in the selected research context—the Saudi healthcare system. To do so, a quantitative approach was deployed in this study.

The next chapter is designed to review the main features of the Saudi healthcare system and their potential impact on the study.

CHAPTER 2: AN OVERVIEW OF THE HEALTH SECTOR IN SAUDI ARABIA

2.1 Introduction

This chapter first focuses on the general introduction of the healthcare sector in Saudi Arabia. It presents the background and overview about the healthcare system. In Section 2.2 a description of Saudi healthcare systems is presented and evaluated according to previous research. Moreover, this chapter provides justification for choosing Saudi Arabia as the country of interest for this research in Section 2.3. A summary of this chapter is presented in Section 2.4.

2.2 Saudi healthcare system

2.2.1 Country context

Saudi Arabia is the largest country in the Arabia Peninsula. It covers an area of 2150 thousand km^2 (Muenjohn 2017). Geographically, Saudi Arabia is located in the Middle East, bordering the Persian Gulf and the Red Sea, just north of Yemen. The geographic coordinates are 25 N and 45 E. The geographical location of Saudi Arabia with its borders is given in Fig 1. The total area consists of 2149690 km^2, entirely land area. Saudi Arabia has a harsh dry desert with great temperature extremes. The terrain is mostly sandy desert (Muenjohn 2017). Major natural hazards are frequent, especially sand and dust storms. Desertification, complete depletion of perennial water sources and coastal oil spills are the main environmental problems. Saudi Arabia is the largest country in the world without a river (Aljuaid et al. 2016). Its extensive coastline facilitates shipping, especially oil.

According to Mohammed (2016), it serves as a vital bridging hub between Africa and Europe. The country has been an important member of the UN since 1945. It is also the founding member of the Gulf Cooperation Council (GCC) and the League of Arab States. The official language of Saudi Arabia is Arabic (Adebanjo, Laosirihongthong & Samaranayake 2016). Saudi Arabia is considered to be one of the richest and fastest growing countries in the Middle East. It is the largest producer and exporter of oil. The population of the country is rapidly increasing, and this has become a major concern for the Government and policymakers of the country (Aljuaid et al. 2016).

The population is approximately 30 million according to the estimated population, out of which, 77% are Saudi nationals and the remaining 23% consist of non-Saudis who are visitors or temporary workers from other countries (Muenjohn 2017). The 2015 estimated population growth rate was 1.46%. Saudi Arabia has a relatively young population with about 50% of its population being under the age of 24 years. During the past five decades, the country has been transformed from a small country where the rural population was less than 4 million people to one of the most urbanised countries in the Middle East. The rapid development of major cities has made its capital city, Riyadh, into a place with a population of more than six million people (Muenjohn 2017).

The Government operates as a monarch regime. There are 13 provinces. The constitution was adopted on 1 March 1992. Basic laws are issued by royal decree, serving as the constitutional framework. These are based on the Quran and the life and tradition of the Prophet Mohammad. The Islamic (Sharia) legal system is followed with some elements of Egyptian, French and customary laws mixed in. Several secular codes have been introduced

and there are special committees to resolve commercial disputes. The monarch is both the chief of the state and head of the government (Muenjohn 2017). A council of ministers is appointed by the monarch every four years. Monarchy is hereditary. Future kings—as per hereditary norms—are determined by a committee constituted by the Allegiance Commission. The legal arm is the unicameral Consultative Council of Majlis al-Shura of 150 members (including 30 women since 2013) appointed by the monarch for a four-year term. The highest authority of the judiciary system is the High Court, appointed by the monarch based on the recommendations of the Supreme Judiciary Council. Subordinate courts work under the High Court. There are special courts and committees that handle separate cases of labour, commercial and administrative disputes.

The economy of Saudi Arabia is based mainly on oil. There is strong governmental control over major economic activities. The country holds approximately 16% of global oil reserves and is the largest oil exporter and leading player in the Organisation of the Petroleum Exporting Countries (OPEC). The oil sector contributes to about 80% of budget revenues, 45% of the GDP and 90% of export earnings. In 2013, a daily average production of 11.59 million barrels was achieved and around seven million barrels were exported. As of 1 January 2014, the reserves consisted of around 268.4 billion barrels (Muenjohn 2017).

2.2.2 Health services in Saudi Arabia

To diversify its economy and tackle the large-scale unemployment of Saudi nationals, Saudi Arabia encourages the private sector. There are about six million foreign workers who contribute to the economy. However, the country has initiated many skill development

programmes to solve the problem of unemployment. The unemployment levels decreased from 11.6% in 2012 to 5.5% in 2013. The current low prices of oil caused some stress to its economy. Although GDP per capita is steadily increasing US$ 37 million in 2014 and is comparable to western developed countries, GDP growth declined from 5.4% in 2012 to 3.6% in 2014. Industry accounted for about 60% of the GDP and services accounted for about 38% of the GDP in 2014. About 80% of the 11.6 million labour force are non-Saudis. Inflation reduced from 3.5% in 2013 to 2.7% in 2014 (Muenjohn 2017).

The Ministry of Health (MOH) in Saudi Arabia gave an elaborate account of healthcare status in Saudi Arabia with data. On average, the budget of the MOH constituted around 6.5% of the total government budget and the GDP per capita between 2009 and 2013(Ministry of Health in Saudi Arabia 2018). According to research, many indicators on health outcomes have shown notable improvements during the last few years. For instance, the life expectancy of 75 years in 2013 was five years higher than the global average. The percentage of population below 15 years in 2013 was 30.8% and was higher than the global average of 27%. This indicates the potential for a higher proportion of a younger generation in the future and, at the same time, the increased threat of early childhood diseases of a communicable nature(Ministry of Health in Saudi Arabia 2018). The crude birth rate of 22 per 1000 in Saudi Arabia in 2013 was lower than the global average of 24.3. The crude death rate of 3.8 in 2013 was almost half of the global average of 7.9 per 1000 people. The infant mortality rate of 8 per 1000 live births was 56%, lower than the global average of 37%. All these health indictors are also higher than other Middle Eastern countries (Ministry of Health in Saudi Arabia 2018).

Between 2006 and 2013 there was a 25.6% increase in physicians, 68% in dentists, 33.1% in nurses, 19.5% in pharmacists and 53% allied healthcare professionals. The proportion of Saudis employed in all these roles, especially nurses, also increased significantly during this period. This was due to the deliberate efforts of the government to provide facilities and training for the provision of the necessary skills to Saudi nationals. Due to fully-fledged immunisation programmes reaching over 95% of coverage, the threat of communicable diseases has also decreased significantly. In 2013, there were 2.2 nurses for every physician, compared to 1.8 nurses globally.

The number of primary healthcare centres (PHC) increased by 17.4% from 2007 (1925) to 2013 (2259). This represents 7.53 PHCs per 100000 of the population. The total number of hospitals owned by the MOH was 268 in 2013 with 38,970 beds. Thus, there was almost one hospital and 13 beds per 100000 of the population. The number of public hospitals increased from 244 to 268 and beds from 33,277 to 38,970 between 2009 and 2013. There are also healthcare facilities in other government sectors too. The main sector consists of universities, medical education and research centres. Armed forces and other national security services also have their own facilities. These sectors added 11,497 beds, 13,577 physicians, 29,969 nurses, 1,860 pharmacists and 22,641 allied healthcare professionals in 2013 with a significant increase and proportion of Saudi employment over that time. Between 2009 and 2013, the total number of private hospitals increased from 125 to 136, beds from 11,833 to 14,310 and dispensaries from 1,944 to 2,249. A significant increase in healthcare professionals was observed, as well as an increase in Saudi employment.

Currently, Saudi Arabia is known as one of the richest countries, which has effectively managed the healthcare industry and sector so that people can live healthy lives. Government bodies continuously monitor the healthcare services offered to people by using different organisations and hospitals. It has helped significantly by introducing strategies and methods to facilitate patient care. With the passage of time, advancements have been brought into healthcare services. To manage performance effectively, improvement has been linked to different factors and forces.

The overall effect of all of these advancements was formidable. The proportion of hospitals owned by the MOH, other government sectors and private sectors charted in the report are displayed below (Figure 2.1).
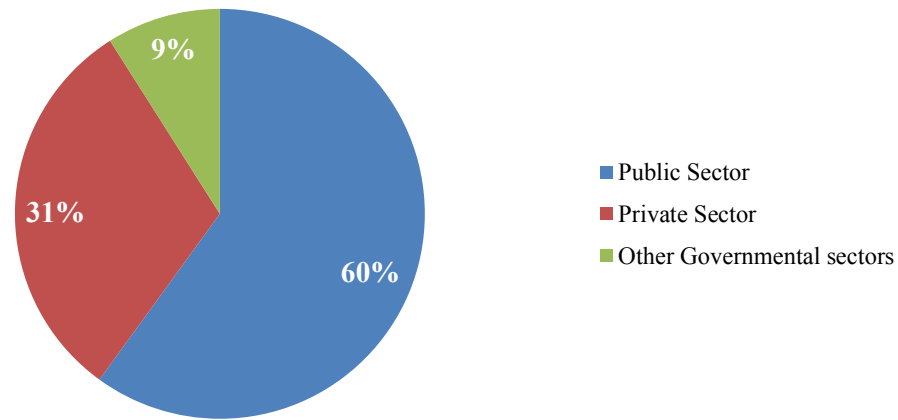
Figure 2.1 The percentage of health services provided through public and private hospitals in Saudi Arabia (Source: Ministry of Health in Saudi Arabia 2018).

According to research, the GDP per capita in Saudi Arabia in 2015 was US$ 20.7million and the percentage of the MOH budget was approximately 7.5%, increasing from 6.8% of

the total governmental budget in 2013, while the per capita of the MOH annual expenditure was US$ 43 million(Ministry of Health in Saudi Arabia 2018). Since hospital supplies are the main component of health expenditure and integrally linked to robust healthcare systems, finding new methods to reduce supply costs and to increase efficiency is important (Dejohn 2009; Ministry of Health in Saudi Arabia 2018). The focus of this research is on health purchases. This includes drugs, medical accessories and non-medical purchases. This is particularly important as the latest published figures indicate that these purchases contribute to a considerable amount of general healthcare spending in Saudi Arabia (Figure. 2.2 and Figure. 2.3).
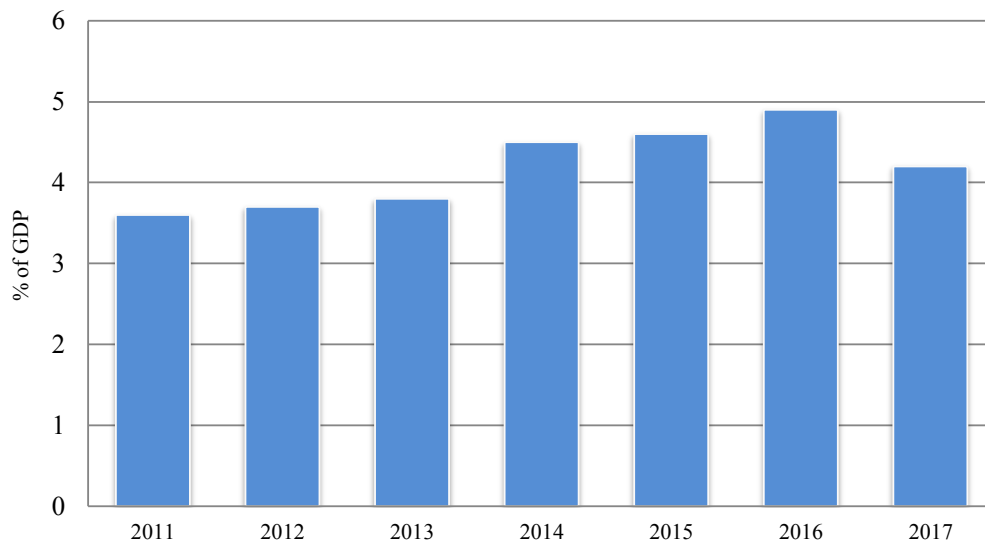
Figure 2.2 Total expenditure on health in Saudi Arabia as a percentage of GDP between 2011 - 2017 (Source: Ministry of Health in Saudi Arabia 2018).
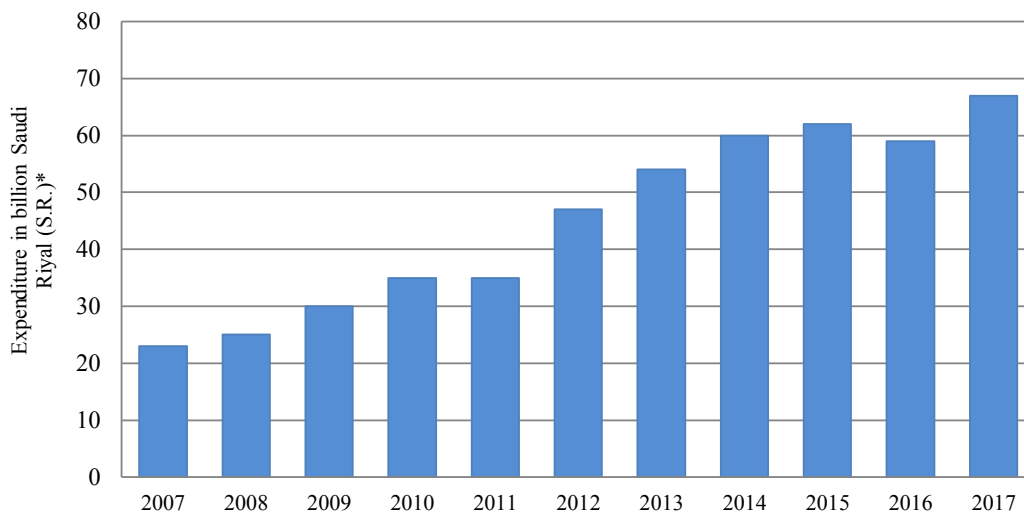
Figure 2.3 Total health purchases in Saudi Arabia 2007-2017 (Source: Ministry of Health in Saudi Arabia 2018).

The increasing trend of hospitals and beds in Saudi Arabia was only contributed to by the MOH and private sectors. There was little addition from other Government sectors. The trend of healthcare employees in these three sectors (public sector, private sector and other governmental sectors) was similar. Medical education facilities exist in all universities in all regions and there are significant numbers of healthcare professionals from various specialisations graduating from these universities. These people add to the human resources in the healthcare sector of Saudi Arabia. In addition, training both in Saudi Arabia and abroad for various specialisations, quality improvement and other suspects of healthcare is given to suitably qualified people.

---

[2] *1 S.R = 0.267US$ Approx.

42

Outpatient visits account for 62% of total visits to healthcare facilities as shown in Figure 2.4. Approximately 62% of patients visited general clinics. Some of them may have been referred to specialist hospitals and others might have been treated for relatively minor health problems, which can be dealt with at general clinics.
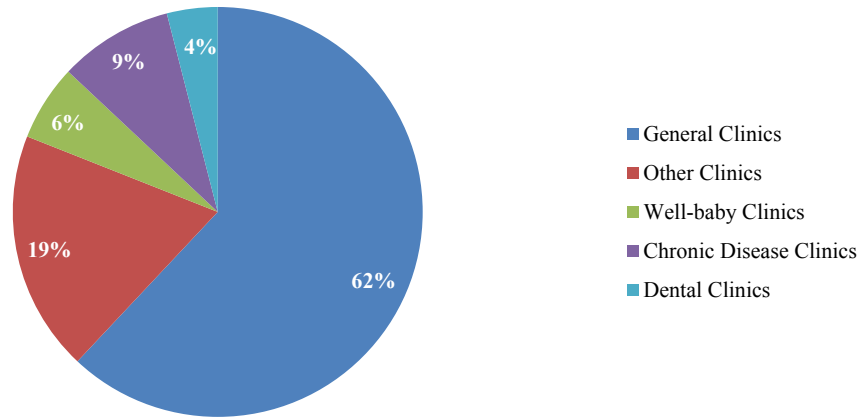
Figure 2.4 Proportion of outpatient visits to various health care sectors (Source: Ministry of Health in Saudi Arabia2018).

The average number of visits to healthcare facilities per person per year decreased from approximately 5.2 million in 2009 to 4.5 million in2013. Thus, there was a definite reduction in the need to visit hospitals—an indication of the decline in health problems of the population. Of the total outpatient visits, the MOH accounted for about 48%, the private sector about 35% and other Government sectors, the remaining 17%(Ministry of Health in Saudi Arabia 2018). Data is available for outpatient visits disease-wise, sector-wise and region-wise.

The MOH of Saudi Arabia has played an important role in enhancing healthcare services by promoting professional standards and placing emphasis on the quality of services. It is important to introduce and integrate advanced techniques and methods so that the services can be improved accordingly. In this era, hospitals are required to keep track of information relating to patients so that they can facilitate the patients appropriately. If they fail to manage the information, this can negatively affect the healthcare services and facilities offered to patients (Dejohn 2009; Ministry of Health in Saudi Arabia 2018).

In-patient admissions decreased from 12 per 100 people in 2009 to 10.5 per 100 people in 2013 across Saudi Arabia. The sector-wise in-patient admissions are reproduced in Figure 2.5 of the report. Of the total, 54% were admitted to hospitals owned by the MOH and 30% to private hospitals. Data on various other services are also given sector-wise, region-wise and year-wise.

Reports noted that the MOH is the main healthcare provider in Saudi Arabia. Since 1970, healthcare has been receiving steady attention and is improving through the five-year national development plan. A plan for adding 150 new primary healthcare centres every year until 2016 is being implemented. The MOH collaborates with other national and international agencies to improve the service delivery system. The new model is based on a national level integration of all healthcare and related services through efficient coordination. This involves the levels from primary to quaternary care and elements from primary to various specialist areas. The standardisation of operating procedures and accreditation of healthcare facilities is also being undertaken. Patient safety—both inside and outside of hospitals—is important. Although expatriates constitute most of the skilled

staff, local skill development is actively being pursued(Lee, Lee & Schniederjans 2011). Research notes that Saudi Arabia is on track to achieve its Millennium Development Goals of healthcare(World Health Organization 2013).

Major health risks are related to the chronic health problems of its residents and infections likely to arise from the gathering of people from different countries arriving for Hajj and other pilgrimages and religious occasions. There are advanced healthcare systems in 177 primary clinics and 27 hospitals located around the pilgrim centres. The main challenges are rapid cost increases, economic stress due to declining fuel prices, other economic challenges and an increasing demand for improved healthcare from the rising population.
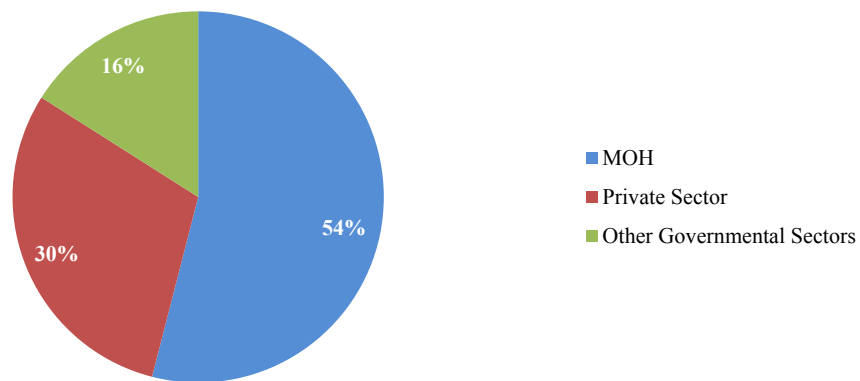
Figure2.5 In-patient admissions in Saudi Arabia hospitals in various categories in 2017
(Source: Ministry of Health in Saudi Arabia 2018).

Satisfied with the current progress of healthcare in Saudi Arabia, literature has observed that future challenges to achieve the ambitious health development plans are the optimum

utilisation of existing resources, the development of competent skills in health management, the search for means of financing services, the maintenance of a good balance between curative and preventive measures and increasing Saudi competence to meet long term needs and greater attention paid to primary healthcare (Sebai, Milaat & Al-Zulaibani 2001). Adopting modern techniques and approaches has significantly enhanced the level of professionalism and quality of services so that overall progress levels can be improved. It is vital for organisations to introduce changes over time so that their systems and techniques are upgraded with advanced methods.

According to research, the major challenges are the rising cost of quality healthcare aggravated by an increasing population at the rate of 2.7% per annum and the rising incidence of chronic illnesses, which will place more financial stress on Saudi Arabia, especially in the current context of declining oil prices (Watts & Freudmann 2014). There is a need for more private investment and tertiary care hospitals. The demand for foreign healthcare workers will remain high, even if the proportion of Saudi employment rises(Yousef Alkhateeb, Sultan & Ahmad 2017). Maintenance of quality while expanding is also a major challenge. Researchers identified the major challenges to the future development of healthcare in Saudi Arabia. These include the development of Saudi health professionals, the multiple roles of the health ministry, diversification of limited financial resources, the changing patterns of diseases, the high demand due to free services, the implementation of cooperative health insurance policies, the privatisation of public hospitals, the effective management of chronic diseases, the development of practical policies for crisis management, poor accessibility to some healthcare facilities, the establishment of an efficient national healthcare information system and also the utilisation

of IT to its potential in healthcare strategies (Almalki, Fitzgerald & Clark 2011b). Information technology plays a significant role in making relevant and timely decisions so that resources and performance can be enhanced effectively and efficiently.

Government healthcare services are free, whereas, private services are charged. The government sector consists of the MOH and other agencies. Both government and private services are available at all levels. Both the private and government organisations play an important role in improving healthcare facilities and the services provided to patients. This not only helps to meet changing demands but also helps to improve the overall health quality in the country. The population of Saudi Arabia has increased over time. In consideration of this, it is essential that the healthcare sector also improves accordingly. The services must be affordable for everyone so that people can enjoy a good quality of life.

The MOH has regional health service directors, who separate deputy directors of hospitals and of primary healthcare functions. A sectoral coordinator coordinates the activities of the two types of services. Hospitals are managed by individual managers and supervisors manage primary health centres. There are associates on both sides interacting with the respective services.

It is evident that the current dimensions and future expansion of healthcare facilities and services play an important role in determining the structure and operational logistics of hospital supply chains in Saudi Arabia. The hospital suppliers include both the local and international suppliers that provide the hospital with the required supplies to manage their performance. The suppliers are selected based on quality and timely supply of the required

materials, tools, and equipment. Therefore, it is important to manage relationships with the suppliers so that they can easily be notified about the requirements. It allows the transportation of supplies effectively on time so that there is no delay or barrier in the healthcare services provided to the patients.

The healthcare sector in Saudi Arabia has evolved with time. The Western model of in-service has been integrated and incorporated to enhance the level of professional healthcare services. Along with this, social work practice has been improved, which forms an important part of the care provided to patients. In the cultural context of Saudi Arabia, the work education has become a critical aspect of the society, which effectively contributes to enhancing the level of professionalism in different fields. Similarly, in the healthcare sector, the improvement and changes have led to enhancing the hospital setting (Staemmler 2008). Currently, the MOH in Saudi Arabia is responsible for governing and monitoring the healthcare services in the country. The MOH not only sponsors the healthcare facilities and services, but also monitors and controls the services provided to patients according to the standards and quality measures (Ministry of Health in Saudi Arabia 2018).

2.2.3 Expenditure of health purchases in Saudi Arabia

There are three kinds of health expenditure reported in the literature. These include the national budgetary expenditure on healthcare, hospital expenditure that is given to provide healthcare services to patients and finally the expenditure incurred by patients (Alrasheedy et al. 2017). Unfortunately, data on these expenditures is not available. It is critical for healthcare organisations to focus on these different types of expenditure so that they can control costs and expenses (Alkhamis 2012). It can help to improve revenues and can also

help to meet budgetary requirements. The available data on Saudi Arabia's health expenditure is discussed below.

Healthcare expenditure in GCC countries, including Saudi Arabia, is governed by the large number of expatriate population compared to the national population, leading to the control of expenditure on non-nationals. High Government expenditure is neutralising high revenue levels and leading to insufficiently developed healthcare systems in some countries. This conclusion is based on data obtained up to the year 2008 (Alkhamis, Hassan & Cosgrove 2014). According to the World Health Statistics report (2015), the total expenditure of Saudi Arabia on health as a percentage of the GDP was around 4% between 2000 and 2012. The general Government expenditure accounted for 72% of this (or 8% of the total Government expenditure), with the remainder accounted for by private expenditure. There was no external or social security expenditure. About 60% of the private expenditure was accounted for by out of pocket expenses. Private pre-paid insurance plans as a percentage of private expenditure doubled from 11% in 2000 to 22% in 2012. Based on the average exchange rate, the per capita private expenditure almost tripled during this period to about US$ 992 million. A high increase in government expenditure on a per capita basis was also observed.

The Saudi Arabia healthcare market was also assessed by research (Sameer 2014). Saudi Arabia needs to invest annually about US$ 420 million to increase hospital bed capacity, in order to keep pace with the increasing demands due to the annual increase of 2.5 to 3.0% in population(Ministry of Health in Saudi Arabia 2018). The current high budgetary allocation of around US$ 21 billion for this sector is designed to improve the service delivery of

existing facilities, along with the expansion and growth of existing hospitals and clinics and an improvement of the health of the ageing population and a reduction in morbidity due to lifestyle diseases(Ministry of Health in Saudi Arabia 2018). Saudi Arabia procured over US$ 1.2 billion worth of medical and surgical equipment as of 2013. This represents about 50% of all medical expenses in the entire GCC countries.

There are bright prospects for marketing certain specific types of healthcare products. Saudi Arabia's market for pharmaceuticals grows at the rate of about 4.7% per annum. Life science products will have a higher demand due to the increase in the ageing population and lifestyle diseases. Medical products need to be approved by the Saudi Food and Drug Authority (SFDA), very similar to the FDA in the USA. Exporters should have a local importing representative registered with the SFDA. This individual will be responsible for post-market surveillance and will report any adverse events to the SFDA. The SFDA has an open source directory of all the companies, consultants and organisations registered with it (Alahmad & Silverman 2017). Major projects of medical cities and medical parks worth over US$ 3.6 billion are under implementation. Indirectly, these market figures suggest that Saudi Arabia is spending these amounts or more on its healthcare purchases.

Research noted that the total annual pharmaceutical expenditure was projected to increase to about US$2.6 billion by 2013, that means the pharmaceutical market is highly regulated in Saudi Arabia (Walston, Al-Harbi & Al-Omar 2008). The MOH is involved in assessing and evaluating the drugs produced and sold in the country so that they can ensure that they meet their standards and requirements. It is essential that the drugs prescribed to the patients are approved by the MOH. If the pharmaceutical companies fail to meet the standards of

drugs and their manufacture, they can face legal problems (Almalki, Fitzgerald & Clark 2011a). Any drug which is rejected by the health administrators cannot be prescribed to the patients. If practitioners fail to follow the legal policies and regulations, this can result in their career and professional standing being affected in the country in which they practice (Walston, Al-Harbi & Al-Omar 2008).

Literature has noted that the private health insurance system was the forerunner of many social security systems found around the world (Saxena et al. 2006). For instance, Sekhri and Savedoff (2005) found that, in seven countries, more than 20% of healthcare was financed by private insurance companies. In these systems, health insurance payments are reimbursements of the expenditure incurred by patients. Private health insurance is always mandatory with risk rated premiums and either for-profit or non-profit management. Among other countries, Saudi Arabia has a significant private health insurance market. In the Netherlands, France and Switzerland, 80% of the population are covered by health insurance. Other countries rank below this level. However, these observations are based on data obtained in the year 2015(World Health Organization 2015).

The regulatory problems of non-Saudi investors in the healthcare sector were reviewed by literature (Khan et al. 2016). The Hanbali School of Islamic laws are generally conservative and strict in interpreting the Quran and Hadith, but it does provide freedom for contracts between competent contracting parties. The maxim is that a contract is the law between the parties except when it violates the Sharia. Thus, there is room for reforms, and this justifies the healthcare investment reforms for non-Saudis. To this "God-made law" is added the

51

"man-made law", developed by royal decrees, the resolution of council of ministers and other legal processes(Woodcock 2006, p. 251). These laws and regulations can be challenged only if they violate the Sharia. There are various Government authorities to interpret laws made by various authorities. Saudi Arabia's pharma market accounts for about 65% of the total GCC pharma market. More than 90% of the medicines used in Saudi Arabia are imported.

Patients in GCC generally favour branded rather than generic products, although the majority of drugs produced in GCC are generic. The market share of generic products in Saudi Arabia is only about 6% compared to over 50% in European countries. In Saudi Arabia, most medicines can be purchased from pharmacies without prescription. Hence consumers can choose branded products. Health insurance can be made mandatory for companies that employ more than fifty employees. Additionally, Saudi Arabia permits 100% foreign-owned manufacturing facilities and provides low-cost loan programmes and low-cost power to encourage private and foreign investment in its healthcare sector. With the passage of time, the regulations and policies are evolving, and this has effectively improved the level and quality of services offered to patients. Hospitals operating in the country are required to follow policies and regulations so that they can manage the quality of their services. The aim is to meet the service requirements of the patients so that a safe and healthy population can be supported. If organisations fail to act responsibly, this can create problems and challenges in maintaining the health requirements of the country.

Ever since Saudi Arabia became a member of the World Trade Organisation (WTO), it has improved its intellectual property rights, laws and is liberalising its economy to diversify

from oil(Watts & Freudmann 2014). The challenges include strict price controls, limitations on foreign ownership for the distribution of pharma products produced outside Saudi Arabia and extensive procedures to obtain approval. It takes six to eighteen months to gain approval, however the process is currently quickening. Nonetheless over 200 foreign firms are registered with the MOH, demonstrating the opportunity for successful registration. Although registering a company is a simple ministerial process, the registration of products is lengthy. However, Saudi Arabia is more liberal than other GCC countries (Albejaidi 2010). Thus, several GCC-based groups are investing in pharmacies and distribution in Saudi Arabia.

Most foreign investors enter Saudi Arabia through joint ventures with local companies by appointing local distributors. Producers in GCC countries are routed through an accelerated process for approval to export to Saudi Arabia. This effectively results in preferential treatment to regional producers through a tendering system for public purchases of large quantities. Non-GCC companies can establish a corporate firm in a GCC country to gain this benefit. Saudi Arabia is entering into numerous free trade agreements (FTA) with different countries (Arunanondchai & Fink 2007). This can facilitate easier entry for companies located in those countries. GCC countries have a common patent office and patents issued from this office are valid across all member countries for a period of 20 years. The time required to issue patents has been progressively reduced over the last four years. The patented product or process should not violate Islamic principles. If the patent owner is

unable to use it within three years, the patent office grants a compulsory license to a third party with adequate compensatory coverage for the patent owner.

Collective bulk purchases on an annual basis are carried out in Saudi Arabia and other GCC countries. The total tender value of the common GCC tendering process, covering all GCC countries, is over US$ 501 million. About one-third of this is to procure hospital supplies, 28% oral hygiene and 15% vaccines. There are programmes in place to reduce imports and to manufacture locally. There are specific mechanisms to settle commercial disputes between a foreign firm and its Saudi agent. Saudi Arabia promotes foreign investment through the addition of a significant number of hospitals beds every year, but not in its local management or other healthcare sectors. Although the establishment of joint stock companies (JSC) takes a longer than limited liability companies (LLC), the former is more advantageous in terms of permission to issue tradable shares. Apart from a higher tax burden, companies are required to participate in employee social insurance schemes. There are real estate ownership restrictions in Saudi Arabia for non-Saudis. Low interest or interest-free loan facilities are restricted to Saudi nationals.

The healthcare expenditure was considered from three angles: the government expenditure in the sector, the procurement of healthcare supplies and finally the legal and regulatory aspects of investments in the healthcare sector. Hospital supply chains depend upon these dimensions. The scope of supply chain for each type of product varies according to the number of hospitals and their sizes (beds) in each region, as well as the procurement procedure and legal aspects to be attended to. It is significant that about 70% of healthcare is managed by the MOH and supplies are procured through tendering for bulk purchases

through GCC common tendering methods. These factors affect the supply chain structure and operational aspects. If the factors are not monitored and controlled by the management of hospitals, this can affect the overall performance and services of the organisation. Patients and their needs are given high priority while it is important to ensure that the quality of services is maintained throughout.

2.3 Why this research is in the context of Saudi Arabia

In Saudi Arabia, the government provides unlimited, free medical care to native citizens among network of healthcare sectors. It also provides main healthcare services within a network of 1925 healthcare centres(Ministry of Health in Saudi Arabia 2018). From 2007 to 2017, a sharp increase in total expenditure on healthcare services has been evidenced from US$ 6 billion to around US$ 18 billion, respectively; a threefold increase within ten years(Ministry of Health in Saudi Arabia 2018). Therefore, supply chain practice needs to be applied for more efficient and effective in healthcare sectors.

From a thorough review of the available work, specific features of the healthcare system in Saudi Arabia were outlined. Public healthcare dominates in Saudi Arabia, holding an approximate 60% share of the total healthcare facilities. However, public hospitals face the pressure of increasing costs and there exists financial stress on the Government imposed by declining oil prices. This may limit the extent of budgetary fund allocation for healthcare. Thus, public hospitals are compelled to seek ways of reducing costs while maintaining high quality healthcare. The need to reduce costs is also important for private hospitals, as their costs are increasing due to higher costs of healthcare products, transportation, inventory and

services. These differences between public and private hospitals may lead to different approaches by the two categories of hospitals with regards to SCM.

The contextual peculiarities of Saudi Arabia also justify separate studies useable in this country. Saudi Arabia is an Islamic country with Islamic traditions. The laws, regulations and procedures to do business are all governed by Islamic laws, unlike non-Muslim western countries. The laws and regulations have been deliberately made in such way that foreign companies need to qualify in all respects to gain business in Saudi Arabia (Arunanondchai & Fink 2007). On the other hand, to expand the healthcare infrastructure, facilities, supplies and services, more investment is needed. The best and easiest source is foreign investment. To encourage foreign investment in the sector, business processes need to be made easier for them. They need to achieve a reasonably high return on investments. Saudi Arabia needs to liberalise its economy and modify its rules and regulations to enable this. The design and functioning of healthcare facilities financed by external agencies needs to adapt to these conditions. They will only achieve the best financial results with high quality services by implementing such effective supply chains. Thus, the findings from this study can be applied to a global context and even other Islamic nations.

2.4 Summary

Saudi Arabia is one of the developing countries, which is different from western countries in terms of its culture, demographics and general way of life. The above sections discussed the various aspects of Saudi Arabia including its geography, demographic mix, religion, monarchical and governmental structure, economy and standing in the Middle-East. The healthcare system in Saudi Arabia is influenced by these country-specific factors. With

growth in economic prosperity and population, all aspects of the healthcare system in Saudi Arabia are being impacted. Noteworthy amongst these is the increase in the number of patient visits and general patient demand. This has translated to an increase in the number of healthcare facilities, healthcare workers and the general cost of operations. This has highlighted a need to minimise the cost of operations and, at the same time, not compromise on the quality of patient care. One way of achieving this is to optimise the healthcare supply chains in Saudi Arabia. Any contribution to literature emerging from this study can also benefit other Middle-Eastern nations. Saudi Arabia is a country of high standing in the Middle-East and it is not uncommon for other Middle-Eastern countries to follow its lead. This is also another justification for choosing Saudi Arabia as the target country for this research.

CHAPTER 3: LITERATURE REVIEW, CONCEPTUAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

3.1 Introduction

In this chapter, the literature will be reviewed, which involves an introduction and an overview on studies conducted on HSI. It also presents an overview about supply management and supplier-buyer integration. Section 3.2 presents the concept of SCM and its efficiency and effectiveness as well as its competitive aspect in Section 3.3 Buyer-supplier integration in the healthcare sector will be presented in Section 3.4. This chapter also includes the description about the factors that affect HSI in Section 3.5. Furthermore, Section 3.6 describes the impact of HSI on the service provided. The following Section, 3.7, discusses the conceptual framework and research hypotheses for this thesis. Section 3.8 will describe the theoretical underpinnings in two terms; the relational views of competitive advantages and lean thinking. Finally, Section 3.9 presents a summary of the research conducted on the topic of HSI.

3.1 Supply management and supplier-buyer integration

Nowadays, the competition between companies is about the type of supply chain management (SCM) to attain a high degree of performance and productivity, and to reduce costs in the entire supply chain. Studies define supply chain integration as the range to which activities included in an organisation are connected and integrated(Ali & Salehi 2016). These activities connect the suppliers, customers, distributors, retailers, and transporters together. There are two types of integrations: internal and external integration and both of them are used in management (Li et al. 2009). In a hospital context, applying SCM and good

supplier integration can improve the cost reduction of hospital services (Brot-Goldberg et al. 2017). Klug (2013)as well as Saranga, Mukherji and Shah (2015)explain that cost reduction can be identified by supply chain mapping. This method is very important to control the cost reduction opportunities. In addition, increasing transparency among supply chain partners can reduce total inventory costs along the entire supply chain which is possible with integration. The supplier-integration can help to increase connectivity, which helps suppliers to understand the needs of the organisation so that they can provide them with the necessary supplies accordingly.

3.2 Supply chain management to increase efficiency and effectiveness

Both efficiency and effectiveness are indicators about the performance of SCM in any company. There is a significant relationship between cost reduction and the performance measures including efficiency and effectiveness (Wirtz & Zeithaml 2018). Proper control is required to maintain competition through increasing the effectiveness of tools and techniques to achieve good SCM performance (Ellram & Cooper 2014; Yang et al. 2013). In Saudi Arabia, the Government has given high priority to the enhancement, development and improvement of healthcare services and to increase performance. Primary, secondary, and tertiary are three levels of change conducted to make the healthcare for patient more efficient and able to face several challenges and complications in healthcare organisations. In Saudi Arabia, there are some challenges in limited financial resources in term of managing costs as well as meeting healthcare standards (Economou et al. 2015). In addition, healthcare

systems are facing concerns since there is no proper national health information system and national crisis management system in place.

The integration system has been divided into two parts; fully integrated and semi-integrated. Some studies have supported semi-integrated rather than fully integrated considering the trends of current supply chains displaying the pressures of various dimensions and intensities of integration (Klug 2013; Saranga, Mukherji & Shah 2015). Adebanjo, Laosirihongthong and Samaranayake (2016)argues that the optimum level of integration declines when there are deviations in performance. The need to integrate supply chains has increased due to the development of e-business. Some essential criteria for integrated supply chains are safety, security, completeness, flexibility, scalability, inter-operability and enabling applications (Morita et al. 2015). There have been huge efforts from companies to increase, maximise and enhance the effectiveness and efficiency of integrated levels by improving their global supply chain management (Danese 2013). HSI is highly influenced by the level of communication between the suppliers and the organisation. The integration of the supplier increases collaboration and partnership in order to solve and face problems and challenges effectively (Oruezabala & Rico 2012).

3.3 Supply management and competitiveness

Supply chains are essential in supply management applications and competitiveness. Many studies have focused on single supply chain to achieve the best goals. A limited number of papers have focused on supply management, supply chain design and competition together. Farahani et al. (2014)claim that there is an influence of competition on the design of supply chain networks. Another study noted that the competition can satisfy the success of

companies if they align their inter-operational systems according to the supply management (Saeed, Malhotra & Grover 2011). Ellram and Cooper (2014); Yang et al. (2013)state that hospitals with better supplier integration can be expected to attract more patients due to higher efficiency and effectiveness of service provided and a higher quality of care and patient outcomes.

3.4 Buyer-supplier integration in the healthcare sector

Studies reveal that the members and components of a supply chain should be fully connected with each other to achieve the aims of the organisation and satisfy high performance standards. Maintaining connection with members and components can help in ensuring that the overall performance and operations are adequately managed (Zhang et al. 2018). Research reveals the advantages of buyers and suppliers in terms of financial and market success with selected purchase practices as well as customer relations practices (Prajogo & Olhager 2012; Yang et al. 2013). The efficiency of a supply chain is directly related with the relationship between the integration of the supplier and costumer. This relationship is very useful in increasing patient volumes through its effect on improved customer integration (Danese & Romano 2011). Yao (2017)suggests that hospitals should invite suppliers directly into their decision-making process and they should improve and adjust their purchasing processes, which correspond to the regulations of the organisations. Some studies have found that there is a negative correlation between suppliers, performance measures of the logistics costs, and the rate of return factors related to cost reduction needs (Bagchi et al. 2005). Attempts were made to relate the findings to hospitals. However, there are many

difficulties in applying the findings to a hospital context. This is due to the differences between hospitals and other sectors with regards to the nature of business and its impact on society. Hence, this offers sufficient justification for undertaking this study and conveys the uniqueness of health supply chains, which is discussed in detail below.

3.5 Factors affecting hospital-supplier integration

The uniqueness of healthcare supply chains makes the integration of supply chain concepts challenging (Elmuti et al. 2013).These challenges have been discussed in detail in the previous chapters. Based on these discussions and due to the scarcity of research available on supply chain studies in healthcare, there exists an urgent need to conduct such studies, which therefore justifies this research. Based on this argument, the research gap has been identified, that is the impact of HSI on hospitals' overall performance.

In a cursory literature survey, four factors, namely: logistics integration, information technology, information sharing and trust, were found to be more widely dealt with in research associated with this topic. Therefore, research available on the effect of these factors were reviewed. More emphasis was placed on the relational view of competitive advantage, as this was found to be more useful in explaining the relationships. Additionally, some works specifically mentioned hospital size as the control variable to account for the differences among hospitals in the effects detected. Additionally, there are several works on lean management and its related concepts being applied to different healthcare scenarios. Lean and related concepts only have a moderating role on the relationships of the four factors of HSI. The following subsections set out to present a literature review on the factors that affect HSI.

3.5.1 Logistics integration

Logistics integration is a process that allows an organisation to integrate logistics as a system-wide process that allows the firm to deliver value to the customers with greater efficiency. Logistics integration can be defined as the well-coordinated flow of materials from suppliers, which allows companies to maintain a smooth production process (Frohlich & Westbrook 2001).Such coordination produces a seamless connection between companies and suppliers in such a way that the boundary of activities between the two parties is blurred. Studies have proven that logistic functions play a critical role in managing the overall performance and capability of an organisation in utilising its resources. Logistics integration can facilitate in managing the process smoothly by increasing the connectivity and coordination between the logistics members (Stock, Greis & Kasarda 2000). Lee, Padmanabhan and Whang (2004) mention that effective logistics integration is crucial to reduce the bullwhip effect. The bullwhip phenomenon—as explained by the authors—is the enhancement of demand variability from downstream to upstream within a supply chain. It is often a considered as an ill-effect that paralyses the supply chain of a company. Geary, Disney and Towill (2006)have further highlighted that logistics integration eliminates the issues of the bullwhip phenomenon and helps to enhance the overall supply chain performance. It has been mentioned that the bullwhip effect can be caused by several reasons. However, an organisation can pacify the effects through the re-engineering of the supply chain to remove all possible causes of uncertainty. Following an integrated logistics approach within a company can facilitate a seamless flow of information across the supply chain, thereby reducing uncertainty in the system. It has been further stated that the effects

63

of the bullwhip effect can be reduced through effective application of technological, organisational, cultural and financial aspects.

Researchers have proposed a healthcare supply chain template using e-commerce that is based on industrial engineering concepts. The management spectrum using different time frames is presented in Table 3.1.

Table 3.1 Supply chain decision-making dimensions

Decision Making Level	Time Frame	Decision Type
Strategic	5 to 10 years	Investments on plants and capacities. Introduction of new products. Creation of a logistics network.
Tactical	3 months to 2 years	Inventory policies to be used. Procurement policies to be implemented. Transportation strategies to be adopted.
Operational	Day-to-day	Scheduling of resources. Routing of raw materials and finished products. Soliciting bids and quotations.

(Source: Chandra and Kachhal 2004)

Thus, the full integration of supply chain management into the business strategies of an organisation takes approximately 5 to 10 years. Hence, any evaluation of the effects of the supply chain on performance or other aspects is more valid only after strategic integration is fully achieved. This theory puts the various research findings regarding the effects of supply chains that are discussed below into doubtful validity.

Literature has presented that third part logistics service providers (3PLs) have played a vital role in the triad of logistics. It has significantly influenced the collaboration of the supply chain and has gained much attention in different fields (Zacharia, Sanders & Nix 2011). It

has been found that, in SCM, logistics is one of the most important functions, which has a strong impact on the overall performance of the organisation. Logistic activities are traditionally managed with the aim of connecting and increasing collaboration between production and consumption. As the field of the supply chain is going through continuous change and development, it has become critical to integrate advanced strategies and approaches to create and sustain competitive advantage. The theoretical perspective related to the resource-based method and network theory is based on the idea of developing a strong connection between different components and elements of the supply chain and logistics.

In healthcare, logistics integration covers the configuration of the distribution network, distribution strategies, inventory control, supply contracts, supply chain integration and strategic partnering together with outsourcing, procurement strategies, IT, decision support systems and customer value (Privett & Gonsalvez 2014). The configuration of the distribution network consists of the following: the locations and capacities of warehouses, the production level of products and transportation flows from product units to the warehouses. Network flows and capacity utilisation are important issues here. Hospitals are affected by the extent of the efficiency with which suppliers organise these matters (Bornbusch et al. 2014; Denton 2013). Inventory control is not limited to stock levels at hospitals alone but along the entire supply chain as well. Decisions are made depending on the demand from different levels of the supply chain components (Saedi, Kundakcioglu & Henry 2016). This decision-making issue can only be resolved by using forecasting, inventory management and simulation and optimisation algorithms across the supply chain.

Supply contracts deal with supplier relations along the entire supply chain to equitably distribute the impact of decisions. Linear programming for complex algorithms is used to solve this decision-making problem. For HSI, this dimension is very important. Network algorithms of linear or non-linear programming in deterministic or stochastic conditions are the solution to this problem.

Supply chain integration and strategic partnering are inter-related (Youn et al. 2013). This is where the actual integration happens (Saleh Shatat & Mohamed Udin 2012). Information sharing, and collaborative or joint operational planning are two examples of the effects of integration. If the process of information sharing is not managed adequately and faces different barriers and complications, this can result in delaying decision-making and can also ultimately impact the overall process of health treatments (Zhang & Chen 2013).A study conducted by Cagliano, Caniato and Spina (2006)has mentioned that logistics integration can be used in the effective adoption of a lean production system. The findings of the study conducted by these authors have highlighted that, adopting a lean production system can have a strong influence over the flow of information and physical goods through the supply chain. Schonberger (2007)states that the application of JPM (Japanese Production management) can have a strong impact on the field of operations management. It helps to improve resource efficiency by reducing the time of operations and inventory volume, along with improving the order cycles. Prajogo et al. (2018) highlight that logistics integration facilitates an organisation to integrate all the supply chain partners as one entity. Starting from the beginning of the supply chain (procurement of resources) till the end (delivery of final products to the end user), the flow of information and physical goods can be efficiently conducted, with the help of logistics integration. Sweeney, Grant and Mangan (2018)have

mentioned in their study that through the adoption of logistics integration, a company is able to reap the potential benefits of taking the vertical integration approach. Vertical integration allows a firm to have higher control over the supply chain, reduces the overdependence on third party suppliers and lowers the overall cost of operations of the company. Designing a logistics management system helps an organisation to reap the advantages of these aspects, without taking the vertical integration approach.

Researchers have pointed out that multinational third-party logistics have been introduced in this competitive and challenging era as a result of the increasing demand for connected supply chain and logistic functions (Marasco 2008). In the Chinese logistics industry, it has been found that the service delivery industry requires change and development so that customers can be facilitated in a more effective manner. Supply chain managers are required to prioritise the strategic importance of multinational third-party logistics so that the level of services can be enhanced effectively and efficiently (Rahman et al. 2017). The purpose of management is to prioritise the needs of customers, follow government regulations, manage pressure, deal with price challenges and control transportation costs. Overall, minimising the cost of delivery and ensuring a high-level of customer satisfaction can help to overcome challenges and problems.

In terms of customer satisfaction, the study of Liu and Lee (2018)has shown that logistics integration can have a positive impact. It can help a company to become more efficient in terms of delivering value to the customers, which improves their satisfaction level. Logistics integration also helps to reduce the lead time, so that the customers do not have to wait

longer for their product delivery Liu, Zhang and Hu (2005); Kim (2009)have further mentioned that taking an integrated approach of logistics management can be beneficial in terms of cost reduction, sales improvement, pacifying operational risks and improving customer service.

Collaborative planning, forecasting and replenishment are models that are increasingly used in other sectors, such as global retailing. Popular software platforms such as ERP are used across the chain through which information sharing also occurs. In healthcare, this would also involve hospitals, suppliers and the manufacturers of healthcare items (Alturki, Bosua & Kurnia 2013). Often, the decision of whether to outsource or manufacture internally is a critical issue. Relative risks need to be weighed against the advantages of each option to arrive at a proper decision (Rotaru, Wilkin & Ceglowski 2014). When dealing with trade partners, the extent of data security and confidentiality will determine whether to use Internet public/private portals. Using IT facilitates information acquisition and sharing across the system (Eastwood 2011). This information can also be used for decision support software. Finally, the success of any integration at any level is determined and should be measured by the value it gives to the customer, the patient, with respect to cost, quality, service levels, perceived value and satisfaction (Surbone et al. 2013).

Although the situation has now improved tremendously, it was found that supply chains in the mid-1990s contributed to approximately 500% of the total healthcare cost of 23 billion in the USA (Nachtmann & Pohl 2009). According to literature, healthcare supply chains are immature, highly collaborative among partners, extremely expensive, information-poor and disconnected from talent (Michael, Jonathan & James 2013). It used to be distributor-

dominated with little contact between manufacturers and hospitals. The key drivers of a healthcare supply chain are a fragmented supplier base, reduced government funding, the need to reduce inefficiencies, facilitation in managing core competencies, e-purchasing for supplier consolidation, reducing ordering costs, enabling a common purchasing platform for hospital networks, along with the standardisation of purchase procedures with respect to product volumes, as well as ordering and tracking, storage space, resource allocation, scale economies through group purchase power and data standardisation (Coustasse, Tomblin & Slack 2013).

Avoidable costs occur at different points of transportation, from the production unit to distribution centres, as well as at the distribution centre operations during outward transport from distribution centres, in addition to when the wholesale distributor receives and stocks the warehouse and also when the wholesale distributor marks-up the price and finally during the transportation to the hospital and inventory (Oecd 2013).

Supply chain integration streamlines all these activities holistically, cost-effectively and in a standardised manner. Table 3.2 highlights some of the research undertaken on logistics integration.

Table 3.2 Summary of literature on logistics integration

Author/ year	Area of interest	Contribution/ findings
(Lee, Padmanabhan & Whang 2004)	The problem of demand amplification (bullwhip effect)	Solid logistics integration will reduce bullwhip effect.
(Geary, Disney & Towill 2006)	Bullwhip effect	Logistics integration eliminates the problem and enhances the overall performance of the supply chain.
(Cagliano, Caniato & Spina 2006) (Schonberger 2007)	Introducing lean production system	Integrated logistics allows firms to adopt lean production systems, which are characterised by reliable order cycles and inventory reduction.
(Prajogo et al. 2018)	Logistics Integration	Logistics integration allows companies and their supply chain partners to act as a single entity which would result in improved performance throughout the chain.
(Sweeney, Grant & Mangan 2018)	Logistics Integration	Through logistics integration, firms can have the potential benefits of vertical integration (quality dependability, planning and control, and lower costs) without having it in the physical sense.
(Clemons, Reddi & Row 1993; Kim 2009; Liu & Lee 2018; Liu, Zhang & Hu 2005; Nooteboom 1992; Seidmann & Sundararajan 1997)	The impact of logistics integration of supply chain	Logistics integration has a positive impact on customer satisfaction, lead time, reducing cost, reducing risks, improving sales, distribution, customer service and service levels respectively.

The integration benefits the overall processes and activities. It is understood that supply chain partners are dependent on each other. Their activities are inter-connected and it is impossible to manage the services without ensuring effective communication and coordination between the supply chain members (Chan, Lettice & Durowoju 2012). In this integration process—along with the management of demand, order, logistics and inventory

components—supplier management is an important aspect. It essentially consists of a reduction in suppliers and a participation in group purchasing. However, to be effective, supplier management needs to be integrated with logistics integration. Thus, logistics integration becomes a part of HSI in the overall supply chain.

According to the tabulated findings of the authors in Table 3.2, logistics integration evens out the effect of sudden spurts in demand that cause bullwhip effects(Lee, Padmanabhan & Whang 2004). It helps in the introduction of lean management. Logistics integration also improves a company's performance through positive effects on time, distribution, cost reduction, risk reduction, the improvement of sales and enhanced customer service and customer satisfaction. Healthcare professionals working in hospitals are continuously involved in analysing the needs of their patients so that they can be served accordingly. If they fail to respond effectively and efficiently, this can result in creating problems and challenges for the hospital. Healthcare professionals are the primary stakeholders of a hospital. They are responsible for managing the services and facilities, according to the needs of their patients. They are also responsible for coordinating with suppliers and supply chain managers so that they can integrate processes and services effectively and efficiently.

Logistics consists mainly of all the processes related to order fulfilment and delivery to the point of use. Thus, with the integration of these processes with suppliers on one hand and with the hospitals on the other, the total hospital supply chain integration represents logistics integration within an HSI. In the case of hospital supply chains, researchers have noted that the US healthcare sector has experimented with different types of supply chain integrations

for medical supplies with varying results (Rivard-Royer, Landry & Beaulieu 2002; Sampaio & Csillag 2010). Literature has stated that hospital managers must aim to reduce the total delivered cost rather than just the acquisition cost. Process re-engineering to eliminate non-value costs was also recommended by other studies (Wang, Chan & Pauleen 2010). However, this forms part of the lean management concept (Lau & Wang 2013). Instead of making multi-echelon inventory decisions, the coordination of distribution and delivery through scheduling decisions is required (Nyberg, Grossmann & Westerlund 2013). This was found to result in better coordination of purchase and procurement (Lapierre & Ruiz 2007).

The logistics activities of Singapore hospitals were also investigated by research (Pan & Pokharel 2007). The hospital logistics division was found to carry out many other related activities, including engineering services. The hospitals made extensive use of ICT. Hospitals were clustered into many groups to minimise operational costs including logistics costs. Instead of alliances with suppliers, they preferred outsourcing logistics services. The Singapore hospitals had good inventory policies to handle both medical and non-medical supplies which enabled them to handle different patient mixes efficiently. In the case of Malaysian hospitals, a vendor managed inventory was proposed to solve problems relating to urgent orders and stock availability at the wholesaler point (Haszlinna Mustaffa & Potter 2009).

A relational view was proposed by several authors with regards to HSI, which works through the logistics of order fulfilment and delivery. Literature has observed a close relationship between HSI and hospital supply chain performance (Chen, Preston & Xia 2013).

Additionally, researchers expected suppliers to find logistics innovations, which would enhance HSI(Ivan Su, Gammelgaard & Yang 2011). They provided a new perspective to logistics, which resulted in innovations facilitating better relationships with suppliers. Studies have also placed emphasis on supplier relationship management and proposed an HSI model based on this principle.

On other hand, French public hospitals were forced to reduce their supplier-base to those who could comply with new environmental requirements (Lavastre, Gunasekaran & Spalanzani 2012). These hospitals now use the total cost of ownership approach and expect suppliers to create methods to achieve environmental compliance (Oruezabala & Rico 2012). In the case of New Zealand hospitals, research has demonstrated the role of district health boards in coordinating supplies to public hospitals and their order fulfilment and delivery (Msimangira 2010). Other literature has proposed a Collaborative Planning, Forecasting and Replenishment (CPFR) model for integrated purchasing, operations and logistics of hospital supply chains(Lin & Ho 2014). Both internal and external (specifically with suppliers) collaborations were included in the model, which was proposed particularly in the context of the problems faced by hospitals in the adoption of e-procurement practices. In two papers, researchers demonstrated the use of an unattended electronic locker bank concept to separate urgent and non-urgent supplies to NHS hospitals in the UK to solve the problem of sub-optimal vehicle fleet operations due to the non-separation of the two categories of supplies (Bailey et al. 2014). Research has also observed that the US healthcare sector invests more in inventing drugs and diagnostic systems than in the technology and

management of healthcare delivery systems to manage day-to-day operations (Chandra & Kachhal 2004).

Additionally, studies note that the structure and nature of healthcare supply chains consist of unsustainable freight patterns due to poor communication and the unpredictability of inventory demand from hospitals to suppliers. This leads to high freight volumes, confusion between urgent and non-urgent goods within the same supply chain and additional laboratory couriers (Bailey 2015). Researchers have proposed three strategies to address these problems. These solutions are (1) mobile consolidation for high freight volumes; (2) unattended electronic local bank delivery to separate urgent and non-urgent goods; and (3) the consolidation of courier supplies to control high courier delivery volumes. Apart from integrating logistics for efficiency, these steps are also sustainable (Yu 2015).

High complexities and high degrees of inter-relatedness among the components render hospital supply chains difficult to optimise and manage, which is now being simplified due to the use of newly evolving concepts and practices of consolidated service centres (CSC) (Abdulsalam et al. 2015). CSC facilitate supply base rationalisation and reduces the number of components in the inter-relatedness involved in supply chains. The integration between supply chain components has proved to be effective in the case of complex situations and large corporations. Suppliers are known as the primary stakeholders that contribute to the overall effectiveness of an organisation. It is important that hospitals form a long-term contract with their suppliers where the quantity, quality and level of supplies are clearly indicated. The suppliers must be influenced to manage the quality of supplies at every possible level so that the final results are managed adequately and effectively.

Based on this conceptualisation of logistics integration and its relationship with HSI, the following hypothesis is proposed:

Hypothesis 1: Logistics integration is positively associated with hospital-supplier integration.

3.5.2 Information technology integration

IT allows the management of data and information to facilitate seamless operational activities, with higher productivity and resource efficiency. As stated by Li et al. (2009),IT may not have a significant influence on the supply chain model, but it definitely helps to improve supply chain performance. It acts as a supporting pillar to ensure that an organisation is capable of integrating its supply chain, in order to facilitate seamless management of information and communication across the chain. Belkoski (2008) mentions that integrating IT within a supply chain can greatly help in reducing the long-term operating cost of the company. Moreover, from the perspective of the health care service sector, IT integration can facilitate in improving safety of the patients within a hospital. IT can help in performing activities like constant monitoring individual operational activities, thereby reducing the margin of error. Rick (2010)has further mentioned that IT increases the efficiency in performance by improving the overall reactiveness of the firm. It also reduces human intervention to some degree, thereby reducing resource requirements, while improving the overall performance of the company.

The literature on IT in healthcare is rich in the areas of implementing IT for patient care and managing the organisation. There are, however, relatively fewer studies on the use of IT in

75

the supply chain. There has been wide agreement that IT integration between hospitals and their suppliers has direct and indirect impacts on HSI and on the overall performance of the supply chain. Table3.3 summarises the main findings of literature in the area of IT integration between hospitals and their suppliers and the different impacts. There have been numerous studies on the effect of IT integration on hospital-supplier relationships (Chen, Preston & Xia 2013; Lii & Kuo 2016; Yao 2017). IT integration reduces costs and increases efficiency. This is achievable because increased efficiency can decrease costs and the effect may be direct or indirect.

Sanders (2007)highlights the importance of e-business or e-commerce technology and how it can improve supply chain performance. It has been stated that e-commerce-based IT brings all the stakeholders in a supply chain close to each other. Not only does it help in facilitate in seamless collaboration among the business partners, but it also helps to improve their supply chain performance. It has been found, that firms who implement IT to improve their external business communication, have also benefitted from better performance in terms of output and resource efficiency. The suppliers, vendors, distributors can seamless communicate with each other and share information regarding the state of the supply chain in real time, which drastically helps to improve organisational performance.

A study by Vickery et al. (2003) indicated that the integrated supply chain has long-term implications on performance. The findings of the study showed that there is a direct positive relationship between IT integration and supply chain integration. Moreover, supply chain integration was found to be directly related to customer service quality and satisfaction. Finally, the study indicated that service quality is correlated to organisational performance.

Sambamurthy, Bharadwaj and Grover (2003) highlighted the importance of IT in terms of firm agility. It was found that an organisation is faced with two different types of options due to IT integration, which are digitised process capital and digital knowledge capital. The digitised process capital is defined by the firm's capacity of inter- and intra- organisational processes for supply chain integration. The direct and indirect effects of IT integration and its impact on HSI is further reviewed by the literature to derive the second hypothesis. Literature has shown the importance of IT in managing HSI. IT systems help to track and keep a check on supplies so that the flow of information is adequately managed. It is critical that the processes and systems are utilised in the best possible manner. IT integration depends on effective communication and coordination between the supplier and hospitals (Rivard-Royer, Landry & Beaulieu 2002).

In an Australian-based study, researchers noted that the e-procurement system simply generates a purchase order and faxes it to the supplier directly without the aid of the Internet. Through this process, a reduction of wastage, inventory and administration costs was noticed (Chan et al. 2006). User training was an important issue. Table 3.3 shows the IT integration-compiled data in hospital-supplier relations.

Table 3.3 Summary of literature on information technology

Author/ year	Area of interest	Contribution/ findings
(Li et al. 2009)	The impact of IT on supply chain integration and performance	IT implementation has no direct impact on supply chain performance, but it indirectly enhances it through its positive impact on supply chain integration
(Belkoski 2008)	Supply chain insanity in healthcare	IT integration can increase supply chain efficiency, reduce costs and improve patient safety
(Barlow 2010)	IT and supply chain	IT integration can reduce costs and increase efficiency
(Sanders 2007)	The use of e-businesses to achieve firm-supplier integration	The use of e-business technologies impacts performance both directly and indirectly by promoting both measures of collaboration. Intra-firm collaboration is also found to have a direct impact on organisational performance. However, the impact of inter-organisational collaboration on performance is only found to be indirect through the impact of intra-organisational collaboration.
(Vickery et al. 2003)	Performance implications of an integrated supply chain strategy	The results showed direct positive relationships between (1) integrated information technologies and supply chain integration, (2) supply chain integration and customer service, and (3) customer service and firm performance.
(Sambamurthy, Bharadwaj & Grover 2003)	Firm agility table	IT could affect firm agility by generating two types of digital options, namely; digitised process capital and digitised knowledge capital. Digitised process capital is the IT-enabled inter- and intra-organisational work processes for integrating various organisational activities including supply chain. Higher levels of IT integration increase both the reach (i.e. the range and scope) and the richness (i.e. the quality) of the digitised processes.

The above-discussed CPFR model for logistics integration and its use in HSI utilises IT as its basis (Lin & Ho 2014). Poor integration between the hospital information system and materials management department has been detected within some hospitals by certain studies (Staemmler 2008). The need for both business and technology integration were stressed.

The above points highlight the importance of IT integration in a hospital-supplier relationship. Based on this, the following hypothesis is proposed:

Hypothesis 2: The level of IT integration between a hospital and its suppliers is positively associated with hospital-supplier integration.

3.5.3 Information sharing

Information and knowledge sharing between hospitals and their suppliers plays a key role in gaining competitive success and forms a major strategic resource for SCM (Hora & Klassen 2013; Hult et al. 2006; Wang, Yan & Wei 2013). Studies by Gavirneni, Kapuscinski and Tayur (1999); Koçoğlu et al. (2011) highlight that the collaboration among the stakeholders within a supply chain is largely dependent on the information sharing among them. The ease of information sharing—owing to supply chain integration—allows for direct and frequent information sharing between a hospital and the primary supplier bodies. Such collaborative initiatives help in improving certain aspects of the supply chain, such as production scheduling, inventory monitoring, and ordering. There has been a wider recognition of the importance of these factors in both research and industry (Lotfi et al. 2013;

Wu, Chuang & Hsu 2014; Youn et al. 2013) Research defines inter-organisational information sharing between hospitals and their key suppliers as the extent to which the hospital shares information about transactions in the business to generate specialised knowledge (Pirnejad et al. 2007).

Devaraj, Krajewski and Wei (2007); Lotfi et al. (2013)mention that the information sharing capability of an organisation plays a determining factor that differentiates it from the rest of its peer firms in the industry. Seamless sharing of information makes a health care institution to be more reactive and more effective in improving its performance in terms of service quality. Chen and Paulraj (2004) state that a good business relationship between a firm and the supplier is often characterised by ease of information sharing between them. Moreover, it has been further stated that information sharing is directly correlated to the financial performance of the organisation. Narayanan, Marucheck and Handfield (2009)mention that the exchange of information among the stakeholders within a supply chain helps in making better decisions. Due to information sharing, an organisation is equipped with superior business intelligence that enables them to make better decisions, leading to better performance of the firm. Wang, Yan and Wei (2013)elaborate that in the contemporary business environment, ICT (information and communication technology) or electronic media plays a crucial role in information sharing between the stakeholders. The information can be shared within the organisational departments or with external entities, such as the business partners with the use of the Internet and centralised systems.

Table 3.4 demonstrates that information sharing is fundamental to collaboration and trust between supply chain partners for successful integration. Based upon role linkage and the

level of system support, literature classified B2B inter-organisational systems into four types: resource pooling, operational cooperation, operational coordination and complementary coordination. The type of cooperation adopted in any supply chain collaboration depends upon the aim of the collaboration. The type and level of information sharing depends upon what type of inter-organisational system is used (Hong 2002). This also applies to healthcare systems and it is essential that managers and leaders play their roles effectively and efficiently. Supply chain partners must coordinate and communicate continuously so that they are able to build a positive working environment and develop long-term working relationships (Wu, Chuang & Hsu 2014).

Fawcett et al. (2007)found that supply chain integration has a positive and direct correlation with the performance of a company. Thus, an organisation which can develop an integrated supply chain system—characterised by the presence of seamless information sharing—is one that can deliver outstanding business performances. Koçoğlu et al. (2011)highlight that the success of an organisation is largely dependent on how well it can use its IT infrastructure to build good business relationships with the business partners. Therefore, investing in a firm's IT infrastructure is a crucial factor behind ensuring long term success and sustainability. Therefore, it can be stated that every organisation needs to develop a supply chain that is equipped with modern information and telecommunication technologies that can help to foster superior business performance.

According to studies, real time information sharing was incorporated as an integral part of the SCM system developed for vendor-managed inventory control involving hospitals,

pharmaceutical firms and wholesalers. The aim was to improve material handling efficiency. Online procurement systems were developed for departments which ordered and consumed drugs directly. Information sharing of distributors with hospitals enabled the procurement of timely and exact information regarding stock levels and the usage volume of drugs (Wu, Chuang & Hsu 2014). This enabled a more precise forecast of demand, which, in turn, facilitated the timely delivery of products in a cost-effective manner. Hospitals were able to control inventory costs by approximately 30%.

Table 3.4 Summary of literature on information sharing

Author/ year	Area of interest	Contribution/ findings
(Gavirneni, Kapuscinski & Tayur 1999; Koçoğlu et al. 2011)	Hospital-supplier Integration	Collaborative planning activities can be enhanced by maintaining direct and frequent information sharing between a hospital and its key suppliers, citing examples such as inventory monitoring, ordering, and production scheduling.
(Devaraj, Krajewski & Wei 2007; Lotfi et al. 2013)	Hospital-supplier integration	Information sharing as the separator that differentiates successful firms from the rest.
(Chen & Paulraj 2004)	Firm-supplier integration	More extensive process integration and information sharing between supply chain partners enhances financial performance.
(Narayanan, Marucheck & Handfield 2009; Wang, Yan & Wei 2013)	Information interchange between supply chain partners	Information sharing reflects the extent to which partners exchange decision-relevant information via electronic data interchange and other forms of communication, such as face-to-face meetings.
(Fawcett et al. 2007; Koçoğlu et al. 2011)	Supply chain integration and performance	Without the willingness to share the necessary information between supply chain partners and a lack of large investments in IT could fail to produce the expected benefits.

The knowledge of the inter-organisational ecology of hospitals can act as a platform for information sharing. Information sharing between suppliers and hospitals should occur at the level where supplies are delivered to provide laboratory and other services (Fedorowicz, Gogan & Ray 2004). Similar findings can be found in other literature (Muangchoo & Kritchanchai 2015).

The hospital ecology profile reproduced in Figure 3.2 identifies that the information sharing suppliers perform as external stakeholders. Supplier-level information sharing occurs at the level of external laboratory staff, life science companies and pharmacy levels. Thus, ecology helps to determine the levels at which information sharing occurs and this is relevant to information sharing with suppliers. If the information sharing process is disrupted in any way, this affects the flow of information, which delays processes and also leads to the creation of problems and challenges.

Researches identified information sharing as the connecting link between an organisational structure and the structure of its information systems. This concept was also applied to healthcare organisations. However, the concept does not directly link information sharing with suppliers. In a survey of hospitals and their purchase alliance organisations, information sharing was included as an aspect of the questionnaire's components (Zhang & Chen 2013). Information of different types, such as products and prices, emerging trends and innovations, disclosures of vital data, clinical data support, education programmes, experience sharing and networking and finally cross-reference materials, were shared between hospitals and purchasing organisations.

83

Literature has found that hospitals with good quality coding had a better information sharing network structure with a high brokerage content. This type of information sharing can be helpful in deciding the quality of the healthcare products to be procured. This can, in turn, be shared with suppliers appropriately. Examples of the sharing of information of hospitals, physicians and insurance firms are travellers' care histories for horizontal information sharing and of drug distributors and independent drug stores for value in inter-organisational systems. Another example is the need for Australians to use IT and e-commerce for information communication and sharing between suppliers along the supply chain using internet-based platforms (Zhang & Chen 2013).

The consequences of suppliers having more information than the purchasing hospital (absence of information sharing) have been discussed by many studies (Lotfi et al. 2013). Suppliers may choose non-certifiable quality, the quality of a product may be inconsistent between suppliers, the quality may affect demand, suppliers may choose unverifiable efforts to reduce costs and suppliers may choose patients to reduce costs. The findings also support the view that information sharing in the form of knowledge exchange and IT integration influence hospital supply chain performance and are fully mediated by hospital-supplier integration. According to research, the partnership between hospitals and suppliers can be influenced by communication as a management decision variable in medical supply chains (Chao et al. 2013). In the proposed CPFR model, collaborative planning is possible only if there is adequate information sharing between hospitals and suppliers (Lin & Ho 2014).

Material management involves ordering, receiving and storing stocks and issuing these for patient care. Usually, a look-back approach is practiced in which materials are pushed into

hospitals based on demand forecasts with high stock levels distributed throughout the system to prevent stock-outs. However, some studies have proposed a instead (Iannone et al. 2015). Using this method, orders are issued using medical information through a pulled flow of information from beds to pharmacy warehouses. The information flow also involves suppliers in the chain. The suppliers are provided with information relating to the required supplies so that they can ensure that they are able to maintain the flow of supplies. Any delay in the supply can result in delaying the healthcare services offered to patients. Overall, this can create problems and difficulties.

The current trend of large-scale outsourcing of manufacturing has required effective collaboration between manufacturers and their suppliers. This can only be achieved by sharing a large amount of information. Secure collaboration becomes an issue due to the need to protect intellectual property rights (IPR) and other confidential information. Of the four controls for information sharing discussed by researchers, the SCM system is the only one applicable to HSI(Zeng et al. 2012).

The need for collaboration in a vendor-managed inventory (VMI) and a co-managed inventory (CMI) has also been recognised by studies (Matopoulos & Michailidou 2013). In the case of CMI, the customer (the hospital) has the responsibility of maintaining and replenishing stock levels to pre-agreed levels with the supplier. In the case of a VMI, this responsibility rests with the vendor. The supplier uses the information given by the hospital for timely stock replenishments or uses the data to forecast future stock requirements. The ordering phase is thus abolished, and the supplier has full responsibility and authority to take

care of the entire process. In either case, information relating to inventory and sales needs to be shared between the supplier and the hospital. Inventory management is the point of integration. In an evaluation of Australian inter-organisational systems (IOS), literature discovered that endogenous and institutional pressures of various kinds resulted in high heterogeneity of such systems at each tier level (multiple numbers of hospitals, suppliers, distributors, manufacturers) and across the tiers. This affected information systems and SCM in these tiers leading to inadequacies of information sharing across the tiers (Bhakoo & Choi 2013).

Based on this conceptualisation of information sharing and its impact on an HSI, this conclusion led to the following hypothesis:

Hypothesis 3: The level of information sharing between a hospital and its supplier is positivity associated with hospital-supplier integration.

3.5.4 Trust

Trust and information sharing are inter-related. Where there is trust, there will be a free flow of information. An increased flow of information builds and maintains trust. It therefore follows that the level of information sharing determines the level of trust and vice versa. These conclusions arise from a summary of findings listed in Table 3.5. More research findings are reviewed below to evaluate these conclusions.

The required information sharing between hospitals and their suppliers is a somewhat risky practice since giving outsiders access to information regarding the internal activities of a hospital, needs to be handled carefully (Ajami, Rajabzadeh & Ketabi 2014; Zhang & Huo

2013). Prior research in this area recognises the importance of trust in maintaining the integration between hospitals and their suppliers. Table 3.5 summarises the main findings on the impact of trust on hospital-supplier integration in the literature.

Table 3.5 Summary of literature on trust

Author/ year	Area of interest	Contribution/ findings
(Bhakoo & Chan 2011; Colquitt, Scott & Lepine 2007)	Trust	Trust has a positive impact on hospital-supplier integration
(Chan, Lettice & Durowoju 2012; Mcevily, Perrone & Zaheer 2003)	Trust in inter-organisational partnership	Trust has a positive impact on the quality of inter-organisational interaction and structuring. Trust reduces the fear of information misappropriation and encourages openness in relationships.
(Kale, Singh & Perlmutter 2000; Lengnick-Hall, Lengnick-Hall & Rigsbee 2013)	Trust	Trust plays a key role in overcoming the trade-off between protecting proprietary assets and acquiring new knowledge.
(Sankowska 2013; Squire, Cousins & Brown 2009)	Trust	Trust helps to speed up the knowledge transfer between firms and their suppliers.
(Mantzana et al. 2017; Moorman, Zaltman & Deshpande 1992)	Trust	By trust, there is an improvement in the quality of information sharing practices between hospitals and their suppliers.

Studies contend that establishing trust within the internal and external business environment with the stakeholders and shareholders, supports in enhancing the operational activities of the organisation(Chan, Lettice & Durowoju 2012). It has been identified that there can be a significant influence on the HSI if the firms are able to build a connection based on trust with the suppliers (Bhakoo & Chan 2011; Colquitt, Scott & Lepine 2007).Studies conducted

by Mcevily, Perrone and Zaheer (2003); Chan, Lettice and Durowoju (2012) illustrate that trust significantly influences the quality of inter-organisational integration and structuring. Trust makes decision-making more efficient by streamlining the procurement and interpretation of data. This in turn, enables the management of companies to channelise behaviours and routines, which can be most beneficial and viable to organisational activities. It has been further determined that the fear of information misappropriation can be reduced by focusing on trust (Chan, Lettice & Durowoju 2012; Mcevily, Perrone & Zaheer 2003). Moreover, it has been determined that trust encourages openness in relationships, which can allow the hospital to exchange information with suppliers regarding the cost of supplies, and the requirement of materials. However, it is considered imperative to maintain transparency with the suppliers in order to build and attain long-term sustainability in dealing with prospective suppliers. Building trust is a long process as it cannot be developed in a short period of time. Both the organisation and partners need to share data and information along with any challenges faced by either of them. This helps in strengthening the trust between parties, thereby enhancing the supply chain of companies to provide goods to the buyers.

Literature has found that trust influences hospital-supplier relationships and that this is mediated by knowledge exchange. On the other hand, trust moderates the relationship between knowledge exchange and HSI(Chen, Preston & Xia 2013). According to research, the primary means involved in relationship processes with suppliers includes trust in combination with the sourcing strategy and agenda purchasing portfolios with each supplier, commitment and targeting system. The importance of trust in building and maintaining relationships with suppliers has also been stressed by studies (Gelderman et al. 2018; Naidu et al. 1999; Syahrir, Suparno & Vanany 2018; Young 1989). Trust and cooperation as the

basis of long-term relationships has also been highlighted by researchers (Oruezabala & Rico 2012).

Literature has applied both the transaction cost theory and social exchange theory to explain the development of trust and commitment in hospital-supplier relationships. Management decision variables, such as asset specificity, communication and perceived benefits positively influenced trust whereas behavioural uncertainty negatively influenced trust. Trust was also positively related to commitment (Chao et al. 2013). Additionally, it was found that trust, but not commitment, positively influenced future relationships between hospitals and suppliers (Chao et al. 2013). There was no effect of supplier reputation and tenure of relationships on continued future relationships. Studies have found that the trust variable was deleted from variables considered for further analysis as its Eigen value was less than one (Msimangira 2010). Literature describes green trust as the level of trust in the marketing orientation of sustainable supply chains. Although trust is mentioned in many other works, clear findings on the effect of trust on supplier relationships in the case of hospitals has not been achieved (Chahal, Dangwal & Raina 2014)

The risks related to the trade-off between safeguarding proprietary assets and obtaining new knowledge can be overcome by establishing trust in the organisation (Kale, Singh & Perlmutter 2000; Lengnick-Hall, Lengnick-Hall & Rigsbee 2013). In this regard, the management of the hospital can seek suggestions from suppliers and can also include them in the decision-making procedure, which can support in maintaining the intellectual property and protecting the assets that can assist in strengthening the supply chain system of the

company. On the other hand, it has been determined that trust between hospital and suppliers can help in speeding up the knowledge transfer. It is regarded crucial to maintain a greater degree of cooperation within the firms-supplier relationship in order to ensure productive inter-organisational knowledge transfer. By engaging with suppliers, organisations can be able to ascertain the demand of the customers. Suppliers can provide valuable information about the market situation and other key data that can enable the company to utilise the knowledge base to meet the needs of the market. Apart from that, it can be pointed out that by building trust with the suppliers, hospitals can ensure improvement in the quality of information sharing practices that can support in providing quality services to the people (Mantzana et al. 2017; Moorman, Zaltman & Deshpande 1992). In addition, hospitals are then able to maintain a strong database of resources and materials by collecting information from suppliers.

Based on this conceptualisation of trust and its relationship with HSI. This conclusion leads to the following hypothesis:

Hypothesis 4: Trust between hospitals and their suppliers is positively associated with hospital-supplier integration.

3.6 The impact of hospital-supplier integration on hospital performance

HSI can be defined as the extent to which the business processes between a hospital and its key suppliers are strategically coupled and unified as a whole (Chen, Preston & Xia 2013). Literature in this area is quite rich with studies that assign the positive impact of this

integration on the overall performance of a hospital. Table 3.6 summarises some of these studies.

Table 3.6 Summary of literature on hospital-supplier integration and its impact on overall performance

Author/ year	Area of interest	Contribution/ findings
(Flynn, Huo & Zhao 2010; Vickery et al. 2003)	Hospital-supplier integration	Hospital-supplier integration is a key driver at the process-level of the hospital supply chain performance
(Hult et al. 2006; Ozcan 2008)	Hospital-supplier integration	Conceptualising the performance of supply chain performance based on four priorities including cost, quality, speed and flexibility.
(Flynn, Huo & Zhao 2010; Vickery et al. 2003)	Hospital-supplier integration	There is a positive relationship between hospital-supplier integration and delivery speed, dependability and responsiveness to customers.
(Stanley & Wisner 2001)	Firm-supplier integration	There is a positive impact from firm-supplier integration on delivery quality.

Hospital-supplier integration is the crucial driving factor at the process-level of the hospital supply chain performance (Flynn, Huo & Zhao 2010; Vickery et al. 2003). In this regard, it has been determined that the hospital can engage with the suppliers to figure out any challenges within the supply chain system. As a result, the management of the company can develop a strategy that can support in dealing with the issues related with the supply chain process. It is considered important for the organisations to understand the type of information to be shared with the suppliers so that any loopholes in the supply chain practices can be improved. Suppliers can help the hospital in making a strategic plan to enhance customer satisfaction level, decrease lead time, reduce the cost of operation and

risks and enhance distribution and customer service levels(Wild 2017). On the other hand, it has been claimed that a HSI can be useful for the organisational effectiveness if the firms focus on different aspects of supply chain performance like cost, quality, speed and flexibility (Hult et al. 2006; Ozcan 2008). These are crucial priorities that can help the company to increase the efficiency of the supply chain system. It would be effective in maintaining a cordial relationship with the suppliers that can help in receiving the required resources and materials in a timely manner. Studies reveal that for better HSI, it is regarded important to consider the technological factor, which would assist in facilitating the free flow of information internally and externally of the company(Vickery et al. 2003). Furthermore, the organisation needs to understand the problems of their suppliers as not only would it help in developing long-term relations, but would also support in increasing the organisation's productivity, thereby meeting market and customer needs.

According to studies, the transaction cost, quality and scale economies determine the level of integration in the healthcare sector (Coles & Hesterly 1998; Croes, Krabbe-Alkemade & Mikkers 2018). Literature has measured supply chain performance in terms of quality, speed, cost and flexibility(Chen, Preston & Xia 2013). Hospital size, the size of the purchasing department, the hospital type, location and profit status were used as control variables to account for organisational variations. Thus, hospital performance was not used as a dependent variable but as a control variable. Hospital performance variables are measured by research, which include occupancy rate, admissions per bed, net income margin, gross patient revenue per patient day, total profit margin and uncollectible ratios (Ozcan 2008). These variables were used to test the hypothesis that the higher the

relationship intensity of a hospital, the higher its performance is in terms of these variables (Naidu et al. 1999; Syahrir, Suparno & Vanany 2018).

It has been ascertained that there is a considerable relationship between HSI and delivery swiftness, reliability and responsiveness to consumers (Flynn, Huo & Zhao 2010; Vickery et al. 2003).Therefore, it can be said that if there is delay in obtaining required resources from the suppliers, then the hospital may face difficulty in providing timely service to people. As a result, this can affect the overall performance of the institution. Moreover, the image of the company would be hampered, which can result in low customer traffic. Thus, it can be indicated that it is important to maintain regular interactions with the suppliers in order to sustain the performance and enhance the supply chain productivity. On the other hand, it has been identified that an effective firm-supplier integration would positively impact the delivery quality of the company (Stanley & Wisner 2001). Both the firm and supplier can make considerable contributions in arranging resources that can help the organisation to be prepared to deal with the customers' requirement. As an outcome, the company would be able to enhance the delivery system, thereby obtaining quality performance. It is important for the organisation to include their suppliers in various aspects of operational activities as it helps in receiving full commitment from suppliers that can support in dealing with uncertain challenges.

Further research has restricted this performance measure to material management performance in order to study the effect of the prime distributor (vendor)-hospital relationship (Gelderman et al. 2018; Young 1989). On the other hand, another study only

focused on the financial performance of the effect of relational exchange (Germain et al. 2011). Other research has measured performance variables of savings of various kinds that are only achieved by logistics integration. The performance variables were cost savings and logistics operations, savings in storage space, savings on purchase prices and savings in personnel time (Ivan Su, Gammelgaard & Yang 2011). Performance variables measured by additional studies include the ability to handle expected challenges, cost reduction of purchased items, inventory costs, order fulfilment and hospital profitability. The study was related to supply chain integration and supplier relationships (Msimangira 2010).

From the above discussions, it is clear that variables of hospital performance chosen in any study depend on the aim of the work and the variables that can be measured using the prescribed methodology. Based on this observation, the following hypothesis was proposed:

Hypothesis 5: Hospital-supplier integration is positivity associated with hospital performance.

In this research, four variables of hospital performance were selected: 1) quality (order fulfilment process); 2) speed (length and efficiency of the order fulfilment process and cycle time); 3) cost of order fulfilment; and 4) flexibility of order fulfilment. These variables have also been used in a prior study conducted by Chen, Preston and Xia (2013).

3.6.1 Lean practices in healthcare

Lean practices are a management practice that attempts to classify operations and activities according to the values they generate into two distinctive groups, namely: value adding activities and non-value adding activities (Improta et al. 2018; Womack & Jones 1997). Lean

practices can be defined as a systematic waste removal process, which is carried out by all members of an organisation from all parts of the value stream (Worley & Doolen 2006).

The appealing idea of applying lean practices is to minimise non-value adding activities and keeping other activities. This has created a plethora of studies that focus on lean practices in different industries. The use of this methodology in literature has been reviewed to find that 51% of the publications about increasing the efficiency of operations in the healthcare sector are lean-centred, 13% are about business processes reengineering and 35% of these studies are in healthcare contexts. Although lean practices have extensively been studied in healthcare contexts, there is a scarcity of studies that explore the concept from a supply chain perspective, where increasing the efficiency of operation is vital.

According to the study by Aronsson et al. (2011),a lean strategy provides markets with predictable demand, low variety and a long product life cycle. The adoption of lean management practices significantly supports in increasing the efficiency of the supply chain system. It can be illustrated that by applying lean practices in operational activities, hospitals may be able to control any errors in the supply chain system, which can result in improved quality of service. Moreover, the suppliers can become aware about supplying products and services without causing defect to goods. Therefore, both suppliers and hospitals would be able to focus on improving their performance, which can benefit the overall organisation and external shareholders. Studies show that most of the activity in the lean environment focuses on quality improvement. In relation to that, it can be mentioned that without waste and its additional costs—like inventory or transport—the value of goods increases, which

95

also enhances quality. Thus, the hospital can manage the wastage of resources and also train the suppliers to control the wastage level, thereby leading to better performance of the hospital. On the other hand, So and Sun (2011)opined that lean thinking can be adopted to healthcare systems to ensure effective utilisation of resources. It was determined that it is important to focus on the key performance measures of the supply chain system, which would include time, comfort of the patient, empowerment of the team and the active participation of the patient(Bravo et al. 2015). Such measures can enable the hospital to determine whether the staff are able to meet the requirements and demands of the patient in receiving expected customer service. It is important to regularly seek suggestions from people to improve services. This can help the hospital to build a strategy by engaging with the suppliers to figure out any gaps in providing service to the people. As an outcome, the hospital would be able to provide quality service and support to its patients.

Research has investigated the perceptions of practitioners/experts regarding the prioritisation of healthcare performance measures and their relationship with lean supply chain management (LSCM) practices. The results from this study showed that continuous improvement is a dominating LSCM initiative in increasing operational and financial performance, while enterprise alignment/integration is a dominating initiative in enhancing the organisational image and operational performance (Adebanjo, Laosirihongthong & Samaranayake 2016). However, the lack of homogeneity among LSCM initiatives suggests that there is a need for careful consideration when implementing these in healthcare organisations.

Improving financial performance and patient safety in hospitals through lean practices has also been the subject of much interest in the literature. Research has reported that there is a direct and positive impact of lean practices on patient safety and indirectly on financial performance through internal integration. It was determined that the six-sigma approach significantly supports in applying lean thinking in the healthcare system (Aronsson et al. 2011).Through the use of the six-sigma techniques, the hospital would be able to identify the problem areas in providing required services to the people as well as recurring challenges that may impact the overall quality expectations from the viewpoint of the customer. The alignment of both lean thinking and the six-sigma approach can enable the staff of the hospital to increase the productivity on a daily basis by maintaining high levels of quality. Thus, there would greater chances to generate positive revenue and strengthen the inner organisational culture of the hospital. On the other hand, Furterer (2014)states that the organisation can focus on developing a flow model for measuring the changes towards lean thinking. However, it is imperative to ensure a balance in the system to draw an effective lean environment in the organisation.

In this current thesis, lean practices were taken into consideration, to explore their possibilities and potential in Saudi Arabia healthcare. In doing so, the possible moderating role of lean practices were investigated in order to examine whether applying lean practices in hospitals in Saudi Arabia can further improve the overall performance of hospital SCM.

In their review of lean, researchers have cited examples of a reduction in in-hospital infections, reduced cost, improved space utilisation to accommodate more patients with

reduced waiting time and improved access, diagnosis, treatment, a decline in medical errors and improved discharge process, all leading to improved profit margins (Houchens & Kim 2014). Lean practices have also solved sub-optimal care problems. Research has cautioned against only using specific tools such as 'kaizen blitz' and 'rapid improvement events' and suggested a systems approach (Radnor, Holweg & Waring 2012). Limiting to tool-level implementation will deprive the hospital of the opportunity to realise the full benefits to the desired level. The differences between the manufacturing sector and the healthcare sector affect the adoption of lean practices in healthcare. The authors listed several examples of lean management improving various performance variables similar to those listed by literature (Houchens & Kim 2014). Noting that the evidence of lean leading to beneficial outcomes in healthcare is weak, research has also listed its performance outcomes (Poksinska 2010).

Observing that the application of lean practices in the healthcare sector was restricted to narrow technical applications rather than a holistic approach, research suggests that the direct involvement of senior management, close interactions across functional units, value creation for patients, other customers and long-term continuous improvement can lead to better performance outcomes. For each of the six principles of lean implementation, research cites examples of positive performance outcomes in various hospitals similar to the above-cited works (Toussaint & Berry 2013). Lean management of an academic operating room produced positive outcomes, which was measured in terms of financial gains (Collar et al. 2012). Tracing the history of the development of lean management in Toyota and its adaptation to the healthcare sector, there have been many reports of increased quality of care and financial gains due to lean implementation. From an example of an ambulatory clinical

setting, eliminating waste and ensuring continuous process flow led to the generation of extra work capacity to facilitate the handling of more patients by using the same resources more efficiently (Casey, Brinton & Gonzalez 2009). This results in cost saving. Moreover, a number of positive outcomes, which translate into economic impacts have also been explored by literature (Simon & Canacari 2012).

The current status of lean implementation in UK hospitals and their effects have been evaluated by research (Burgess & Radnor 2013). Diverse approaches of lean practices were used in UK hospitals. Lean practices were increasingly being used in UK hospitals and were highly systemic. A qualitative assessment rating of performance was given by the authors in their content analysis table of hospitals. Using an action research method, literature evaluated the effect of lean implementation in increasing patient intake capacity and reducing the no-show outcomes in outpatient clinics of a mental health centre (Laganga 2011). The existence of a robust electronic health record (EHR) system in the centre facilitated the study. The results showed that nurse-led lean practices improved labour productivity by 45-75%, reduced cost by 25-55% and made process flows easier (Johnson, Smith & Mastro 2012). Using value stream mapping and decision point analysis, research has demonstrated that the procurement of stents represented a forecast-driven push system. The application of lean practices converted this into a pull inventory system triggering the movement of stents when stents were withdrawn from stock for use (Teichgräber & De Bucourt 2012). However, researchers have warned that focusing only on the technical

aspect, without attending to business logic, would fail in the application of lean practices in public services like healthcare (Radnor, Holweg & Waring 2012).

Literature has questioned the financial rationale of lean management for cost savings as increasing costs are generally attributed to an ageing population and technological advances. These two facets are beyond the control of hospitals in which lean management is implemented (Pocha 2010). The requirements of lean practices to achieve the best results and the obstacles preventing the expected level of performance to be reached were reviewed by research using the example of a Swedish paediatric accident and emergency department. Lean-inspired changes improved employee roles, staffing and scheduling, communications, coordination, expertise, workspace layout and problem-solving methods reduced waiting and lead times in the emergency care facility of a Swedish children's hospital (Mazzocato et al. 2012). This was made possible due to work standardisation, the removal of ambiguities relating to roles and the connection of functionally related people, which facilitated a smooth flow of activities and empowered staff to solve problems using scientific methods. Mismatched tasks, licensing problems, lack of competence, a sense of being watched and the discomfort associated with inter-professional collaborations can reduce the level of achievement. A lack of awareness may induce resistance to change among employees and necessary training needs to be provided.

Researchers have proposed a combined application of discrete event simulation and lean practices, which was termed Sim Lean. Discrete-Event Simulation (DES) can be used for stream mapping of current and future states and for the training/education of lean practices using such simulations before the actual implementation of lean practices in the

organisation. It can also be used to facilitate the implementation and evaluation after lean implementation (Robinson et al. 2012).The successful application of Sim Lean was achieved in two UK hospitals. A study conducted by Bendato et al. (2015) combined lean management with DES, system dynamics and quantitative methods to improve the efficiency of the emergency department of an Italian hospital. Efficiency was improved in terms of a reduction in patient waiting time and the length of stay. Relocation of staff activities increased their utilisation coefficient (Bendato et al. 2015).

The combined use of lean and agile concepts, rather than in isolation, in healthcare supply chains to improve performance has been discussed by studies (Aronsson et al. 2011). Patient flow and processes are facilitated by a combination of both. Adding the JIT concept reduces inventory, synchronises product supplies with patient demand and this also saves costs. The implementation of lean Six Sigma resulted in releasing locked capital held in the stockrooms of departments (Chiarini 2012). Other benefits of motion and transportation reduction also occurred as was observed in a study on risk management and cost reduction through lean Six Sigma applications(Chopra & Sodhi 2014). Citing the successful example of Red Cross Hospital in Beverwij, research advocated for combining Six Sigma and lean for better performance outcomes (De Koning et al. 2006). Literature compared the three process improvement strategies of lean/Six Sigma, hardwiring excellence and Baldridge for their effects. Their relative effects depended greatly on the healthcare context as each method had its merits and drawbacks (Robbins et al. 2012). However, the need for evidence-based, high-performance work systems to achieve success was stressed by the studies. The beneficial

effects of combining lean and Six Sigma were also described in the case of a nurse and clinician-led emergency department's efforts (Kane et al. 2015; Kuo et al. 2011; Niemeijer et al. 2013).

An Indian hospital's emergency department, which adopted a system dynamics model, used value stream mapping to redesign processes, eliminate non-value adding activities and achieve just-in-time services. The debottlenecking of activities involved lean techniques. Lean practices were integrated with patient queuing methods to separate patients according to the seriousness of injury. This helped to free up capacity for extra patient flows and the length of stay for all patients decreased (Chadha, Singh & Kalra 2012). It is evident that patterns of supplies are determined by processes. The optimisation of processes using lean practices determines when and where a certain product needs to be supplied. When lean practices are combined with JIT or agile practices, timely supplies at the right time and at the right point are important. Performance outcomes depend on the integration of hospital needs with that of supplies. Any improvement in process flow and efficiencies will be reflected in increased patient intake and cost savings. These undoubtedly reflect on hospital performance. Thus, lean practices play a mediating role between HSI and hospital performance.

As such, lean practices have been studied heavily in the literature. Table 3.7 summarises the main findings in this respect.

Table 3.7 Summary of literature on lean practice in healthcare

Author/ year	Area of interest	Contribution/ findings
(Aronsson et al. 2011)	Supply chain	Lean strategy provides markets with predictable demand, low variety and a long product life cycle.
(So & Sun 2011)	Healthcare	Lean thinking can be applied to healthcare systems. They identified the key performance measures of the system as: time, comfort of the patient, empowered teams and the active involvement of the patient.
(Aronsson et al. 2011)	Healthcare	Lean thinking is possibly useful to healthcare through the six-sigma approach.
(Furterer 2014)	Healthcare	Measuring the changes towards lean thinking through designing a model called "the flow model". They suggest that the model needs to be balanced to receive a complete picture of lean performance.

Based on this conceptualisation of lean practices and its relationship *between hospital-supplier integration and hospital performance.* The following hypothesis is proposed:

Hypothesis 6: Lean practices play a moderating role between hospital-supplier integration and hospital performance.

3.6.2 Hospital size

The hospital or company size represents the availability of equipment, tools, technology, and the size of staff. Some studies have even categorised the size of the hospital based on the number of beds. In Saudi Arabia, a report from the Ministry of Health in Saudi Arabia (2018)classified hospitals into less than 100 beds, 100-199 beds, 200-399 beds and 400 beds and above (Ministry of Health in Saudi Arabia 2018). Additionally, in a study on hospital

size, hospital size was used as a control variable to reduce the influence of size, which was significantly and negatively correlated with outsourcing, occupancy rate and contribution margin ratio. Thus, the use of hospital size in terms of the number of beds as a control variable has been demonstrated (Bai, Coronado & Krishnan 2010). Company or hospital size has an effective role in controlling the nature of the relationship of hospital-supplier integration. Also, there is an effective relationship between the company or hospital size and the supply chain. A study on electronic-electric production found that the larger the company, the higher the level of adoption of SCM practices (Lopes De Sousa Jabbour et al. 2011).

Some studies revealed that the performance of a hospital is connected to the size of the hospital. Abdo, Sanai and Al-Faleh (2012)contend that hospital size used a control variable, has an impact on the relationship between HSI and hospital performance. The various aspects of HSI must improve together with a growing hospital for better hospital performance to be evident. In addition, some researchers reveal that larger hospitals have higher levels of HSI and vice versa. This finding confirms that larger hospitals have the resources to adopt and improve their integration with suppliers (Kim 2010; Lopes De Sousa Jabbour et al. 2011). According to Yeates (2012)a large size hospital allows suppliers to deliver products or services consistently, which in turn ensures higher profits for suppliers . In addition, increasing demand within the supply chain industry will create pressure on the suppliers regarding timely delivery of the ordered products. The suppliers' business depends on the demand of the consumer to the healthcare services. In Saudi Arabia, the demand for healthcare services is increasing across the economy at a rapid rate (Phichitchaisopa &

Naenna 2013). Therefore, it is expected that suppliers will receive enough business opportunities to achieve desired levels of profits.

Another perspective about the importance of hospital size in term of risk management, states that if the company's size is greater, the company has the capability to utilise their resources to mitigate supply chain risks (Kim 2010). This study adopts the same approach and proposes the following hypothesis:

Hypothesis 7: Hospital size has an impact on hospital-supplier integration.

The categorisation of hospital sizes will be carried out as per the official classification of the MOH in Saudi Arabia. According to Ministry of Health in Saudi Arabia (2018)hospitals in Saudi Arabia are classified based on the number of beds as follows:

- 100 beds or less
- 101-299 beds
- 300-499 beds
- 500 beds or more

This classification was used in this study.

The following section summaries the theory, builds upon this research and then introduces the conceptual model.

3.7 The conceptual framework and research hypotheses

The conceptual model in this study is a conceptual framework that can guide the research process where it clarifies what is known and what is unknown. This model goes beyond simple cause-effect explanations towards linkages and feedback in complex systems.

Based on the discussion regarding different variables of hospital-supplier integration and the related hypotheses proposed above, a conceptual model was developed in this study to investigate the factors that affect HSI and the impact of this integration on the overall performance of hospitals in Saudi Arabia. The model is given in Figure 3.2.
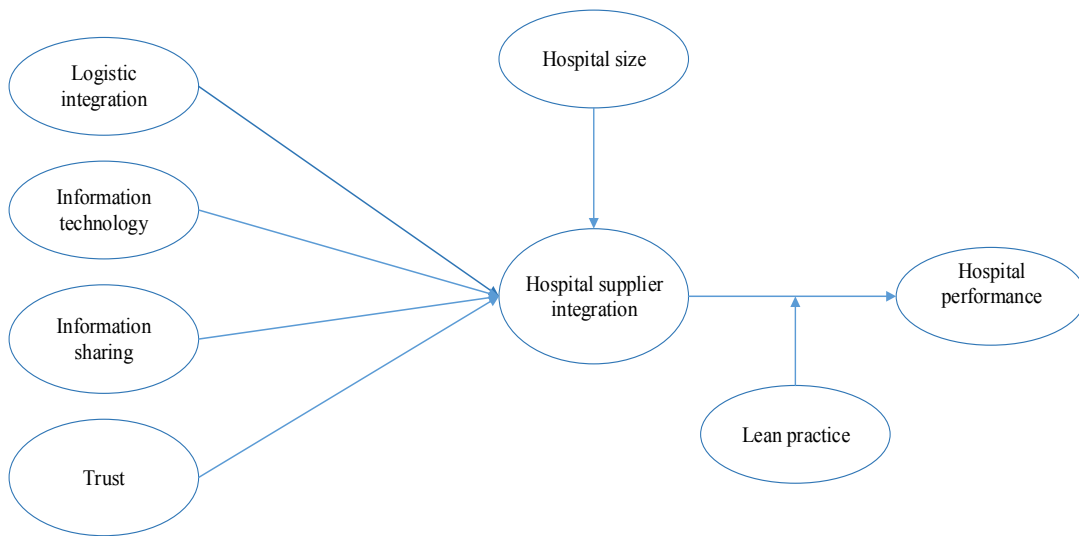
Figure 3.1 The Conceptual model

In the model, the four factors of logistics integration, information technology, information sharing, and trust are shown to influence HSI. In turn, HSI is shown to influence hospital performance. In the first part of the model, the four factors affecting HSI are independent

factors and HSI is the dependent factor. The HSI becomes the independent variable and hospital performance becomes the dependent variable in the second part of the model. Overall, hospital performance can be considered as the dependent variable and all the remainder as independent variables. Hospital size is the control variable affecting HSI. Also, lean practices become the moderating variable for the relationship between HSI and performance. All the relationships have been hypothesised as positive effects as shown in the list of hypotheses summarised in Table 3.8 below.

Table 3.8 Summary of hypotheses

Hypothesis	Description
H1	Logistics integration is positively associated with hospital-supplier integration.
H2	The level of IT integration between a hospital and its suppliers is positively associated with hospital-supplier integration.
H3	The level of information sharing between a hospital and its supplier is positivity associated with hospital-supplier integration
H4	Trust between hospitals and their suppliers is positively associated with hospital-supplier integration
H5	Hospital-supplier integration is positively associated with hospital performance
H6	Lean practices play a moderating role between hospital-supplier integration and hospital performance.
H7	Hospital size has an impact on hospital-supplier integration.

Thus, studying the relationships between the different components of the conceptual model is the focus of this study. For this purpose, SEM was selected as the most appropriate technique as was justified by Katou and Budhwar (2010). This current study is based on the relational view of the competitive advantage theory. The reason for choosing this theory is its focus on the partnership between companies and their suppliers to achieve a competitive advantage. As discussed above, partnerships and collaborations are needed to achieve the desired level of integration between the hospital and its suppliers. Hence, by deploying this theory, a better understanding of the factors that affect the integration between hospitals and their suppliers is possible. The following section presents this theory and its main concepts.

3.8 The theoretical underpinnings

This section introduces the theoretical underpinnings of this study. Two theories were used. The first was the relational view of competitive advantage and the second was lean thinking.

3.8.1 The relational view of competitive advantage

This study explores HSI through the lens of the theory of relational view of competitive advantage (Zhang & Chen 2013). The main argument of this theory is that *"idiosyncratic inter-firm linkages may be a source of relational rents and competitive advantages",* which justifies the use of this as one of the theoretical underpinnings for this study(Chen, Preston & Xia 2013, p. 393). Moreover, Chen, Preston and Xia (2013)state that the relational view is an important factor that is connected and related to the performance of a hospital supply chain. The relational view is a tool of the IT integration between the suppliers and buyers. Chen, Preston and Xia (2013)also reveal that the relational view can be used as an indication about knowledge exchange between hospitals and suppliers. Hora and Klassen (2013)reveal

that the importance of using relational view theory is to connect the competitive advantages to supply chain integration. After that, identify the shape of HIS. Research had earlier concluded that a single company cannot achieve a competitive advantage by itself because, when it enters a partnership with other stakeholders (partner, supplier, etc.), it is subject to the change in the competitive nature to becoming less universal (Zajac & Olsen 1993). The theory states that generating better rent and competitive advantage by partnering firms may derive from four sources: investments in relation-specific assets; substantial knowledge exchange; complementary resources and capabilities and effective governance.

These sources, and the main argument of this theory, have been used as a theoretical base for much research, such as strategic alliances in social service delivery networks, and using collaboration as a strategy for enhancing network governance in watershed management programmes Graddy and Chen (2006); Imperial (2005) claim the economic aspects of inter-organisational relationships in the context of strategy formation and strategic governance in public agencies and the role of public business centres in a company's networking capabilities and performance (Spithoven, X00e & Knockaert 2011).

In the above discussion, many authors were found to have used this theory to explain HIS (Chen, Preston & Xia 2013; Mettler & Rohner 2009; Naidu et al. 1999; Oruezabala & Rico 2012).

This study will use the theory to better understand the impact of HSI on the overall performance of hospitals in Saudi Arabia. It is expected that the use of this theory will highlight the individual effects of the proposed factors, both internally and externally, on the

integration. This study will look through this lens in an attempt to understand the impact of different internal and external factors on HSI. This theory is therefore used in this research to explain the HSI model proposed and tested in this study, as it provides a robust foundation to explain how the HSI model has been constructed in the context of Saudi Arabia. It is very useful and efficient to identify the relationship between the hospital and suppliers. Then summarising and evaluating the outcomes of the theory to develop a complete and efficient supply chain integration.

As discussed in Section 3.5, four factors were found to impact the level of HSI, namely: logistics integration, information technology integration, information sharing and trust. This level of HSI is argued to have a direct and indirect impact on the overall performance of hospitals in Saudi Arabia as discussed in Section 3.6. As the focus of the relational view of competitive advantage is inter-organisational interactions, these two key elements of the HSI model are expected to be better highlighted by using the rich lens of this theory.

3.8.2 Lean thinking

Lean thinking is a set of principles and practices that aim to transform the way businesses operate by reducing waste. This practice derives from the manufacturing industry and was introduced and used by Toyota. Dealing with waste as a centre of this theory includes identifying the sources of waste and then trying to eliminate these and convert them into values from the customers' perspective. Waste can be defined as anything that does not add value to the final product or service; conversely, value is the capability to provide the right product or service, at the right time and at an appropriate price(Womack, Jones & Roos 1990).

Research specifies the lean thinking approach as consisting of five steps. First, specify the value from the customer's perspective. Second, identify the value stream (from order to delivery) for each product or service and remove the waste. Third, make value flow without interruption from the beginning to the end of the process. Fourth, let the customers pull what they value from processes when they need it. Finally, pursue perfection through continuous improvement. In healthcare, one can also view the approach to lean thinking following these five steps. The goal of lean thinking in healthcare is to continuously focus on how appropriate healthcare can be delivered most efficiently, safely and with the highest quality by transforming waste into value from the perspective of a customer (Houchens & Kim 2014).

This well-known theory has had a considerable impact on the formation of the framework as it helps to understand the moderating role of lean practices on the overall performance of hospitals in Saudi Arabia. The effects of lean and other related practices on HSI and performance have been discussed in detail above.

This aspect could be very important in differentiating between private hospitals and their public counterparts as they have different approaches in managing their supply chains even though they share the same core business of delivering care. So, this theory will be strictly used to study the moderating role of lean practices among hospitals in both private and public settings in Saudi Arabia. In other words, this theory will be used to clarify three dimensions around the use of lean thinking in the context of this study. First, this study will help to establish a baseline for lean practices in Saudi Arabia. Although the country is a wealthy

111

developing country, the establishment of lean practices is still not fully understood nor highlighted. Hence, this study will help to shed some light on this aspect. Second, the use of this theory will help to explain whether these practices have an impact (if any) on the overall performance of the surveyed hospitals. Third—and most importantly—this theory will help to clarify if lean practices perform any moderating role in the relationship between HSI and hospital performance.

3.9 Summary

This chapter has provided a literature review on the factors impacting HSI. Four factors were identified in this review, namely: logistics integration, IT integration, information sharing and trust. These factors have been shown in the literature as influencing factors that play key roles in determining HSI. In addition, this chapter addressed the establishment of the research hypotheses. Seven hypotheses were posited related to confirming the impact that this integration has on the overall performance of hospitals. Lean practices in hospital supply chains and their possible moderating role, along with any potential role of hospital size, have also been discussed. Based on this discussion, a framework of HSI has been proposed and supported by two theories; the relational view of competitive advantage and lean thinking.

CHAPTER 4: RESEARCHMETHODOLOGY AND ANALYTICAL APPROACH

4.1 Introduction

This chapter describes the research methodology and analytical approach that were used in this study. The chapter begins with a general introduction about the research methodology and analytical approaches that were used in this study. The research methodology is presented by reflecting on the research paradigm, design, and stages selected to achieve the objective of the study. Sections 4.5 and 4.6 explain the formation of the testable hypotheses and the justifications for the selected methodology and research design. In Section 4.7, the method of constructing the study's questionnaire survey was introduced to evaluate the development variables of hospital performance. The validation of the survey instrument will be presented in Section 4.8, followed by the Ethics Approval and the administration of survey in Sections 4.10 and 4.11, respectively. Finally, a summary of the research methodology and analytical approach will be presented.

4.2 Research methodology

Literature has proposed a research paradigm that explains the various steps of the research process (Mark Saunders and Paul Tosey 2013). The dimensions involved in the research include philosophy, approach, choice of data and strategy. Time horizon, techniques and procedures form part of the data collection and analysis process that constitutes the core of the onion. In this study, the research philosophy adopted a positivist view. According to this philosophy, there exists the possibility to observe and describe reality from an objective

viewpoint. In contrast, an interpretivist philosophy involves a subjective viewpoint. In this study, data was collected using a survey and the findings were interpreted in an objective manner. Data is considered to reveal the reality of the situation as the findings will be useful to develop recommendations for hospitals in order to enhance their supply chains and thereby improve performance. Although the realistic and pragmatic view regarding the alternative possibilities is considered, this does not form part of the research process in this study. Ontologically, it is very objective with a specific aim tested through assumptions derived on the basis of available research reports. The logic applied is deductive since it begins with a theoretical framework, forms hypotheses, tests the hypotheses using real data and verifies the hypotheses, which are used for generalised applications.

The framework shown in Figure 3.2 was used in structuring the methodology that was applied in this study—as surveys and SEM were used(Healy & Perry 2000). The paradigm is positivist as is explained below.
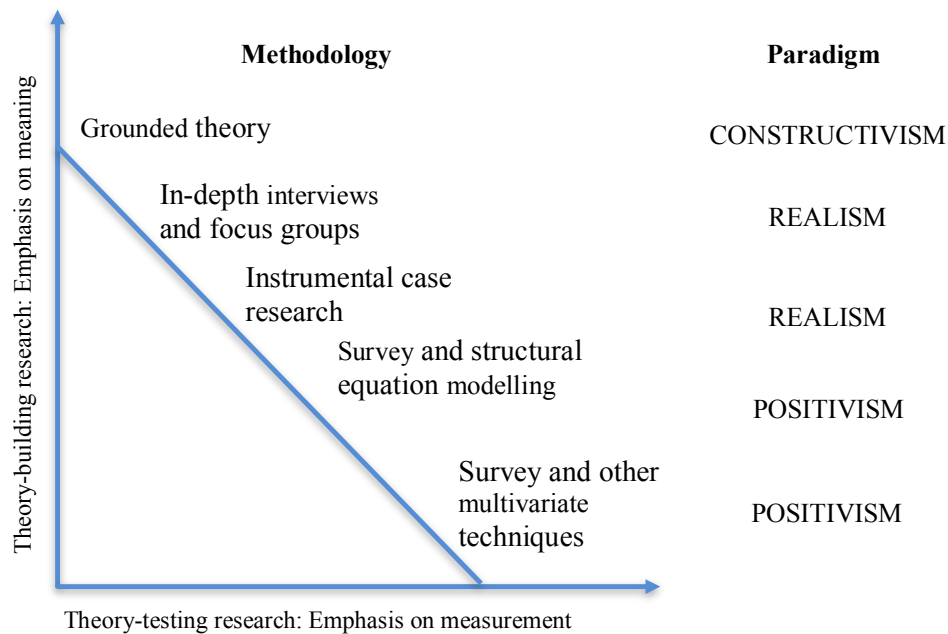
Figure 4.1 Research methodologies in relation to paradigms (Source: Healy & Perry 2000)

The second paradigm is where mathematical modelling is positivist in nature, as is presented in Figure 4.1. This also relates to ontology and epistemology, as ontology is concerned with reality and epistemology is concerned with the relationship between reality and the researcher (Dornberger 2018). In an objective study, the researcher is positioned outside the observations. In contrast, the researcher becomes part of the study through involvement in data gathering such as interviews and participant observation.

This study required testing the hypotheses in order to answer the research questions. The hypotheses were concerned about the relationship of certain factors with regards to HSI and performance. Previous research has used three elements to differentiate between these factors. These include the philosophical basis for the assumptions regarding knowledge,

research strategies and research methods. The positivist view underlies knowledge development in quantitative methods. Positivism is a philosophical theory in which positive knowledge is based on natural phenomena, their properties and the relationships that may occur. Reason and logic are used for the interpretation of information. This produces a statement of an authoritative tone. In the positivist approach, the research question is broken down into specific, testable hypotheses through knowledge gained (Dornberger 2018).
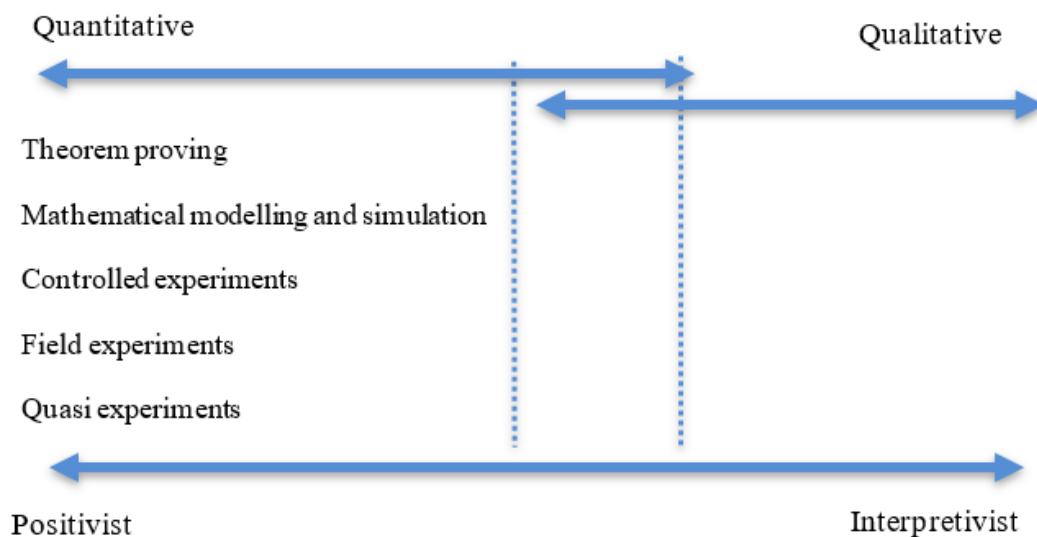
Figure 4.2 Research strategies in relation to research philosophy (Source: Durenberger 2018)

The framework shown in Figure 4.2 was used in constructing the strategies that were applied in this study. The research demonstrates the linkage between the different strategies and the research philosophy. A quantitative research methodology could be used when data is measurable and quantifiable. Furthermore, qualitative research is suitable when the data is subjective and determined through knowledge and experience. The appropriateness of the method determines the validity and reliability of the work to obtain consistent results.

However, the appropriate methods are often determined under constraints, such as financial and time issues as well as research objectives.

In this study, a questionnaire survey—in which responses were scaled for quantification—was used. This study favoured a quantitative method because it was necessary to quantitatively measure the different degrees of responses for a proper evaluation of supplier chain integration in relation to the independent variables. A qualitative method would not have correctly measured the different degrees of responses. Many of the questions in the survey measured the feelings and emotions of participants regarding supplier integration in their hospitals. Thus, what could be achieved by qualitative research was more precisely obtained through a quantitative method. Therefore, the human aspect of the research was accommodated.

This current study employed quantitative methods to gather and analyse the data to meet the research aims. Access to hospitals and participant managers was facilitated by the Saudi MOH. The methodology and findings may be usefully extended to other countries of the Middle East and possibly other developing countries in a similar context. There were three reasons for obtaining quantitative data. First, there was a need to measure the direct effect of various factors on HSI using a relational view. Second, the moderating role of lean management on this effect was to be evaluated. Third, it was necessary to compare public and private hospitals in these aspects. First-hand data on all three aspects simultaneously was only possible through a quantitative survey. In this study, the aim and objectives guided the method.

117

Hypotheses are used to determine the variables which are to be observed. Observation and measurement are used for data collection. Based on this, different theories can be tested to conclude the cause and relationships between different elements/subjects. The results obtained are then used to form an interpretation and a conclusion. These characteristics of the quantitative method are used in this study. According to research, the quantitative method involves counting and measuring the phenomena(Sale, Lohfeld & Brazil 2002). There are advantageous elements of the quantitative method over the qualitative method in this respect (Hair et al. 2015). This justifies the use of the quantitative method in this study.

Literature has listed the steps required for the quantitative method as: (1) theory and hypothesis formation; (2) selection of appropriate research design; (3) selection of suitable research elements, (4) using the research elements to collect data, (5) analysis of data using appropriate methods, (6) deriving results and interpreting them to validate or reject the hypothesis itself and to draw conclusions (Bryman & Bell 2011).These steps are extensively discussed below.

4.3 Research paradigm

Several studies contain the basic aspects of business research. Two primary types of research are recognised—basic and applied. Since the findings of this study are intended to be used by hospitals to improve their integration with suppliers for better performance, applied research was selected. This is also classed as primary research since data is collected directly from reliable and original sources, unlike secondary research in which data that has already been collected is used (Bell, Bryman & Harley 2018; Sekaran & Bougie 2016). The different types of research approach can be categorised as exploratory, explanatory, descriptive,

hypothesis testing, case analysis or meta-analysis. As data on this topic in the context of Saudi Arabia is scarce, this study is more or less a pioneering project. Hence this study can be regarded as an exploratory study. This can form the basis for more detailed studies in Saudi Arabia and other similar countries.

4.4 Research design and stages

Literature has provided thorough explanations of research designs(De Vaus 2013). A research design should specify the type of evidence required to answer the research question, to test a theory or hypothesis, to evaluate a programme or to accurately and unambiguously describe a function. The work plan, which is the research process, then flows from this. This consists of sampling, data collection, questionnaire and analysis. The research designed as an exploratory study, an experiment, a case study, a longitudinal or a cross-sectional design. Methods of data collection flow from the type of study specifically selected. A good research design also involves considering alternative plausible explanations as well. Evidence collected should be compelling by which alternate explanations can be eliminated. Competing alternative explanations should be anticipated prior to the collection of data (Creswell & Creswell 2017).

One of the points stressed by the literature is that the research design begins by raising questions about certain phenomena leading to the conversion of these questions into feasible research work, which seeks answers to the research questions. The substantive research questions need to be answered completely, carefully and sufficiently (Yao 2017). According to literature, the research design is the bridge between the research question and the

execution of research(Creswell & Creswell 2017). This current study consists of the stages presented in Figure 4.3. The appropriateness of this design can be tested by critically evaluating the methodology adopted by other researchers in similar studies who have dealt with the same analytical models used in supply chain research (Yu 2015).

Four types of models have been identified by previous literature, deterministic, stochastic, economic and simulation, and various qualitative and quantitative performance measures (Harrison et al. 2007). Moreover, cost minimisation, the minimisation of average inventory levels, maximisation of profits, minimisation of obsolete inventory, minimisation of demand uncertainty and also the maximisation of buyer-supplier benefits have also been considered. In this study, a theoretical model was adopted based on the literature review, and the variables of measurement were selected according to the model's components. The unique aspects of healthcare supply are that they are incomplete and fragmented. There are smart procurement strategies such as Group Purchasing Organisations (GPOs), but these are nullified by a strict regulatory regime, the need to minimise incorrect, unsafe, spoiled or out-dated products during delivery, storage or use, the need to meet critical requirements via agile systems, product standardisation, resolution of the problems of service process flows due to service failure incidents, ensuring that regular supplies are supported by efficient inventory management, the prediction of demand for various types of requirements as precisely as possible, streamlining ordering procedure, lack of data standardisation, use of IT including RFID, e-procurement and preference of generic rather than branded drugs, the use of leagile practices and proper supplier integration to address these unique issues (Nollet & Beaulieu 2003). These aspects were elicited through an adequate and exhaustive review of the literature.

120

However, it is not possible to cover all aspects in a single exploratory study within the limited resources and time of this study. Hence, this study is limited to evaluating the effect of some of the main factors on performance in terms of quality, time, cost and the flexibility of order fulfilment. The influencing factors are hospital size, logistics integration, IT and information sharing with suppliers, trust and lean practices. Hospital size indicates the size of demand and procurement. Logistics integration determines the delivery of the correct product in the correct quantity and quality at the correct time. The use of IT can increase the efficiency of supply processes. Information sharing with suppliers and trust are elements of supplier integration, which directly influence the order fulfilment processes and inventory management. Lean practices are deliberate attempts to reduce costs, primarily through waste reduction and increasing the flow of efficiencies. All these factors are inter-related. Information sharing, and trust are important components of the relationship with suppliers and thus, to the relational aspect.
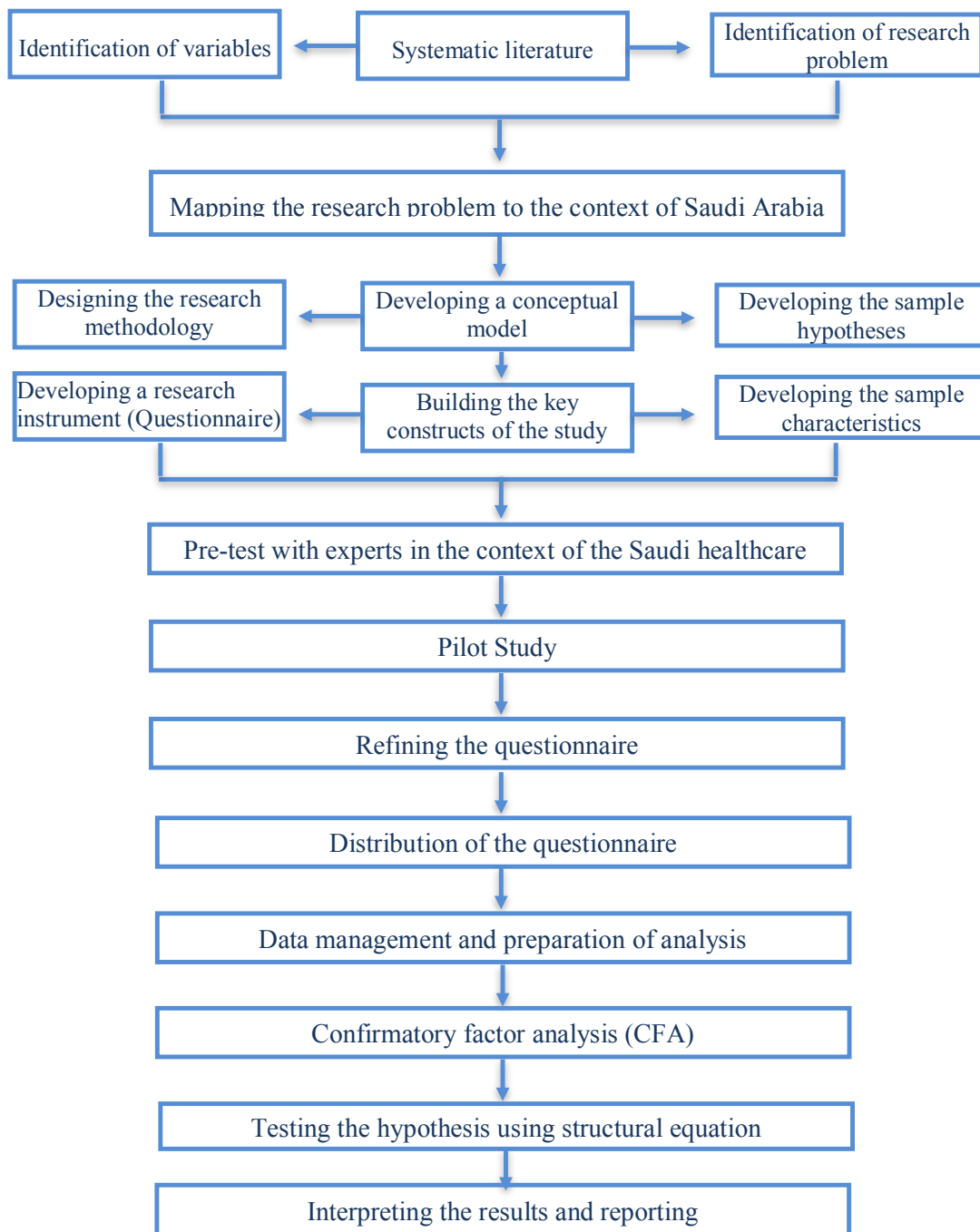
Figure 4.3 Research design of this study.

4.5 Formation of testable hypotheses

The above research design explains the relationship of logistics integration, IT, information sharing and trust to HSI, which, in turn, is related to hospital performance. Lean practices have a moderating role here. The size of hospital is used as the control variable for the relationship of supply chain variables with supplier integration. Different components of the framework are connected through testable hypotheses. The testable hypotheses were formed from the exhaustive and critical review of work undertaken on each critical aspect of the supply chain. These are presented in Table 3.8. The variables and constructs of the survey were designed to test the validity of the hypotheses. The extent of a relationship can be used for the construction of structural relationship pathways, thus making SEM possible(Heck & Thomas 2015).

The methodology deserves to be examined in detail. With regards to this current study, the questionnaire was validated through two steps. First, a qualitative item sorting procedure was carried out to evaluate the discriminant validity of each construct being measured. Then the psychometric properties of the scales were statistically analysed. Supply chain performance was modelled as a second order construct of the four variables—quality, speed, cost and flexibility. The constructs used by these include trust, information sharing, IT integration, supplier integration and performance in terms of order fulfilment processes. The last two were control variables containing many sub components within each construct. The same constructs (details differing) were also used in this study. In the two-stage process of validation, this current study used expert opinions to narrow down the focus of the questions

and a pilot study was used to evaluate the statistical validity and logistics of the questionnaire administration.

The methodological considerations used in previous research also provide some useful leads. After final refinements and fieldwork, the data is cleaned and tested for reliability and validity before being used for statistical analysis (Mohamed Binti Sayuti 2013). With regards to this current study, the findings based on the analysis were used for the validation of the hypotheses and the formation of conclusions. Similar methodologies have also been adopted by many other works (Lii & Kuo 2016; Stank, Keller & Closs 2001; Wisner 2003).

Various literatures have used a theoretical framework and SEM for supply chain performance studies through questionnaire surveys. SEM has also been used by various other studies (Corsten & Felde 2005; Cousins, Lawson & Squire 2008).

4.6 Justification for research design

Prior to writing any research paper or thesis, a plan or strategy must be developed for conducting the study. The whole research design refers to the complete strategy that is further implemented to carry on the research work. This can be considered as a systematic approach that the researcher uses in their scientific study (Mackey 2015). The most important aspect of the research design should consist of the strategies used to carry out a comprehensive study of the subject with a logical bend, which ensures that the complete research problem is addressed. This is comprised of the synchronisation of distinguishable modules and data that result in reasonable outcomes. Moreover, the research design should represent a blueprint for the collection, measurement and data analysis. Furthermore, the research design is always selected on the basis of the identified research problem. The

chosen research design should be applied only after critically analysing the subject of the study. Likewise, the length and complexity of the research design depends on the type of the research problem and the justification of the solution. Reviewing and synthesising the literature is associated with the research design, specification to the applied hypothesis, effective description of the data and a detailed description of how the data will be obtained and, lastly, analysing the data to examine whether the hypotheses are true or not.

Research designs or methods consist of the research design and philosophy. Research designs consist of four types: exploratory design, descriptive research design, explanatory design and evaluation research design, which can be selected according to the type of research problem. Exploratory research design approaches the research in a specific questionnaire form; i.e. in the "what" and "how" manner (Nardi 2018). Descriptive research design takes account of undertaking in-depth research that justifies the "what" and "how" in an elaborated manner (Blaikie & Priest 2019). An explanatory research design verifies the subject matter that is being researched and answers the questions in terms of the "what", "how" and "why"(Fink 2015). The fourth design—evaluation research—is quite an extensive approach that evaluates the effectiveness of any program or research work.

With a clear understanding regarding the different types of research design, researchers can adopt the most appropriate approach for their study. However, in general, research designs can be viewed in two forms, quantitative design and qualitative design. Both can be used in a mutually converse and diverse manner depending on the requirement of the research design. The quantitative design basically examines the co-relation between the used

125

variables by the use of numbers and statistics in order to explain and analyse the findings (Roller & Lavrakas 2015). This can be further understood through four types of design. The first is descriptive design research work, which anticipates the present status of the research issue. This type of the research design does not require any hypothesis at the beginning of the work and the analysis of the data is generally derived from pre-existing data. The second type is correlational research design, which is an approach used to identify that any two variables are associated or co-related in some respect. This type of design uses statistical analysis while observing the variables of the data. The third type, also called the experimental design research, is a method that is generally used to establish any particular reason and relationship output between two variables or a number of variables. The last design type is quasi-experimental research design, which is based on a true experimental approach applied on a randomised group of samples. This design is used when three of the above typical research designs are not followed.

On the other hand, qualitative research design follows an exploratory pathway. It explores the subject in the research design rather than delivering the predictive outcome. It is based on discovering the complexity of the social environment by taking a detailed view from several similar surveys or case studies. It basically aims to understand the subject and describe the findings based on questions designed by the researcher who is responsible for formulating the research question. Moreover, there are nine important elements that must be considered in any research design (Bell, Bryman & Harley 2018). These are listed as applied to this study in Table 4.1.

126

Table 4.1: Nine elements of research design explained for this study

Study Dimensions	Application in This Study
Purpose of the study	Testing the hypotheses
Type of investigation	Structural equation modelling
Extent of researcher interferences	Minimum
Study setting	Field study, non-contrived
Unit of analysis	Hospital level
Sampling design	Purposive sampling; 435 public and private hospitals, 5 managers from each, a total of 2175participants.
Time horizon	Cross sectional study of single shot
Data collection method	Quantitative questionnaire survey that is partly administered online and partly direct.
Measurement of variables	Constructs for each variable, response rate measured by a 7-point Likert scale, nominal and dichotomous

All the requirements are fulfilled in this current study and therefore the research design is justified. This current study further uses a descriptive method for proceeding with the task because this is an important pre-cursor for utilising a quantitative research design. The descriptive research design depicts the participants of the research in a clear manner (Nardi 2018). This research design uses quantitative data, which aids in understanding the scenario upon which the research question has been designed. Furthermore, this type of design helps to understand the questions relating to the research design. Moreover, it allows researchers to validate data depending on the valuable pointers that could be used for testing the data quantitatively. Thus, as discussed above, there are several advantages to a quantitative

research design that are followed through the descriptive approach. Hence, all these criteria are further fulfilled in this study.

4.7 Development of the survey instrument-questionnaire

4.7.1 Variables used in the study

According to the theoretical frame, logistics integration, use of IT, information sharing, and trust are independent variables that affect HSI. Hospital size is a controlling variable affecting supplier integration. The effect of supplier integration on performance in terms of order fulfilment is mediated by lean practices. These relationships were stated in seven hypotheses. The variables and the relationships were determined based on a detailed review of the literature in Chapter 2. In this section, the way in which these variables were measured through the questionnaire is explained.

Responses were measured using a seven-point Likert scale. The level of responses varied from strongly disagree, disagree, somewhat disagree, neutral, somewhat agree, agree, and strongly agree. It can be argued that such fine differentiation rather than agree/disagree and agree/disagree is not suitable for precise measurement and, therefore, a five-point Likert scale is more suitable. However, in this study, even small differences in responses may have produced a greater impact on the measurement of supplier integration that was achieved. Therefore, a finer differentiation of responses using a seven-point Likert scale was considered to be more suitable.

4.7.1.1 Control variable

The size of the hospital was defined by the number of beds as per standard classification. Usually, the categorisation of hospitals according to bed size is determined by their rural or

urban location and whether they are a teaching hospital or not, as in the case of the NIS classification in the USA (Nis 2008). Such a detailed classification was considered unnecessary and irrelevant to study supplier integration. Therefore, bed size alone was used as the sole criterion for size classification. This variable was used only as a control variable. In this study, four levels of bed size, ranging from 100 or less to 500 or more at a class interval of 199 were used. The frequency of hospitals with fewer beds is expected to be more and those with a larger number of beds are expected to be less. Therefore, this categorisation was found to be adequate to elicit the effect of hospital size as the controlling factor on supplier integration.

The number of employees increases with increasing hospital size, although not proportionately. Therefore, the number of employees also becomes a virtual measure of hospital size. However, against the four levels of bed sizes, eight levels of employees were categorised ranging from less than 500 to more than 3500 at a class interval of 499. It is difficult to expect hospitals to vary in size substantially enough by the difference of a few employees. This is why a class interval of 499 was selected. Such a categorisation was expected to adequately highlight the differences between hospitals in terms of size.

Following the above discussion of the basic variables, independent variables that were directly related to this current study are discussed below.

4.7.1.2 Independent variables

Logistics integration- Table 4.2 presents four items of Logistics integration. All items were validated for their suitability for this study. All items were accepted for the final questionnaire without any changes.

Table 4.2: Initial measurement items for logistics integration

Construct	Measurement Item	Authors
LI#1	Our hospital recognises the importance of logistics integration with our suppliers	
LI#2	Our logistics activities are well integrated with suppliers' logistics activities	(Chen & Paulraj 2004)
LI#3	Our hospital has a seamless integration of logistics activities with our suppliers	
LI#4	Our inbound and outbound distribution of hospital supplies with our vendors/suppliers is well integrated	

Information Technology (IT)- Table 4.3 presents four items of Information Technology.

All items were validated for their suitability for this study. All items were accepted for the final questionnaire without any changes.

Table 4.3: Initial measurement items for information technology

Construct	Measurement Item	Authors
IT#1	Our hospital has information systems that work seamlessly across our key suppliers/ vendors	(Saraf, Langdon & Gosain 2007)
IT#2	Most of the invoices, purchase orders, funds, and other transactional processes with our suppliers are done electronically	(Chen & Paulraj 2004)
IT#3	Our hospital has advanced information systems that enable online tracking for orders and shipments	(Saraf, Langdon & Gosain 2007)
IT#4	We have electronic mailing capabilities with our key suppliers	(Chen & Paulraj 2004)

Information sharing- Table 4.4 presents five items of Information sharing. All items were validated for their suitability for this study. All items were accepted for the final questionnaire without any changes.

Table 4.4: Initial measurement items for information sharing

Construct	Measurement Item	Authors
ISS#1	We share sensitive information (financial, production, design, research, and/ or competition) with our key suppliers	
ISS#2	Suppliers are provided with any information that might help them	(Chen & Paulraj 2004)
ISS#3	We keep each other informed about events or changes that may affect the other party	
ISS#4	Exchange of information takes place frequently, informally and/ or in a timely manner	
ISS#5	We have frequent face-to-face planning/ communication	

Trust- Table 4.5 presents four items of Trust. All items were validated for their suitability for this study. All items were accepted for the final questionnaire without any changes.

Table 4.5: Initial measurement items for trust

Construct	Measurement Item	Authors
TR#1	Our hospital believes that our key suppliers would act in the best interest of the hospital	(Klein 2007)
TR#2	There is a wide agreement across our hospital that our key suppliers are competent and effective in their interaction with the hospital	(Paparoidamis, Katsikeas & Chumpitaz 2017)
TR#3	Our suppliers keep their commitments	(Paparoidamis, Katsikeas & Chumpitaz 2017)
TR#4	Our suppliers are interested in our organisation's well-being and not just their own.	(Klein 2007)

*Hospital-Supplier Integration-*Table 4.6 presents five items of HSI. All items were validated for their suitability for this study. All items were accepted for the final questionnaire without any changes.

Table 4.6: Initial measurement items for hospital-supplier integration

Construct	Measurement Item	Authors
HSI#1	Our logistics integration with our suppliers can be noted by having excellent distribution, transportation and warehousing facilities	(Chen & Paulraj 2004)
HSI#2	Inter-organisational coordination is achieved	(Chen, Preston & Xia 2013)
HSI#3	Exchange of information takes place frequently, informally and/ or in a timely manner	(Klein 2007)
HSI#4	We exchange performance feedback	(Klein 2007)
HSI#5	Our suppliers trust the processes of the hospital and update the hospital should any complain comes up	(Chen & Paulraj 2004)

4.7.1.3 Moderating variable

Lean practices- Table 4.7 presents four items of Lean practices. All items were validated for their suitability for this study. All items were accepted for the final questionnaire without any changes.

Table 4.7: Initial measurement items for lean practices

Construct	Measurement Item	Authors
LP#1	At our hospital, reducing waste is key strategy	(Shah & Ward 2003)
LP#2	At our hospital, we have the readiness to reengineer processes to eliminate waste	(Shah & Ward 2003)
LP#3	At our hospital, the flow of materials from the inventory to the physicians is quick and smooth	(Rahimnia & Moghadasian 2010)
LP#4	At our hospital, removing bottlenecks from our activities is very important	(Shah & Ward 2003)

4.7.1.4 Dependent variable

Hospital performance- Table 4.8 presents 12 items related to hospital performance. All items were validated for their suitability for this study. All items were accepted for the final questionnaire without any changes.

133

Table 4.8: Initial measurement items for hospital performance

Construct	Measurement Item	Authors
Qual#01	The quality of the order fulfilment process in our hospital is getting better with time	
Qual#02	We have seen an improvement in the quality of the order fulfilment process with time	
Qual#03	Based on our knowledge of the order fulfilment process, we think it is of high quality	
Spe#1	The length of the order fulfilment process in our hospital is getting shorter with time	
Spe#2	We have seen an improvement in the cycle time of the order fulfilment process with time	(Chen, Preston & Xia 2013)
Spe#3	Based on our knowledge of the order fulfilment process, we think it is short and efficient	
Cst#1	The cost associated with the order fulfilment process in our hospital is getting better with time	
Cst#2	We have seen an improvement in the cost associated with the order fulfilment process with time	
Cst#3	Based on our knowledge of the order fulfilment process, we think it is cost efficient	
Flex#1	The flexibility of the order fulfilment process in our hospital is getting better with time	
Flex#2	We have seen an improvement in the flexibility of the order fulfilment process with time	
Flex#3	Based on our knowledge of the order fulfilment process, we think it is flexible	

Note: Qual = Quality, Spe = speedCst = Cost, Flex = flexibility

4.7.2 Survey development

The design of the questionnaire is the most important part of research. Any mistake, however small, can seriously affect the research outcomes. Data-based approaches to questionnaire

design are quite common now with the development of the Internet and communication technology.

The requirements and steps involved in designing a questionnaire are explained in detail by Stone (1993). This is comprised of eight requirements. First, the questions should be appropriate to the study. There is no point in asking unrelated questions. This depends on the objectives of the study and the ultimate outcomes visualised. Second, the questions should be intelligible. They should be easily understandable in which case it is better to use the native language of the respondents. Third, the questions should be unambiguous in that they should mean the same thing to the researcher and the respondent. If the researcher asks a question with one meaning and if the respondent understands it in a different way, the responses will not match the research requirements. The format depends on the method used, such as postal, telephone, direct or any other channel. Open questions are desirable for qualitative work. Open questions can be useful to determine the type of data to be collected in step 1. Closed questions can elicit a dichotomous response (yes/no), a rating on a given scale or other forms of response. The choice of the question and the scale depends on whether the variable is categorical or continuous. Forcing responses into categorical types should be avoided as far as possible. A Likert scale can be used for rated answers.

Fourth, the questions should be perceived as unbiased by the respondent. Although the questions may appear quite unbiased to the researcher, the way they have been framed and a preference for one specific type of response may be directly or indirectly indicated. This will defeat the very purpose of the research. An equal chance for any type of response needs

to be ensured. If the answer depends on the memory of the respondent, there can be recall bias, meaning that only certain palatable events are always recalled in preference to unpleasant ones. Composing words with brevity is important. To design the layout and the presentation in the next step, a conversational tone is suggested. It is best to omit a question, if in doubt.

Furthermore, precise, simple, non-technical language is preferable especially for the general public. Each question should deal only with a single idea, without being leading or biased. Fifth, the omni-competency of the questions needs to be ensured. That is, the question should be capable of coping with any type of response. This is also related to its unbiased nature, although this is an impossible expectation for any question. The potential range of answers is determined by the expected number of respondents. However, the inclusion of options such as "other" or "any other" or a section for comments may enhance the chances of omni-competency.

As for the sixth requirement, there should not be any ambiguity or overlapping in the coding system. This needs to be checked and ensured. The categories must be exhaustive and mutually exclusive. For instance, there should not be any doubt whether an age of 30 years should fit within the 20 to 30 age group or in the next code. If the next code is 30-40, there will be confusion. If it is 31-40 and 21-30, then this will ensure a sense of clarity and hence it is better that the answers are self-coding.

The seventh requirement is that the questionnaire needs to be pilot-tested before it is used in the research proper. This point is described in detail in the section below, which deals with the pilot study used in this current study. Finally, and most importantly, the ethical

requirements must be met. Many organisations insist on this for all research undertaken by their staff, which is why they have clear procedures in place to ensure this. Ethical problems occur when the questions contain invasive, potentially hazardous or adversely impact security or privacy elements. Both the confidentiality of the identity of respondents and the data gathered from the participants needs to be protected from all types of threats using suitable procedures. These are usually guaranteed when requesting participation in the survey.

An introduction to the purpose of the study and an organisational and individual confidentiality guarantee are required. The word "questionnaire" should be avoided, as the term "form" is considered more acceptable.

The order of the items and questions in the form must be arranged in such a way so as to ensure that the respondent is kept interested and does not become bored. Clear print and the use of colour are very important. At completion, the respondent should be thanked for spending valuable time to complete the questionnaire. It is preferable to think about coding in advance, although it is not always possible to predict the complete range of answers. Preparing a first draft and pre-testing among a close circle and repeating it again with experts before piloting is the next desirable step followed by piloting and evaluation. These points are discussed in detail later on. The actual survey is only ready to be started at this point. Learning from mistakes forms part of good research. Using surveys repeatedly and improving upon the previous one each time, will enhance the capability of using the method

without serious errors over time. Many other authors have also provided similar ideas regarding the design of a questionnaire(Brace 2018).

Some key issues regarding questionnaire design have been discussed by researchers. Rattray and Jones (2007) explain that item generation and the scale construction of the questionnaire development are the first steps. In this step, a decision is made on what to measure, as well as what scale should be used for the measurement and the generation of items for the questionnaire. In this current study, the variables to be studied were determined based on the research aim, theoretical framework and the hypotheses outlined above. The constructs to be covered under each variable and the number of questions on each construct were determined based on the literature review. The opinions of experts and hospital managers were also sought, although not as a committee approach for construct validation. The pilot study plays an important role in the item generation.

In designing the actual questions, the order of questions, the language to be used, the framing of sentences and the response scales that will be used were determined on the basis of a literature survey. The type of response given by the respondent depends on how the question is framed. If the question is not understood, the respondent may not answer the question, leading to a rejection of the form as incomplete. If the question is wrongly understood, responses may be wrong. Thus, the cognitive aspects of questions are very important (Willis 2004). The comprehension of questions by participants is dependent upon what the respondent thinks the question is asking and what certain specific words and phrases used in the questions mean to the respondent. If there is a need to recall some information from

memory, the nature of the strategies used by the respondent will also influence the answer given for that question.

The motivation to answer a question accurately and sufficiently is reflected by the mental effort required from the respondent. If this effort is inadequate, the answers can be wrong. Telling the truth or telling what is good for the respondent may tilt the answer in a different direction, away from truth. This affects the research philosophy of positivism since accurate information is required. A cognitive answer involves the conscious or automatic answering of questions. If conscious answering is done where automatic answering is needed or vice versa, this can influence the answers. Thus, the study gives different examples to demonstrate the outcome of cognitive aspects by producing variations to the answers.

Questionnaire design has also been thoroughly explored by research. Mistakes in the writing of the questionnaire are one of the many possible non-sampling errors (Lyberg & Weisberg 2016). Literature has stressed the need to ask the right questions in a way that is properly phrased and correctly ordered. Irrespective of the type of media used for the questionnaire administration, the importance of its proper construction cannot be underestimated. The central aim of any questionnaire survey is to obtain the best answers (Brace 2018). Questionnaires provide a standardised interview across different respondents. Asking the same questions differently to different people can lead to responses that are difficult to interpret, especially in the case of large samples. The questionnaire is a medium of conversation between two (possibly remotely located and unlikely to meet) individuals. Although standardised questionnaires are widely in use, they have limited flexibility and

cannot be used in context-specific situations. All the respondents should be able to read each question for the same intended meaning.

Instead of viewing respondents as mere sources of information, they need to be considered as living individuals. Hence, the use of long questions with long sentences, difficult phrases and long, complex and boring questionnaires should be avoided(Brace 2018). Additionally, it should be recognised that creative responses are not possible with remote access. However, in exploratory research, writing questions is a simpler task. Preliminary research on the topic may indicate the issues and types of information required and familiarity with the context is essential to correctly word the questions. Thus, a questionnaire needs to be written in such a way that the required data to answer the research questions is collected as objectively and completely as possible without irritating the respondents and ensuring a minimum risk of errors. In this current study, the basic structure and variables of the study were determined based on other works discussed in the literature review, which were adapted to the context of this study.

According to research, the use of proper wording (directly, rather than indirectly, asking the required information), accurately drafting and crafting and using the right tactics in questionnaire design is crucial. These are also related to the context specificity (Bradburn, Sudman & Wansink 2004). In the context of this study, the best combination of variables in the questionnaire and the formation of questions were determined by reported findings in the literature review along with the specific context of this study.

4.8 Survey instrument validation

A pilot study refers to a smaller version of the full study, which enables survey instruments such as questionnaires to be pre-tested (Yu 2015). Such an approach has the advantage of increasing the likelihood of the main study succeeding and useful knowledge is generated through it (Zhang & Chen 2013). This section provides information about the pilot study, the evolution of the survey instrument and the validity of its content.

Empirical research is based on the systematic examination of conceptual abstractions through measurable and observable responses. This process is used to identify and explicate the phenomena of interest to a discipline.

4.8.1 Content validity

Content validity is an essential step in the development of new empirical measuring devices, as it represents an initial mechanism for linking abstract concepts with observable and measurable indicators. Content validity is defined as the extent to which an instrument adequately samples the research domain of interest when trying to measure certain phenomena (Wynd, Schmidt & Schaefer 2003). In the case of questionnaire surveys, questions should be able to measure the full range of the construct under consideration. To achieve this, duplicate questions on similar items are to be avoided. Thus, the full range of variables is covered. Both the content validity of each item and of the overall scale are important and are measured (Bell, Bryman & Harley 2018; Zikmund et al. 2013).

Validity is a difficult factor to assess and it can take many forms. For instance, items in a questionnaire must relate to the construct being measured. Content validity is based on how representative the questions are in sampling the adequacy of items. This is achieved when items are first selected. However, items that are blatantly very similar to other items are typically not selected. This is required to ensure that the questions cover the full range of the construct. As noted by other studies, researchers compute two types of content validity indices. The first type involves examining the content validity of individual items and the second involves investigating the content validity of the overall scale (Bell, Bryman & Harley 2018; Zikmund et al. 2013). There is considerable agreement regarding how to compute the content validity indices. A panel of content experts are asked to rate each scale item in terms of its relevance to the underlying construct. Research advises a minimum of three experts but indicates that more than 10 is unnecessary (Lynn 1986).The experts give their ratings to test the degree of agreement between the experts. If the degree of agreement is wide, the question is removed. The process also will be quite unwieldy and will waste a certain amount of time.

The second method involves conducting a pilot study with a smaller sample size and the opinions of the participants regarding the contents whose relevance and practicality are considered and then questions, and formats are revised as necessary. A pilot study is intended to represent a smaller version of the full study. This enables pre-testing of a survey instrument such as a questionnaire and enhances the success of the study. A pilot study enables the identification of problems with items included in the questionnaire, their nature, order, framing and the time taken to complete the questionnaire. These inputs help to revise the content of the questionnaire, if necessary, as well as plan and organise the survey

efficiently and effectively (Bell, Bryman & Harley 2018; Zikmund et al. 2013). The small sample used in the pilot study should represent and indeed reflect the larger sample used in the study properly, otherwise the applicability of the pilot study to a large sample group will be doubtful.

A committee approach for establishing content validity was not conducted for this research. However, a pilot study was conducted, and the opinions of the pilot study respondents were gathered regarding the relevance, practicality and validity of the survey. A committee approach was not utilised due to the multi-disciplinary nature of the study as this would have required engaging a fairly large panel of experts. This would be comprised of academic experts to examine the quality, procurement, supply chain and medical/general administration of hospitals and these experts may not possess practical working knowledge of the various aspects of the hospital-supplier relationship. Therefore, a pilot study on the working professionals in this domain was chosen in favour of a committee approach for content validity.

4.8.2 Pre-test phase

Pre-testing is the best stage for scholars to measure the importance of attributed to survey questionnaire. Failure to understand the questioners item may lead to respondents falsifying answers, missing responses and possibility, and misinterpretation, which may result in offending the respondent (Bowden et al. 2002). With regards to this current study, a pre-test was conducted prior to the pilot study. Validation was used to validate the content of the

survey instrument by looking into the degree of the significance of variable item as well as confirming the proposed item in the survey from the industry representatives and academics.

These academics and professional had extended knowledge in the field of healthcare sector in Saudi Arabia and had much experience in this field (last 30 years).

Table 4.9 : Industry experts for the pre-test

Expert	Background of experts	Years of Company operation	Organisationtype
Expert # 1	Professor at King Abdulaziz University, 27 years of experience working as Health services and Hospital Administration in health department.	>50	Academic institute
Expert # 2	Professor at King Abdulaziz University, 21 years of experience researching in health service sector.	>50	Academic institute
Expert # 3	Professor and Consultant at Prince Mohammad Bin Abdulaziz Hospital-Riyadh. 24 years of experience working as Healthcare Supply Chain Director	>10	Hospital and medical firm.

Given that the data collection took place in Saudi Arabia, an Arabic version of the questionnaire was prepared by a certified interpretation officer. This was done to ensure an accurate translation specifically of the technical terminologies. The questionnaire was pre-tested on two senior researchers from the Faculty of Economic and Administration at the King Abdulaziz University, Jeddah (West) and one Senior Manager and Consultant of

Healthcare at Prince Mohammad Bin Abdulaziz Hospital Riyadh. The qualitative feedback obtained from the participants of the pre-test was mostly positive other then:

1. Deleting two of the questions in the survey relating to the:

    a. Number of years the hospitals have been in operation

    b. The geographic location of the hospitals.

2. Reducing the ambiguity of some questions, and

3. Extending the scope of the study to cover hospitals across Saudi Arabia, rather than only in the four major cities of Saudi Arabia including; Riyadh, Makka, Dammam, and Asir.

The feedback obtained from the participants of the pre-test was addressed; and some of the questions were rephrased to reduce their ambiguity. Furthermore, the scope of the survey was extended to the whole country not just the four major cities of Saudi Arabia. These changes helped make the questionnaire of higher legibility and more appropriate to the context to achieve the aims and objectives of this study. A copy of the survey in the two languages (English and Arabic) is provided in the Appendix.

4.8.3 Pilot study phase

The pilot study involved testing the survey and conducting face-to face interviews with selected hospital managers in seven Saudi Arabia hospitals, three of which were private and the remainder public. A total of 10 executives including representatives from procurement, supply chain, medical administration, quality and general administration departments were engaged in the pilot study.

The quantitative results from the pilot survey of 10 managers revealed that two of the survey respondents were females and the remaining eight were males. From an educational perspective, three of the respondents had a master's degree and the remaining seven held a bachelor's degree. The distribution of occupation was as follows - there were two people each from the quality, procurement, supply chain, medical and general administration departments. In terms of experience, measured by the number of years in practice, all the respondents had between 11 and 20 years of general practice and experience in healthcare. Five of the respondents were associated with 101-299 bed sized hospitals and the remainder were associated with 300-499 bed sized hospitals. In terms of the number of employees, all the respondents had less than 1,499 employees working in their organisation. The responses of the respondents with regards to the logistics integration, IT, information sharing, trust, lean practices and hospital performance were found to be acquiescent since the majority either strongly agreed/agreed or strongly disagreed/disagreed with the questions.

Overall, the results of the pilot study were consistent with what one would expect from a study of this nature. The recommended changes were made to the Arabic version of the survey, which were then used to apply the changes to the English version of the questionnaire.

The content of the survey was also validated through a statistical reliability analysis. Table 4.10 shows the pre-test of survey variables using Cronbach's alpha. Since this test can only be carried out after conducting the survey, it is confirmatory in nature.

Table 4.10: Pre-test of survey variables using Cronbach's alpha (Pilot sample)

Scale	Number of Items (N)	Cronbach's Alpha
Logistics Integration	4	0.788
Information Technology	4	0.845
Information Sharing	5	0.763
Trust	4	0.917
Hospital-supplier Integration	5	0.838
Lean Practices	4	0.815
Hospital Performance	12	0.986

4.9 Assessment of dimensionality and factor structure through exploratory factor analysis (EFA)

An exploratory factor analysis (EFA) is a complicated, multi-level statistical process that is used to arrange the measurement of constructs by researchers who have developed and need to measure a tentative theory. The measurement of constructs involves determining the number of factors that a study must have and examining which specific factors are biased on which hypotheses (Costello & Osborne 2005).

The aim of an EFA is to select a great number of variables and divide them into smaller groups that comprise a more attainable number whilst preserving as many of the original factors as achievable. EFA is utilised to define and compile data by combining variables together, which can be linked to discover the sub-elements that highlight a particular set of

items determining each of the theoretical dimensions of a nomological network that is appropriate to the background of the research (Watkins 2018). An EFA is used to recognise the dimension of a theory and is considered to be a suitable tool when a new set of scales is being established. An EFA is used to first identify the structure between the concepts. Second, it is used to identify and assess the single dimensionality of the hypotheses and, finally, it is used to achieve a minimisation in the number of existing variables (Williams, Onsman & Brown 2010). This current study did not use an EFA for the purpose of data collection. It used a questionnaire that had been developed by Chen, Preston and Xia (2013)Chen and Paulraj (2004), Klein (2007), Rahimnia and Moghadasian (2010), Saraf, Langdon and Gosain (2007); Shah and Ward (2003)to collect the data.

4.10 Ethical approval

The RMIT University has certain regulations regarding the ethical aspects for the conduction of research by its staff and students according to Australian guidelines. The confidentiality, security of information and safety of participants needs to be protected through ethical research practices. Any research involving humans as subjects needs to obtain ethical clearance before the research work commences. The RMIT University also has a College of Human Ethics Advisory Network (CHEAN) and a Human Research Ethics Committee (HREC) for this purpose. The required ethical clearance was obtained from the competent authority before commencement of this current study.

4.11 Survey administration

As mentioned above, the final version of the survey questionnaire (English and Arabic) was administered online to 1,490 participants and hard copies were sent to 685 participants

totalling 2,175 managerial executives spread over 435 public, private and other government sector hospitals across all of Saudi Arabia. Of the 569 returned responses, 71 were incomplete and therefore excluded from the analysis.

4.12 Summary

This study is concerned with hospital-supplier integration and its effect on the order fulfilment performance of hospitals in Saudi Arabia. Based on the research onion proposed, the research philosophy of this study adopted a positivist perspective. The study can be categorised as applied primary research in which a quantitative method is used for investigation using correlation methods. It uses deductive reasoning. The research design has been discussed extensively to justify the research plan of this study.

Based on a systematic literature review, a set of hypotheses were proposed in Chapter 3. The aim of this chapter was to test the validity of the hypotheses. Hence SEM was used as the tool for this.

This current study also used a questionnaire survey of a suitably selected sample of the population. The population consisted of a total of 435 public, other government sectors and private hospitals in Saudi Arabia. Five managers from each hospital concerned with the main and supportive functions of the SCM of these hospitals constituted the total available population for the survey. This was a cross-sectional single shot field study. A set of the collected data for the pilot study and the survey was modified accordingly. The regulatory requirement of ethical approval required by the competent authority was obtained before

administering the questionnaire to the respondents. The data analysis consisted of frequency and descriptive statistics, variable scoring, normality tests, Chi square test of independence, independent sample t-test, correlational analysis and a mediation analysis. The analysed results were converted into summary tables and charts for presentation in the next chapter, which outlines the results obtained from this research.

CHAPTER 5: PRELIMINARY ANALYSIS AND RESULTS

5.1 Introduction

This chapter will discuss the preliminary analysis and outcomes that emerged from the analysis of the data. The overall analysis focuses on using statistical techniques and approaches to test the proposed hypotheses. It includes an overview of the sample size and response rate along with the statistical approaches required to achieve the purpose of the study. This chapter presents an overview of the response rate and sample size of the collected data in Section 5.2. In addition, Section 5.3 presents the data cleansing and screening processes to ensure that the reliability and validity of the data was obtained. Section 5.4 presents the data analysis and modelling. Furthermore, in this chapter the test of normality and demographic profile will be present in Sections 5.5 and 5.6, respectively. In Section 5.7, a summary of this chapter is provided.

5.2 Response rate and sample size

There is a total of 435 hospitals in Saudi Arabia. It was estimated that there would be at least five relevant managers in each of these hospitals. Therefore, the total population size for the study was deemed to be 435 x 5 or 2,175 people. Most of these people were targeted through online surveys 1,490 (69%) and the remaining 685 (31%) were targeted using paper-based surveys. A response rate of 26.2% was achieved for both of these channels. This response rate falls within the recommended range of response rates for quantitative studies targeting organisations (Baruch & Holtom 2008). A total of 441 online surveys were completed and

128 paper-based surveys were returned. Of the 441 online surveys, 128 surveys were only partially completed, and the remaining 313 surveys were fully completed. Similarly, out of the 128 paper-based surveys, 10 surveys were only partially completed, and the remaining 118 surveys were fully completed. Thus, partially completed surveys were excluded from the research. The final sample consisted of a total of 430 surveys. One hundred and ninety-seven (46%) of these were associated with public hospitals and the remaining 233(54%) were associated with private hospitals.
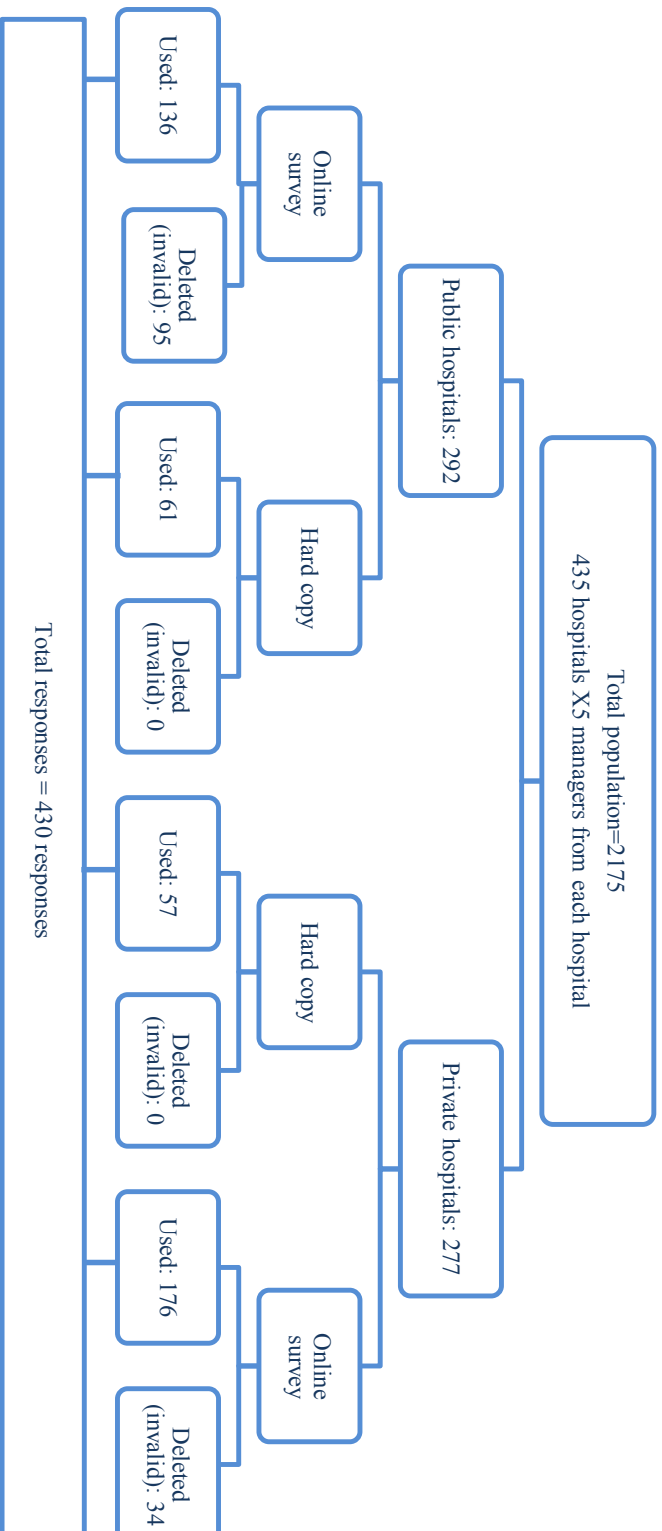
Figure 5.1Schematic representation of survey administration and response data

153

5.3 Data cleansing and screening

The inclusion of missing values (i.e. the items which were not answered and left as blanks in the data matrix) could potentially bias the results of the statistical analysis (Tabachnick & Fidell 2007). Consequently, it was imperative to screen the responses for missing values. Any consistent or regular patterns in the missing values were ascertained. It was found that approximately 180 surveys out of the 569 were partially completed. Consideration was given to replacing the missing values with the median (50th percentile) mode or mean score for the corresponding item but, since the response rate of the study was high—in spite of ignoring the partially completed survey responses—the study was already left with a large sample size of430, it was decided to disregard the partially completed surveys. According to research, the procedure for handling missing values is simply to drop any instances containing them (Acock 2005). If only a few cases contain missing data and these seem to be a random sub-sample of the whole sample, deletion is a good alternative (Tabachnick & Fidell 2007).

5.3.1 Addressing the concerns of questionnaire bias

A definition of bias is the expected difference between the estimated and true characteristics of the population. When using questionnaire survey methods, certain types of bias are possible (Berg 2005). Two of these are known as method bias and no-response bias. These are explained in the following paragraphs and in the next subsection. A common method bias has been documented by many of those involved in social science research(Buchanan & Bryman 2009). When multiple constructs are measured using the same methods, such as multiple scale items being presented within the same survey, such biases are possible. Spurious impacts—due to the measurement of instruments rather than to the impact of constructs—is possible. For instance, when participants are asked to rate

their perceptions regarding two or more constructs in the same survey, spurious correlations due to response styles, social desirability and priming effects can occur. These are independent from the true correlations among the constructs measured. The most common method of measuring and controlling this bias is to use a multifruit–multimethod study(Conway & Lance 2010).

5.3.2 Non-response bias

Non-response indicates a survey response that is outside the range of responses that are considered valid in the research design. There can be two types of non-response. Item non-response refers to the non-response to a survey item when accompanied by at least one valid response from the same respondent. This occurs when responses to some questions are left blank or there is a failure to respond to some questions while answering other items properly. In unit non-response, there is complete non-participation by a respondent whom the survey designers wished to include. Here, the term 'unit' means one specific observation or a single vector of measurements. This usually corresponds with one particular individual at a given time. A sample is comprised of many individuals. Biases are possible with both of these non-response types. As the collection took place in one phase of the study, there is good evidence in the literature that occurrence of non-response bias is at a minimum and there are therefore, no major concerns in this regard (Barclay et al. 2002; Sheikh & Mattingly 1981).

Non-response refers to the error that is expected to be made in estimating a population characteristic due to the non-response of respondents in a survey. Non-random sampling

155

is implied in non-response bias. Non-representative sampling mistakes occur in the coding of survey responses and in the behaviour of the respondents themselves. Being a non-responder in itself leads to the non-random character of the sample. Certain types of individuals refuse to respond to certain types of questions. This action of selecting whether to respond or not themselves is known as selection bias. Selection bias overlaps with non-response bias. There can be different labels for similar types of biases. If only certain particular types of individual are in the sample, then there is a misspecification bias. Misreporting bias occurs when misleading responses are deliberately provided by respondents. These biases are also known as response bias, misclassification bias, contaminated data bias or misreporting bias (Bell, Bryman & Harley 2018; Zikmund et al. 2013). The results from this current study showed that non-response bias did not have any influence in this study as shown in Table 5.1.

Table 5.1: Non-response bias related statists

Variable	χ^2	Sig.
Department associated with	2.737	0.560
Level of education	6.485	0.245
Gender	1.954	0.489
Managerial experience (in years)	4.869	0.495
Managerial experience in healthcare (in years)	1.477	0.456
Hospital type	6.542	0.162
Hospital size	4.457	0.477
Number of employees	2.354	0.468

5.3.3 Missing data

Missing data is common in research studies. Minimising the occurrence of missing data and applying the biases can increase the accuracy of data. However, after the completion

of the study, improvements can only be achieved by testing whether the bias exists and remedying this through suitable modifications in the analytical procedures (Ott & Longnecker 2015). In the case of unit non-response, entire units are missing from the samples, no test or correction can be implemented without additional data, which should include information regarding respondents who did not respond to all the questions in the survey (Barclay et al. 2002; Berg 2005; Sheikh & Mattingly 1981). However, for item response, methods of estimation and correction are available. One such option is the framework of intelligent guesses where the average value of reported responses and predictive equations are used as input methods to fill the missing values. This method has the effect of overstating the precision of estimated values. In the weighting method, partial observations are discarded, and a weight is assigned to each complete observation. The weighted sample represents the average characteristics of the population effectively.

However, the weights themselves may be imprecise and the estimation of standard errors accounting for this will be problematic. Hence, this method is generally not recommended. The usual approach is to discard incomplete responses and to use only the completed responses for the analysis. However, only rarely are the accepted samples representative of the population and hence, this method is also undesirable. The maximum likelihood method is the best available method. This is based on the probability of finding the sample as a function of the population and defined distribution parameters. The likelihood objective of the probability distribution equation is maximised with respect to the defined parameter. This produces the desired characteristics typical of the properties

of maximum likelihood estimation. The probability distribution can be approximated to normal distribution and thus, analysed as per the normal data. However, robust assumptions regarding the probability function need to be made. This method is applied in a wide variety of missing data contexts. However, if the missing data is a dependent variable, this method is not useful. Non-response bias is measured using validity or a validation test. Survey design and randomised responses are two methods of minimising non-response bias. Budget constraints may ultimately determine the survey method used and thus affect the possibility of non-response bias. In such situations, there is an obvious trade-off between the precision and non-response bias. To address this aspect in this current study, the data collected was verified case-by-case and further verification was conducted by using a frequency distribution. The results yielded 107 missing values. These values were excluded from the analysis.

5.3.4 Assessment of common method variance and social desirability bias

Research defines common method variance as 'variance that is attributable to the measurement method rather than to the constructs the measure represents' (Podsakoff et al. 2003, p. 879). The use of surveys as instruments to collect data is sometimes associated with common method variance, which may prompt misleading conclusions regarding the relationships between various variables together with inflating and deflating the findings (Craighead et al. 2011). In order to address this issue, this current study adopted a Harman single-factor test with the aim of identifying and measuring variables that reflect the observed constructs (Podsakoff et al. 2003). The basic assumption of this test is that if a substantial amount of common method variance is present, a factor analysis of all the data

will result in single factor accounting for the majority of covariance in the dependent and independent variables.

An EFA was used where all the variables were loaded into a single factor, with no rotation. Referring to the extraction sums of square loadings in Table 5.2, the results reveal that 39.543% of variance is attributed to the measured items. This value is well below the threshold value of 50%, which indicates that there was no possibility of a common method variance problem within the data. The Harman's single factor test, a commonly used technique, aims to analyse the variance of this study. EFA is used to determine the number of factors that help to examine the variance between the variables. Common method bias occurs when the variation is a result of the instruments used for data collection. The EFA involves loading all the variables into a single factor so that rotation can be avoided. This type of technique does not involve controlling the variance statistically. It is a sensitive technique, which helps to review and analyse the number of variables involved.

Table 5.2: Results of the Harman's single factor solution

Component	Initial eigenvalues			Extraction sums of squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.42	39.543	39.54	15.422	39.543	39.543
2	4.74	12.155	51.70			
3	2.35	6.036	57.73			

5.4 The purpose of data analysis and modelling

5.4.1 Aims

The aims of data analysis and modelling are

1. To describe the demographic characteristics of all the participants who responded to the questionnaire.

2. For the overall sample:

    a. To establish if there is a significant association between hospital type, hospital size and the various measures of logistics integration, including: IT, information sharing, trust, lean practices and hospital performance.

    b. To establish if there is a significant association between hospital type and hospital-supplier integration and/or hospital performance; and hospital size and hospital-supplier integration and/or hospital performance.

    c. To establish if there are significant correlations between the various measures of logistics integration, IT, information sharing, trust, HSI, lean practices and hospital performance.

    d. To establish whether lean practices play a moderating role between HSI and hospital performance while governing the hospital type and hospital size.

3. For the public and private hospitals, separately:

a. To summarise the responses associated with the various measures of logistics integration, IT, information sharing, trust, HSI, lean practices and hospital performance.

b. To establish if there is a significant association between HSI and logistics integration, IT, information sharing and trust.

c. To establish if there is a significant association between HSI and hospital performance.

d. To establish if lean practices can mediate the relationship between HSI and hospital performance while governing the hospital size.

5.4.2 Data coding and software

Data is coded according to a numerical system transposed upon a Likert scale according to the nature of the questions. For example, nominal data can be expressed as n-valued variables. Ordinal data is multi-valued with an ordering relationship where the actual distance between any two-neighbour values is unknown(Katz 2011). This will involve the following format of a scale of three-points such as:

1. Strongly disagree
2. Disagree
3. Somewhat disagree
4. Neutral
5. Somewhat agree

6. Agree

7. Strongly agree

A quantitative analysis was conducted using the most updated version of SPSS statistical software (IBM SPSS AMOS version 23). The SPSS software has proven to be consistently reliable in a variety of statistical analysis projects. The data analysis that was undertaken is described in the subsequent sections.

5.4.3 Frequency counts and descriptive statistics

Frequency distributions (counts and percentages) were presented for all the questions with a categorical response (nominal or ordinal) and descriptive statistics (mean and standard deviation or median and interquartile range as appropriate) were tabulated for all the questions with a continuous response. The trends were summarised, based upon whether the majority (more than 50% of the participants) agreed or disagreed with the items. The skewness of the distributions (e.g. whether the highest frequencies were located at the agreement or disagreement end of the scales) was noted where applicable.

5.4.4 Sampling framework

From every hospital in Saudi Arabia, five categorises of managers were considered for survey participation. These were procurement executives, logistics and supply chain managers, medical services managers, chief executive office (for small hospitals only) and quality management directors. An online survey was used for the majority of participants separated by geographical barriers, as Saudi Arabia is a large country. However, it has a reliable and fast Internet network. This also saved travelling, contacting and personal access time. Hard copy surveys were utilised in the remainder of cases. The

contact details for both the hospitals and the participants were obtained from the MOH. The managers were contacted individually (by distributing the questionnaire in both hard, and soft copy) to explain the research project and they were briefed regarding their right of refusal to participate and withdraw from the study at any time. Consent documents signed by the willing participants were obtained. The sample size and survey response rate details were provided earlier in Section 5.3.

5.4.5 Reliability analysis and validity

Based on the results of the pilot study, and the need to ensure consistency, the scale items were subjected to reliability tests utilising the Cronbach Alpha statics as a measure. An alpha value of 0.7 or above was considered to be reliable and the set of items were internally consistent in measuring the thought of each factor (Santos 1999). There were six scales used in the survey including: logistics integration, IT, information sharing, trust, lean practices and hospital performance.

The reliability coefficient for logistics integration was found to be 0.847 (Items=4); the reliability coefficient for IT was found to be 0.759 (Items=4); the reliability coefficient for information sharing was found to be 0.780 (Items=5); the reliability coefficient for trust was found to be 0.853 (Items=4); the reliability coefficient for HSI was found to be 0.838 (Items=5) the reliability coefficient for lean practices was found to be 0.783 (Items=4); and the reliability coefficient for hospital performance was found to be 0.972 (Items=12). Since all these Cronbach's alphas were greater than the 0.7 alpha value, the

163

items from the scales were deemed fit (reliable) to be used in the analysis. The data is presented in Table 5.3.

Table 5.3: Reliability test of survey variables

Scale	Number of items (N)	Cronbach's alpha
Logistics integration	4	0.847
Information technology	4	0.759
Information sharing	5	0.780
Trust	4	0.853
Hospital-supplier integration	5	0.838
Lean practices	4	0.783
Hospital performance	12	0.972

The results of the reliability analysis indicate that the items included in the survey were valid, non-repeating and representative of the various aspects of logistics integration, IT, information sharing, trust, lean practices and hospital performance being measured. Therefore, the reliability analysis confirms the validity of the items that were used in the questionnaire.

5.4.6 Variable scoring

A 1-7 Likert scale was used to collect the data. High scores indicated a high level of agreement and low scores indicated a low level of agreement. Furthermore, a hospital-supplier score was calculated as an average of the logistics integration score, IT score, information sharing score and trust score. A high score for these variables indicated high levels of HSI and a low score indicated low levels of HSI.
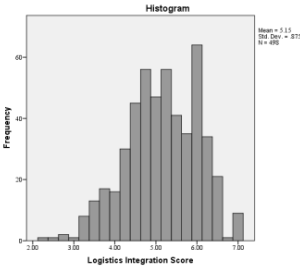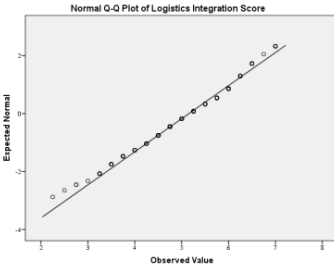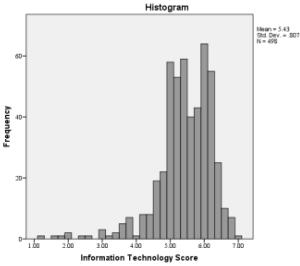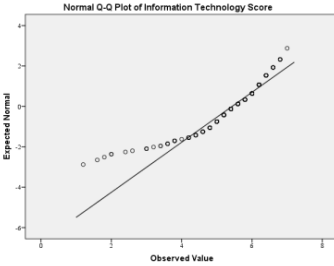
5.4.7 Independent sample t-Test
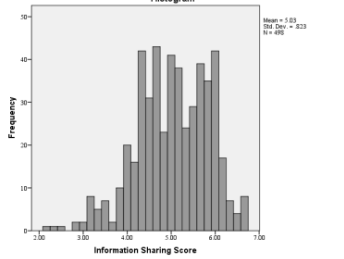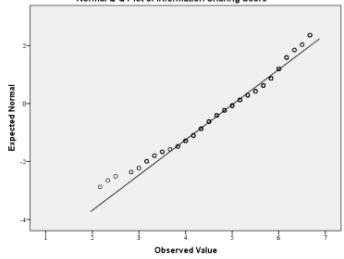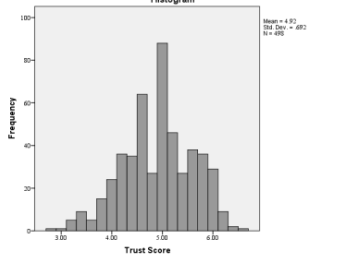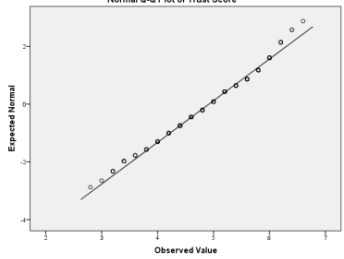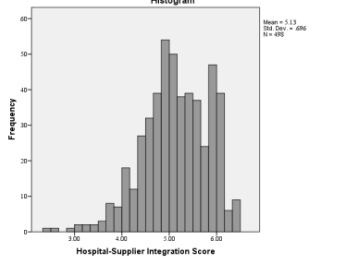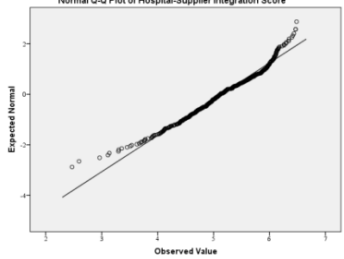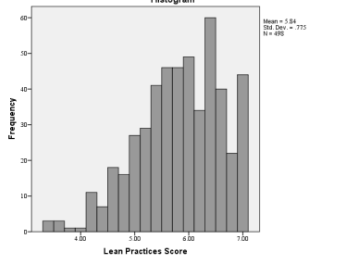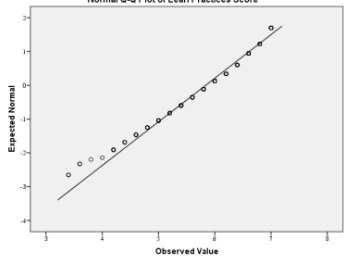
An independent sample t-test was utilised to test the two means of two independent variables, which are significantly different from each other. Equal variances between groups were assumed for this test.

5.5 Test of normality

Histograms and normal Q-Q plots were inspected for all the variables to assess normality. Most of the plots indicated normality or near-normality and therefore the subsequent use of parametric statistics and techniques was justified.

Table 5.4: Test of normality –all hospitals

Variable	Histogram	Normal Q-Q Plot
Logistics integration		
Information technology		

Variable	Histogram	Normal Q-Q Plot
Information sharing		
Trust		
Hospital-supplier integration		
Lean practices		

Variable	Histogram	Normal Q-Q Plot
Hospital performance quality		
Hospital performance speed		
Hospital performance cost		
Hospital performance flexibility		

167

Variable	Histogram	Normal Q-Q Plot
Hospital performance overall		
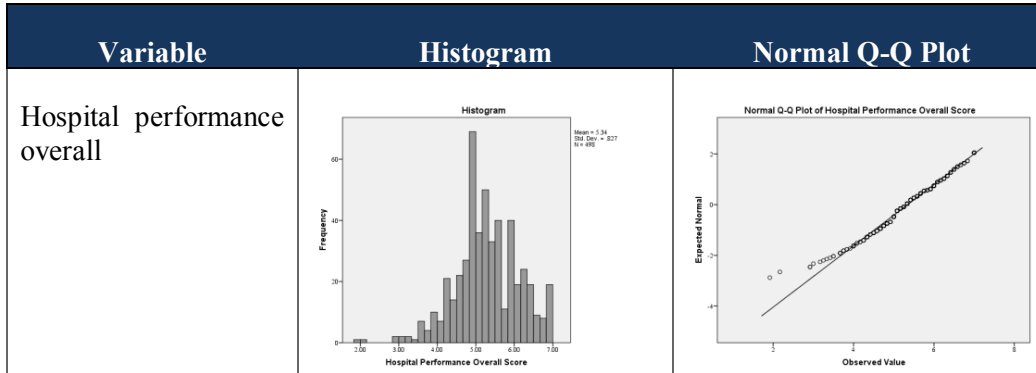
5.6 Demographic profile

A demographic profile of the survey participants was collected for response data classification and characterisation. These included their gender, level of education, departmental affiliation in the organisation, total and healthcare managerial experience and finally the hospital size in which they worked in (in terms of the number of beds and of employees). The same type of data was collected for both public (including other government sector hospitals) and private hospitals.

Educational levels were measured in terms of diploma, degree, post-graduate, doctorate, and post-doctorate. These adequately covered the full range of educational qualifications normally found among hospital managers. Departments to which the participants belonged were procurement, supply chain, medical, general or quality administrations. Of these, the first two are more directly related to supply chains and logistics while the others are supporting departments. Experience was measured in five periods, from less than five years to more than 20 years, conveniently spaced at five-year interval classes.

The overlapping of codes was avoided by clearly differentiating the class intervals, such as 11-15 and 16-20.

5.6.1 Respondents' profile

For all hospitals, the sample size was n = 430 (197 public and 233 private). A clear majority of the participants were males (n = 397, 92%). The largest group of participants held a graduate or a bachelor's degree (n = 167, 38.8%). This was followed by people with a post-graduate or a master's degree (n = 113, 26.3%) and those with a PhD (n = 92, 21.4%). It should be noted that a large proportion of the participants held higher education degrees (e.g. post-graduate/masters or above). Almost one-fifth of the participants held the position of a procurement executive, logistics and supply chain manger, medical services manager, chief executive officer or a quality management director. This is important because the procurement department plays an important role in the supply chain and logistic aspects of an organisation.

Similar trends in the participants of the organisation were observed with regard to departmental affiliations. Almost one-fifth of the participants were each affiliated with the procurement department (n = 89, 20.7%), supply chain department (n = 85, 19.8%), medical administration department (n = 88, 20.5%), general administration department (n = 81, 18.8%) and the quality administration department (n = 87, 20.2%), respectively.

A vast majority of the participants had more than 11 years of experience (n = 391, 90.9%). Amongst these, the largest group had between 16-20 years of experience (n = 161,

37.4%). This was followed by people with more than 20 years of experience (n=117, 27.2%) and people with between 11-15 years of experience (n = 113, 26.3%). These results indicate that the sample was characterised by people who had a large amount of experience. Almost a quarter of each of the participants was indicated to have between 11-15 years of experience in healthcare (n = 115, 26.7%), between 16-20 years of experience in healthcare (n=109, 25.3%) and 6-10 years of experience in healthcare (n = 105, 24.4%). The other major group was people with more than 20 years of experience in healthcare (n = 75, 17.4%). The respondent demographics are shown in Table 5.5.

Table 5.5: Respondent demographics

	All Hospitals		Public		Private	
Gender						
	Number	Percent	Number	Percent	Number	Percent
Female	33	7.7	8	4.1	25	10.7
Male	397	92.3	189	95.9	208	89.3
Total	430	100.0	197	100.0	233	100.0
Level of education						
	Number	Percent	Number	Percent	Number	Percent
Diploma	6	1.4	1	0.50	5	2.1
Graduate/Bachelors	167	38.8	66	33.5	101	43.3
Post-graduate/Masters	113	26.3	58	29.4	55	23.6
PhD	92	21.4	52	26.4	40	17.2
Fellowship/postdoctoral	52	12.1	20	10.2	32	13.7
Total	430	100.0	197	100.0	233	100.0
Department associated with						
	Number	Percent	Number	Percent	Number	Percent

	All Hospitals		Public		Private	
Procurement executive	89	20.7	43	21.8	46	19.7
Logistics and supply chain manager	85	19.8	39	19.8	46	19.7
Medical services manager	88	20.5	41	20.8	47	20.2
Chef executive officer	81	18.8	35	17.8	46	19.7
Quality management director	87	20.2	39	19.8	48	20.6
Total	430	100.0	197	100.0	233	100.0
Managerial experience (in years)						
	Number	Percent	Number	Percent	Number	Percent
Less than 5 years	3	0.7	1	0.5	2	0.9
6-10 years	36	8.4	13	6.6	23	9.9
11-15 years	113	26.3	46	23.4	67	28.8
16-20 years	161	37.4	75	38.1	86	36.9
Above 20 years	117	27.2	62	31.5	55	23.6
Total	430	100.0	197	100.0	233	100.0
Managerial experience in the healthcare (in years)						
	Number	Percent	Number	Percent	Number	Percent
Less than 5 years	26	6.0	12	6.1	14	6.0
6-10 years	105	24.4	44	22.3	61	26.2
11-15 years	115	26.7	48	24.4	67	28.8
16-20 years	109	25.3	48	24.4	61	26.2
Above 20 years	75	17.4	45	22.8	30	12.9
Total	430	100.0	197	100.0	233	100.0

Figure 5.2 shows the gender distribution of respondents in public and private hospitals in Saudi Arabia. There is an indication that about 92% of the sample were male, which is to be expected in a country such as Saudi Arabia where the majority of the workforce is male.
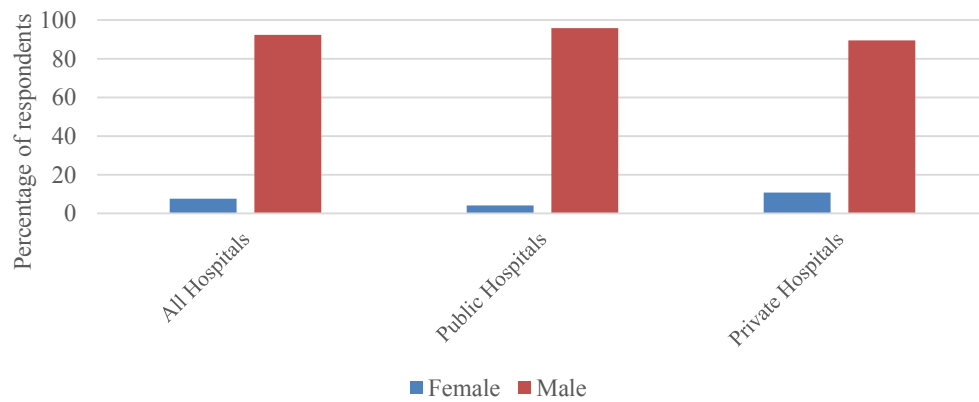
Figure 5.2Distribution of respondents by gender

Figure 5.3. The education level of respondents in Saudi Arabia shows that almost 99% of the sample held a bachelor's degree and higher. This indicates that the sample was comprised of well-educated people.
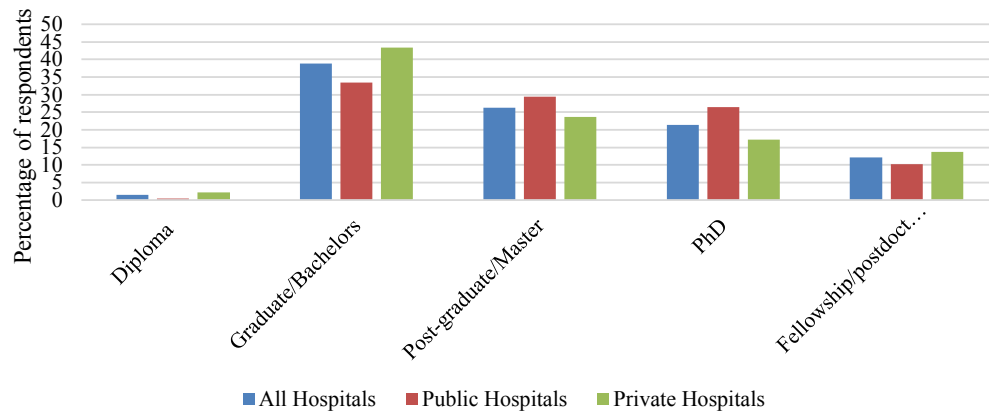
Figure 5.3 Education level of respondents

Figure 5.4 shows the distribution of respondents in hospital departments in Saudi Arabia. The participants were from across all hospital departments, which is ideal for taking into account different perspectives.
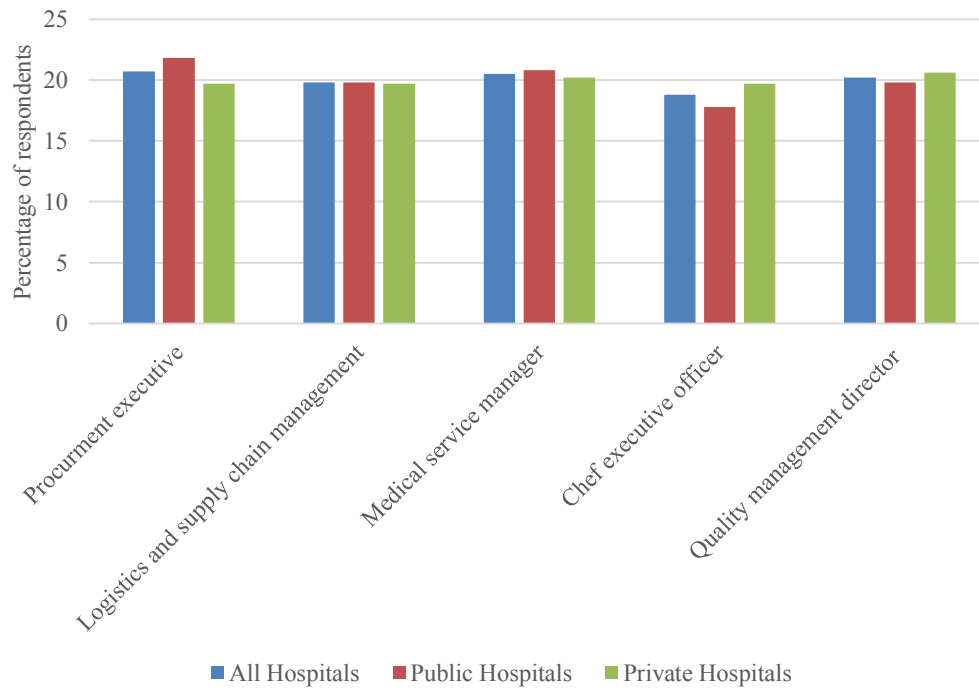
Figure 5.4 Distribution of respondents in hospital departments

Figure 5.5 indicates respondents 'years of experience working in hospitals in Saudi Arabia. It shows that 91% of the sample had more than 11 years of experience.
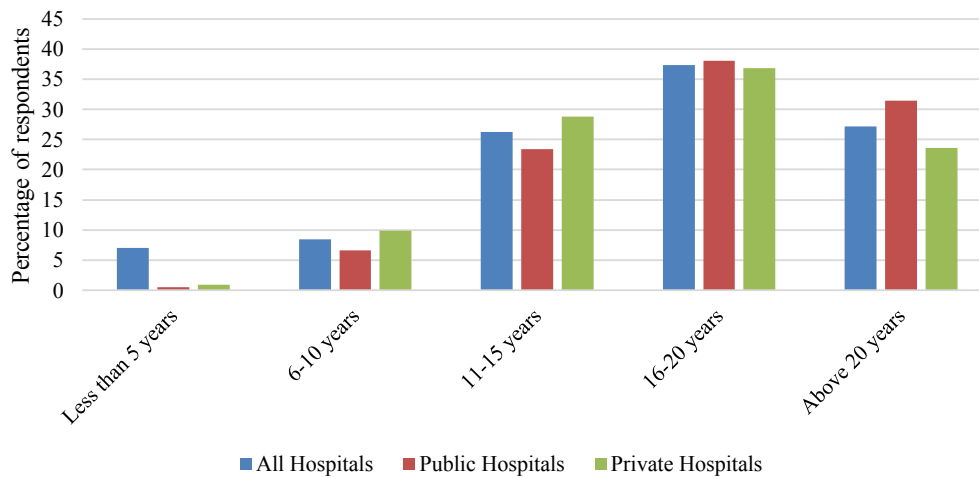
Figure 5.5 Respondents' experience in managerial positions

Figure 5.6 indicates respondents' experience working in Saudi Arabia's healthcare sector. This shows that about 79% of the sample had more than 11 years of experience in the healthcare sector. This experience combined with the high level of education shown in Figure 5.3 affords more trust in the results.
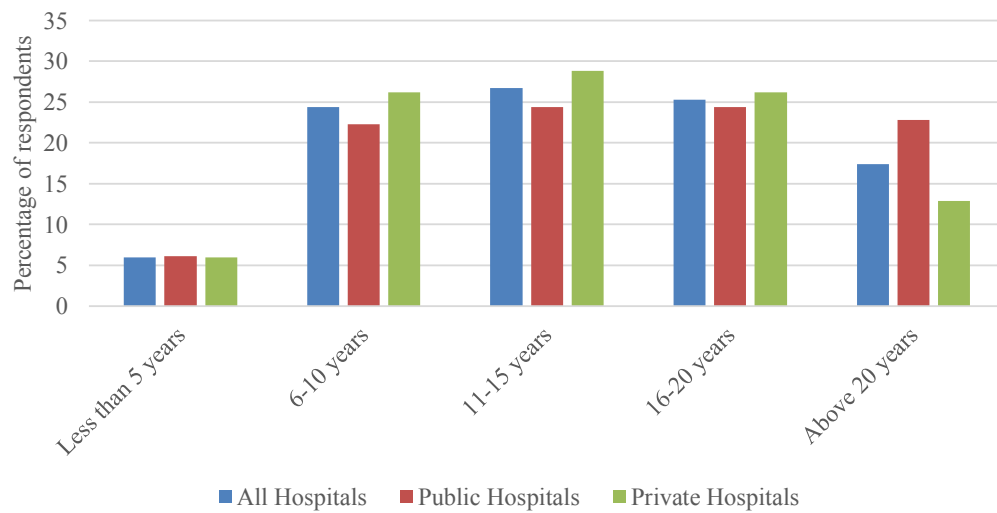
Figure 5.6 Respondents' experience in the healthcare sector

5.6.2 Organisations

Across all the hospitals, 197 respondents were associated with public hospitals (45.8%) and the remaining 233 were associated with private hospitals (54.2%). The largest group of respondents was associated with hospitals with 100 beds or less (n=182, 42.3%). This was followed by almost one-third of respondents who belonged to hospitals with 101-299 beds (n=142, 33%). The balance of the respondents was associated with either hospitals with 500 or more beds (n=53, 12.3%) or hospitals with 300-499 beds (n=53, 12.3%). The

largest group of respondents were associated with a hospital with less than 500 employees (n=173, 40.6%). This was followed by respondents who were associated with hospitals, which employed either 501-999 employees (n=83, 19.3%) or hospitals that employed 1000-1499 employees (n=60, 14%). The balance of the respondents was associated with hospitals that employed more than 1500 employees (n=36, 26.5%).

For public hospitals, the largest of group of respondents were associated with hospitals with 300 beds or more (n=78, 39.6%). This was followed by respondents who specified that they were associated with a hospital with 101-299 beds (n=67, 34%) and 100 beds or less (n=52, 26.4%). More than half of the respondents indicated that they were associated with hospitals with less than 1500 employees (n=111, 56.3%).

For private hospitals, the largest of group of respondents were associated with hospitals having 100 beds or less (n=130, 55.8%). This was followed by respondents who indicated that they were associated with a hospital with 101 beds or more beds (n=103, 44.2%). The largest group of respondents indicated that they were associated with a hospital with less than 500 employees (n=132, 56.7%). This was followed by respondents who were associated with hospitals that employed either 501-999 employees (n=59, 25.3%) or hospitals that employed more than 1000 people (n=42, 18%). The organisation demographics are shown in Table 5.6.

Table 5.6: Organisation demographics

Hospital Type	All Hospitals		Public		Private	
	Number	Percent	Number	Percent	Number	Percent
Public	197	45.8	-	-	-	-
Private	233	54.2	-	-	-	-
Total	430	100.0	-	-	-	-
Hospital Size						
	Number	Percent	Number	Percent	Number	Percent
100 beds or less	182	42.3	52	26.4	130	55.8
101-299 beds	142	33.0	67	34.0	75	32.2
300-499 beds	53	12.3	29	14.7	24	10.3
500 beds or more	53	12.3	49	24.9	4	1.7
Total	430	100.0	197	100.0	233	100.0
Number of employees						
	Number	Percent	Number	Percent	Number	Percent
Less than 500	173	40.2	41	20.8	132	56.7
501-999	83	19.3	24	12.2	59	25.3
1000-1499	60	14.0	46	23.4	14	6.0
1500-1999	36	8.4	13	6.6	23	9.9
2000-2499	24	5.6	19	9.6	5	2.1
2500-2999	12	2.8	12	6.1	0	0.0
3000-3499	7	1.6	7	3.6	0	0.0
3500 and more	35	8.1	35	17.8	0	0.0
Total	430	100.0	197	100.0	233	100.0

Figure 5.7 shows that approximately 46% of the hospitals were public and 54% were private, which was a sufficient number in order to compare the two.
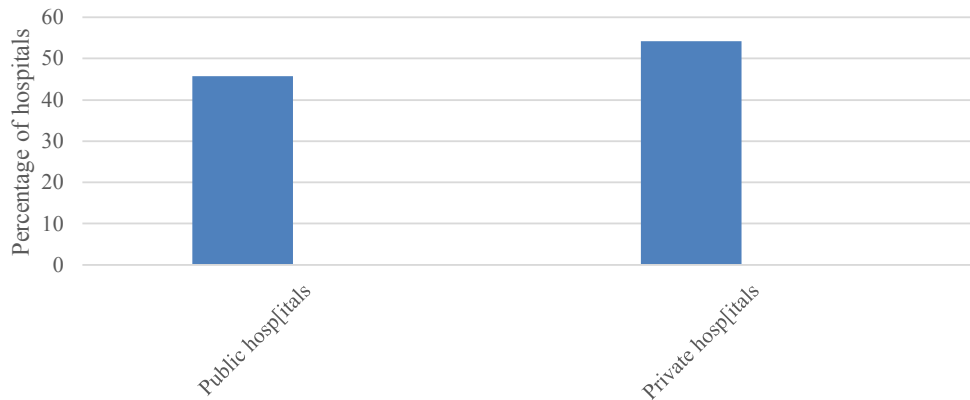
Figure 5.7 Type of hospitals in Saudi Arabia

Figure 5.8 shows that almost 76% of the hospitals had 299 beds or less. This is also useful since this study takes hospital size as a control variable.
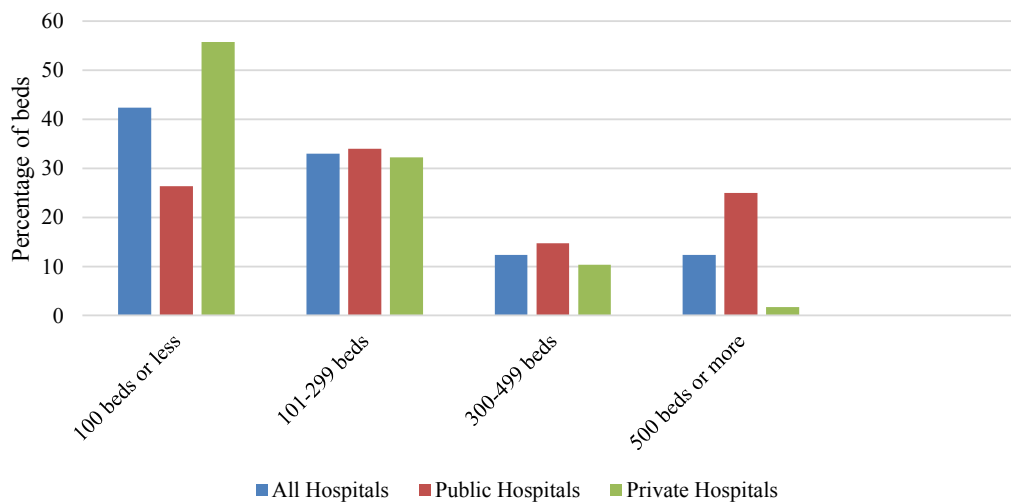
Figure 5.8 Number of beds in Saudi Arabia hospitals

Figure 5.9 shows that 73% of the hospitals had less than 1499 employees and fewer than 10% of the hospitals had more than 3500 employees. This data allows access to data from large hospitals where more complicated issues need to be resolved.
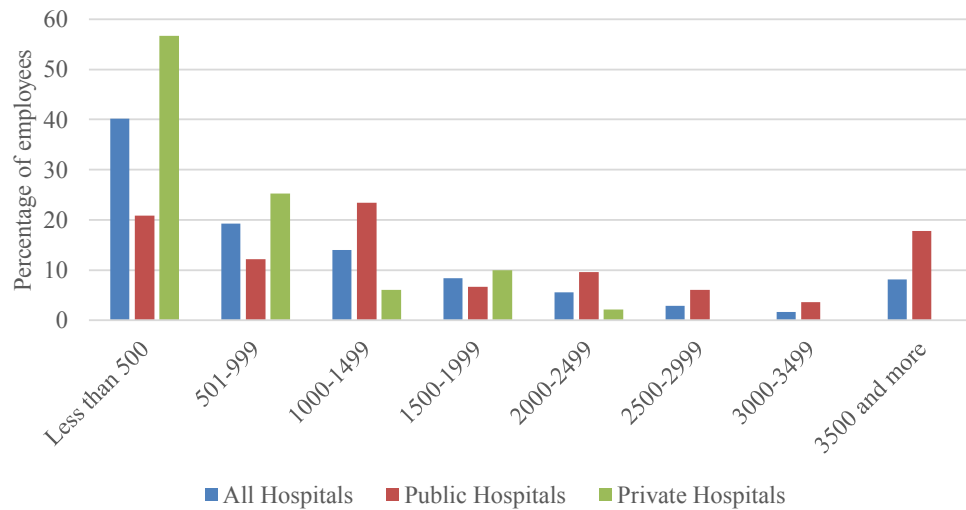
Figure 5.9 Number of employees in Saudi Arabia hospitals

The demographic profile of respondents and organisations indicates that the vast majority of respondents were males; a large proportion of the respondents had higher education degrees; there was almost an equal representation of respondents from the supply chain department, medical administration department, general administration department and the quality administration department. However, a slightly higher proportion of respondents were associated with the procurement department. The respondents were characterised as having a large amount of experience in healthcare and in managerial roles. As for the organisations themselves, there was almost an equal proportion of public and private hospitals in the sample; there was also almost an equal mix of small, medium and large sized hospitals (both in terms of the number of beds and the number of employees). Similar trends were observed when the demographic profile of respondents and organisations were analysed for public and private hospitals separately.

179

5.7 Summary

This chapter has analysed the data gathered between 2015 to 2016. The overall analysis focused on using statistical techniques and approaches to test the proposed hypotheses. The data was analysed using statistical software to encode data, check its frequency and present the descriptive analysis. Reliability and validity were tested along with variable scoring, and a test of normality was included.

A final sample size of n=430 was achieved for this research. The data was screened and cleaned prior to implementing the data analysis. The objective of the data analysis was to address the aims of this research. Out of the total sample size, 197 respondents were associated with public hospitals and 233 were associated with private hospitals.

The demographic profile of the respondents and organisations indicated that the vast majority of the respondents were males; a large proportion of the respondents had higher education degrees; there was an almost equal representation of respondents from the supply chain department, medical administration department, general administration department, or the quality administration department and a slightly higher proportion of respondents associated with the procurement department. The respondents were characterised as having large amounts of experience in healthcare and in managerial roles.

As for the organisations, there was almost an equal proportion of public and private hospitals in the sample; there was almost an equal mix of small medium and large sized hospitals (both in terms of beds and number of employees). Similar trends were observed when the demographic profile of the respondents and organisations were analysed for

public and private hospitals separately. A comparison of the mean scores for public and private hospitals for all the subscales found that the mean scores differed (at alpha=.05) for public and private hospitals for all subscale scores except the hospital performance flexibility subscale. This indicates that there are substantial differences between the characteristics of public and private hospital supply chains.

CHAPTER 6: ADVANCED ANALYSIS AND RESULTS

6.1 Introduction

This chapter focuses on the advanced analysis of the data gathered during the research. Section 6.2 presents the correlation analysis of the results and section 6.3 presents the measurement model in term of confirmatory factor analysis. The hypothesised model was tested using SEM, which includes the seven proposed hypotheses (H1 to H7). The overall analysis focuses on the measurement model Confirmatory Factor Analysis. A comparison between private and public hospitals is also presented in Section 6.3. Section 6.4 presents a summary of this chapter.

6.2 Correlation analysis

A correlation analysis is useful in determining the strength and direction of the linear relationship between two variables. Pearson's correlation coefficient and its statistical significance (0.05 level for significance) was computed between the logistics integration score, the IT score, the information sharing score, the trust score, the HSI score, the lean practices score, the hospital performance score and finally the hospital performance overall score. Statistically significant and relevant correlations from the analysis are reported below. The notable findings from the correlation analysis were:

- Logistics integration (r=0.819, p<0.01), IT (r=0.752, p<0.01), information sharing (r =0.746, p<0.01) and trust (r=0.734, p<0.01) are all positively correlated with HSI. This supports the hypothesis that the level of logistics integration, IT integration, information sharing and the level of trust between hospitals and suppliers is positively associated with HSI.

- HSI (r=0.781, p<0.01) was positively correlated with the overall hospital performance (r=0.916, p<0.01). This supports the hypothesis that HSI is positively associated with hospital performance.

- Lean practices (r=0.949, p<0.01) were positively associated with HSI (r=0.965, p<0.01) and the overall hospital performance (r=0.909, p<0.01). This result indicates that lean practices can play a moderating role between HSI and hospital performance.

As can be seen in Table 6.1, the values of the correlation coefficients and the square root of variance that were extracted did not meet the recommended criteria therefore, the discriminant validity of constructs was not fulfilled.

Table 6.1: Mean and standard deviation

Construct	Mean	SD	HSI	LI	IT	ISS	T	HP	LP
His	5.15	0.88	(0.781)						
LI	5.59	0.74	0.898	(0.819)					
IT	5.36	0.62	0.742	0.777	(0.752)				
ISS	4.93	0.75	0.999	0.787	0.689	(0.746)			
T	4.92	0.69	0.998	0.885	0.714	0.828	(0.734)		
HP	5.45	0.74	0.916	0.813	0.634	0.723	0.901	(0.745)	
LP	5.93	0.70	0.965	0.895	0.678	0.798	0.918	0.909	(0.949)

Note: (n =430), All values are significant at p <0.01, Square root of AVE in shown in the parentheses, where SD=Standard deviation, CR=Composite reliability, AVE= Average variance extracted, HSI =Hospital supply integration, LI = Logistic Integration, IT = Information technology, ISS = Information sharing, T = Trust, HP = Hospital performance, LP = Lean practice

6.3 Measurement model: confirmatory factor analysis

Literature has cautioned that the hypothesised measurement model should not be assumed to be held accurately in the population (Bell, Bryman & Harley 2018; Zikmund et al. 2013). Therefore, it is important to assess the fit of the model using fit indices after conducting a confirmatory factor analysis. Several goodness-of-fit indices were evaluated to determine if the measurement model could be considered as reliable for testing a hypothesis. However, this test is sensitive to sample size and thus the model may be a good fit even with a significant value(Hair et al. 2010). The relative chi-square (χ^2), CMIN/DF, is an index of how much fit the data loses by dropping one or more paths. If too many paths are dropped, the rule of thumb suggests that this index will exceed 2 or 3 (Schermelleh-Engel, Moosbrugger & Müller 2003). The root means square residual (RMR) is an index of the amount by which the estimated variances and co-variances differ from the observed variances and co-variances. It is suggested that the RMR should be less than 0.06.

The goodness of fit index (GFI) describes what proportion of the variance in the sample variance-covariance matrix is accounted for by the model. This should exceed 0.90 for a good model with a large sample (Arbuckle & Wothke 2003). The baseline comparison GFI indices compare the base model to the independent model rather than to the saturated model. The Normed Fit Index (NFI) is simply the difference between the chi-squares of the two models divided by the chi-square for the independent model. Values of 0.90 or higher (some specify 0.95 or higher) indicate a good fit (Arbuckle & Wothke 2003). The Comparative Fit Index (CFI) uses a similar approach (with a non-central chi-square value)

and is a good index to use with small samples. Like the NFI, 0.90 (or higher) indicates a good fit (Bell, Bryman & Harley 2018; Zikmund et al. 2013). The Root Mean Square Error of Approximation (RMSEA) estimates the lack of fit compared to the saturated model. A RMSEA of 0.05 or less indicates a good fit and 0.08 or less indicates an adequate fit (Bell, Bryman & Harley 2018; Zikmund et al. 2013).

A confirmatory factor analysis was used to check the relationship between the observed variable (items) and the latent variables (Podsakoff et al. 2003; Tabachnick & Fidell 2007). AMOS 17.0 was used to run the first and second levels of the confirmatory factor analysis.

6.3.1 First stage measurement

The standardised loading scores of all items should be significantly greater than 0.40 (Bell, Bryman & Harley 2018; Zikmund et al. 2013). In Table 6.2, the loading scores of all items on a latent variable are significantly greater than 0.50 except for two items— the IT item and the trust item. To check the holistic fitness of the model there are multiple global fits, which show the fitness of the model (Bentler 1990; Hair et al. 2010; Hair et al. 2015; Kelloway 1995; Satorra & Bentler 2001). Suggested threshold values of relevant global fits were presented previously. It is suggested that if the values of maximum fit indices meet the recommended criteria then the model is considered to be fit.

Table 6.2: Confirmatory factor analysis-first stage (loading scores of individual variables)

S. No	LI	IT	ISS	T	HIS	HP	LP
1	0.77	0.681	0.554	0.484	0.424	0.927	0.873
2	0.82	0.883	0.763	0.813	0.669	0.936	0.804
3	0.70	0.829	0.839	0.895	0.668	0.955	0.600
4	0.82	0.484	0.604	0.710	0.778	0.976	0.783
5			0.789		0.794		

Note: HSI = Hospital supply integration, LI = Logistic integration, IT = Information technology, ISS = Information sharing, T = Trust, HP = Hospital performance, LP = Lean practice

Table 6.3 shows the result of all the fit indices in which CMIN/df of all constructs is less than or close to 4, except for the lean practice and trust items. The value of SRMR for all variables were less than 0.05 and the RMSEA for all constructs was less than 0.8 except for HSI, lean practice and trust. The values of GFI, NFI, TLI and CFI were greater than 0.95. All global indexes reached the acceptable range. It can therefore be determined that all the observed variables adequately measured the latent variables. At this step of the confirmatory analysis, several disparate items were deleted to enhance the model of fit scores.

Table 6.3: Measurement model fit indices

Construct	CMIN (P-value)	CMIN/df	S	GFI	NFI	TLI	CFI	RMSEA
LI	0.081	2.52	0.014	0.994	0.994	0.988	0.996	0.059
IT	0.530	0.635	0.009	0.999	0.998	0.997	0.998	0.001
ISS	0.003	3.607	0.026	0.984	0.978	0.968	0.984	0.078
T	0.000	4.196	0.046	0.852	0.904	0.902	0.921	0.086
HIS	0.033	4.058	0.045	0.989	0.903	0.908	0.918	0.084
HP	0.292	1.232	0.002	0.997	0.999	0.997	0.999	0.023
LP	0.010	4.363	0.037	0.874	0.915	0.917	0.933	0.088

Note: HSI = Hospital supply integration, LI = Logistic integration, IT = Information technology, ISS = Information sharing, T = Trust, HP = Hospital performance, LP = Lean practice

6.3.2 Second stage measurement

Convergent validity is tested with the help of two tests; the average variance extracted (AVE) and the item loading scores. The AVE of each construct should be greater than 0.50 and the standardised loadings of all items should be significant (Bell, Bryman & Harley 2018; Zikmund et al. 2013). As can be seen in Table6.4, the AVE of all constructs is greater than the threshold scores. In addition, the loading scores of all items is greater than 0.50. Discriminant validity is run through two tests the first of which is the inter-factor correlation (correlation among constructs), which should be less than 0.70 to avoid multi-collinearity. Second, the square root of AVE of any construct should be greater than the correlation of that construct with all other constructs.

Table 6.4: CFA- Estimates, Z value, Inter Item Consistency (α), Composite Reliability and Average Variance Extracted

Item	Source	Item loading	Z-score	Cronbach alpha	C.R.	AVE
LI1		0.821		0.847	0.859	0.670
LI2		0.791	18.132			
LI3		0.843	18.564			
IT1		0. 840	9.889	0.759	0.787	0.566
IT2		0.872	9.968			
IT3		0.482				
ISS1		0. 588	12.214	0.780	0.832	0.556
ISS2		0.768	16.628			
ISS4		0.821	17.986			
ISS5		0.784				
T1		0.538	11.226	0.853	0.735	0.540
T2		0.762	16.245			
T4		0.733				
HSI2		0.767	11.839	0.838	0.781	0.610
HSI3		0.854				
HSI4		0.661	11.943			
HSI5		0.786	13.786			
LP2		0.820	14.983	0.783	0.788	0.554
LP4		0.737	13.684			
LP5		0.669				
HP1		0.957		0.972	0.973	0.901
HP2		0.972	51.832			
HP3		0.928	40.342			

Item	Source	Item loading	Z-score	Cronbach alpha	C.R.	AVE
HP4		0.940	42.855			

Note: HSI = Hospital supply integration, LI = Logistic integration, IT = Information technology, ISS = Information sharing, T = Trust, HP = Hospital performance, LP = Lean practice

6.3.2.1 Measurement model of hospital - supplier integration

Psychometric properties were examined by all the constructs using a confirmatory factor analysis (the second stage of CFA) employing AMOS 23 on the dataset. The fit of the CFA for the study conducted is acceptable with $\chi2=941.363$ df= 229, $\chi2/df = 3.02$, (p <0.01), comparative fit index (CFI) = 0.950, GFI = 0.90, standard root means square residual (SRMR) = 0.030 Incremental fit index (IFI) = 0.915, NFI = 0.928, TLI = 0.939 and root mean square error of approximation (RMSEA) = 0.069. Considering all the goodness of fit measures, the model is adequately fit to the data from the sample. In addition, for scale validation, there are three steps that need to be performed - reliability, convergent validity and discriminant validity. Each step was performed as can be seen in the following sections.
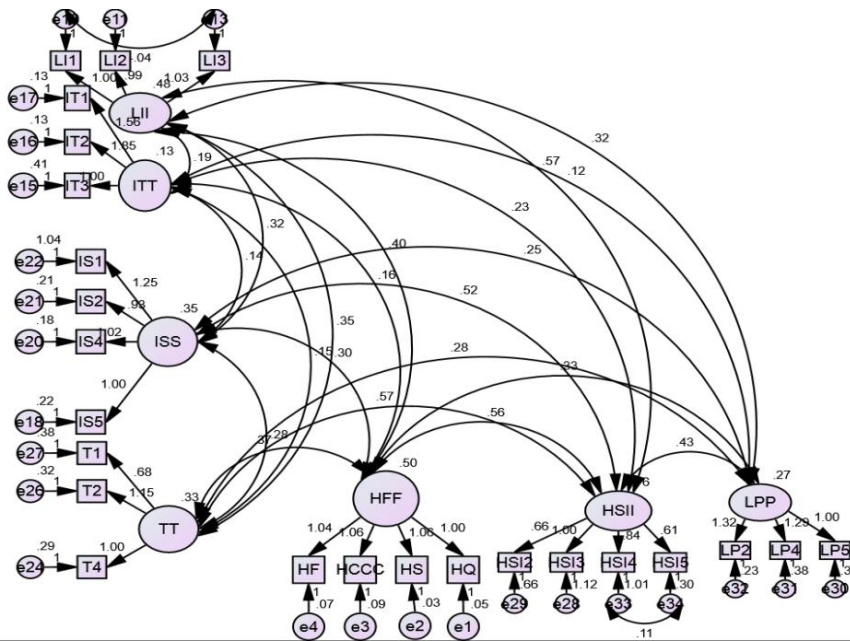
Figure 6.1 Measurement model

Table 6.5: A comparison of goodness-of-fit for the Model

Model	χ2/df ≤5.00ᵃ	CFI ≥0.90ᵃ	GFI ≥0.90ᵃ	RMSR ≤ 0.10ᵃ	IFI ≥ 0.90ᵃ	NFI ≥0.90ᵃ	TLI ≥0.90ᵃ	RMSEA ≤ 0.08ᵃ
Measurement Model	3.02	0.950	0.90	0.030	0.915	0.928	0.939	0.69

Note: a - Recommended value

6.3.3 Final hypothesised structural model without moderating role and control variable

The effects of the predictors were examined (i.e. logistic integration, IT, information sharing, trust) on HSI followed by the influence of the mediating variable (i.e. HSI) on hospital performance. The relationships were modelled and investigated using AMOS 23. The adequacy of this structural model was evaluated by fit indices, which suggested that the structural model displayed a good model fit to the data set with $\chi^2 = 819.815$, df = 202, χ^2/df = 3.66; (p<0.01), GFI = 0.89, CFI = 0.94, IFI = 0.919, TLI = 0.93, NFI = 0.92,

SRMR = 0.035, and RMSEA = 0.079. It is noted that the GFI (0.89) value is slightly less than the recommended value (≥0.90). However, the resulting value is still widely accepted in the literature. For instance, research considers that GFI values of less than 0.9 are acceptable and not a sign of a poor fit (Bell, Bryman & Harley 2018; Zikmund et al. 2013). Similarly, another study accepted GFI values of around 0.9 (plus or minus) for the model to represent a good fit (Zhu, Sarkis & Lai 2008). Furthermore, certain widely accepted business literature considers GFI values of more than 0.8 as sufficient to assure a good model fit (Bell, Bryman & Harley 2018; Zikmund et al. 2013).

A path analysis revealed that logistic integration had a significantly positive impact on HSI (β = 0.49, p <0.05) and that ITI was found to significantly decrease HSI (β = -0.23, p <0.01), which rejects the second hypothesis of this study. Information sharing significantly enhanced HSI (β = 0.131, p <0.01) and trust significantly impacted HSI (β = 0.65, p <0.01). Lastly, HSI significantly enhanced hospital performance (β = 0.847, p <0.01) (See figure 6.2 and table 6.6). In summary, all the hypothesised relationships achieved significance with HSI apart from IT.
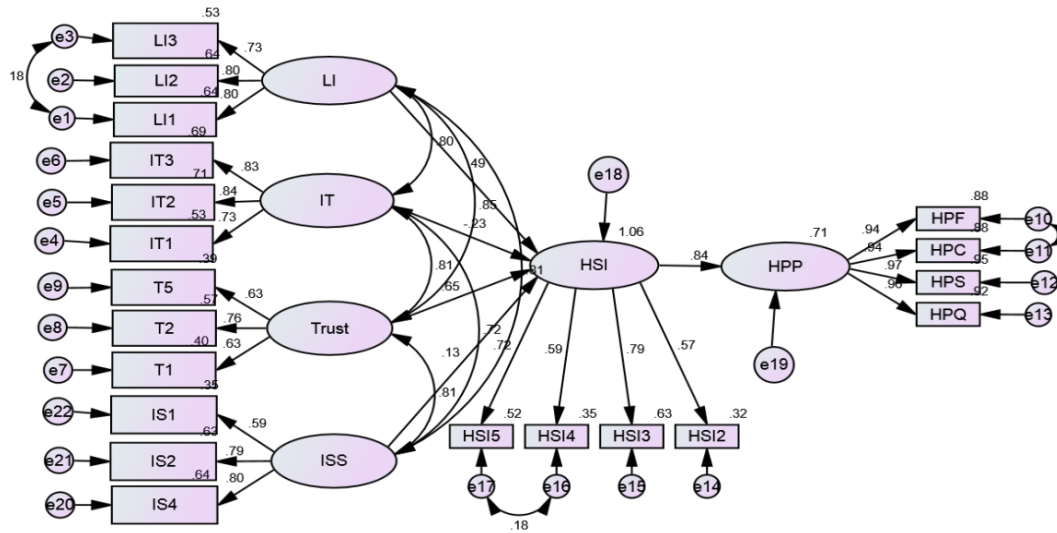
Figure 6.2 Structural full model (without moderator and control variable)

Table 6.6: Path analysis (without moderator and control variable)

Hypothesis	Estimates	S.E	Z-value	p-value	Accepted/Rejected
LI → HSI	0.49	0.111	-2.081	0.001**	H1 accepted
IT → HSI	-0.23	0.096	5.103	0.001**	H2 Rejected
ISS → HSI	0.13	0.05	6.099	0.019*	H3 accepted
T → HSI	0.65	0.154	0.140	0.001**	H4 accepted
HSI → HP	0.84	0.064	6.547	0.001**	H5 accepted

** < 0.01, * < 0.05
Note: HSI = Hospital supply integration, LI = Logistic integration, IT = Information technology, ISS = Information sharing, T = Trust, HP = Hospital performance

Table 6.7: A comparison of the final hypothesised structural model without moderating role and control variable

Model	χ2/df ≤5.00ᵃ	CFI ≥0.90ᵃ	GFI ≥0.90ᵃ	RMSR ≤ 0.10ᵃ	IFI ≥ 0.90ᵃ	NFI ≥0.90ᵃ	TLI ≥0.90ᵃ	RMSEA ≤ 0.08ᵃ
Measurement Model	3.66	0.94	0.89	0.035	0.919	0.92	0.93	0.079

Note: a - Recommended value

192

6.3.4 Final hypothesised structural model without control variable

The following analysis did not take the control variable into consideration. The adequacy of this structural model was evaluated by fit indices which suggested that the structural model displayed a good model fit to the data set with $\chi^2 = 819.815$, df = 202, $\chi^2/df = 3.50$; (p<0.01), CFI = 0.94, IFI = 0.919, TLI = 0.92, NFI = 0.92, SRMR = 0.035, and RMSEA = 0.07. The path analysis revealed (see Table 6.8) that logistic integration had a significantly positive impact on HSI ($\beta = 0.41$, p <0.01) and that IT significantly decreased HSI ($\beta = -0.232$, p <0.01), which rejects the second hypothesis of this study. Information sharing significantly enhanced HSI ($\beta = 0.157$, p = 0.05) and trust significantly affected HSI ($\beta = 0.724$, p <0.01). Additionally, HSI significantly enhanced hospital performance ($\beta = 0.543$, p <0.01). In summary, all hypothesised relationships achieved significance with HSI apart from IT.
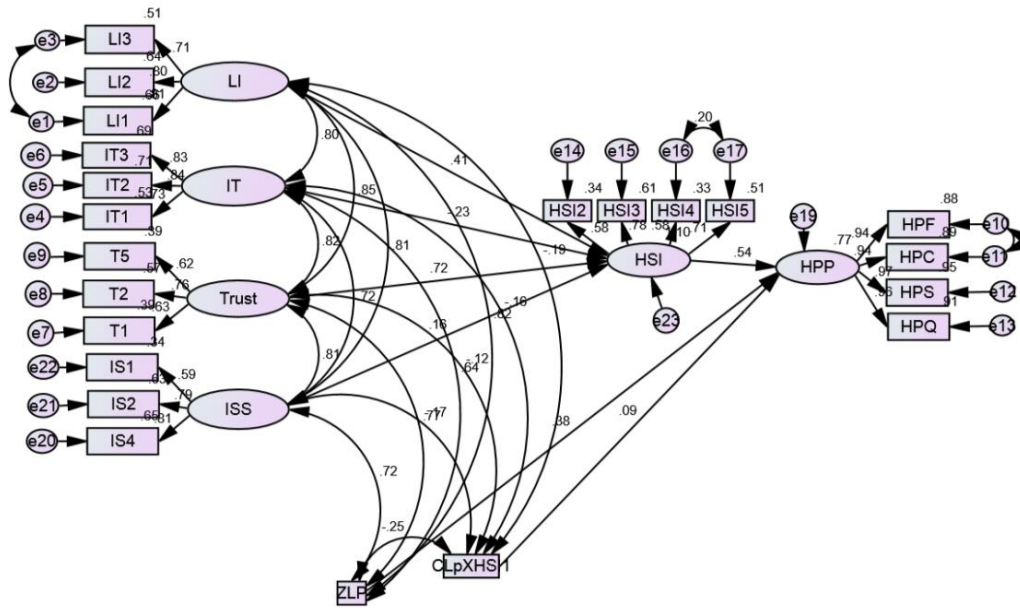
Figure 6.3 Structural full model (without control variable)

Table 6.8: Path analysis (without control variable)

Hypothesis	Estimates	S.E	Z-value	p-value	Accepted/Rejected
LI →HSI	0.41	0.075	3.722	0.001**	H1 accepted
IT → HSI	-0.232	0.096	5.103	0.004**	H2 rejected
ISS→ HSI	0.157	0.082	1.913	0.005**	H3 accepted
T → HSI	0.724	0.189	4.581	0.001**	H4 accepted
HSI →HP	0.543	0.082	8.426	0.001**	H5 accepted
HSI*LP →HP	0.088	0.038	3.219	0.001**	H6 accepted

** < 0.01, * < 0.05

Note: HSI = Hospital supply integration, LI = Logistic integration, IT = Information technology, ISS = Information sharing, T = Trust, HP = Hospital performance, LP = Lean practice

Table 6.9: A comparison of the final hypothesised structural model

Model	χ2/df ≤5.00ᵃ	CFI ≥0.90ᵃ	GFI ≥0.90ᵃ	RMSR ≤ 0.10ᵃ	IFI ≥ 0.90ᵃ	NFI ≥0.90ᵃ	TLI ≥0.90ᵃ	RMSEA ≤ 0.08ᵃ
Measurement Model	3.50	0.94	0.90	0.035	0.919	0.92	0.92	0.070

Note: a - Recommended value

194

6.3.5 Final hypothesised structural model

When taking both the moderating role of lean practices and hospital size as control variables into consideration, the adequacy of the structural model was evaluated by fit indices, which suggested that the structural model displayed a good model fit to the data set with χ^2 = 819.815, df = 202, χ^2/df = 3.50; (p<0.01), GFI= 0.90, CFI = 0.94, IFI = 0.919, TLI = 0.92, NFI = 0.92, SRMR = 0.035, and RMSEA = 0.07.

The path analysis revealed (see Table 6.10) that logistic integration had a significantly positive impact on HSI (β = 0.43, p <0.01). However, IT significantly decreased HSI (β = -0.231, p <0.05), which rejects the second hypothesis of this study. Information sharing significantly enhanced HSI (β = 0.162, p <0.05) and trust significantly affected HSI (β = 0.70, p <0.01). HSI significantly enhanced hospital performance (β = 0.53, p <0.01). Lean practice significantly moderated the impact of HSI on hospital performance (β = 0.084, p <0.05). The control variable of hospital size did not affect hospital performance. In summary, all the hypothesised relationships achieved significance with HSI, apart from IT.
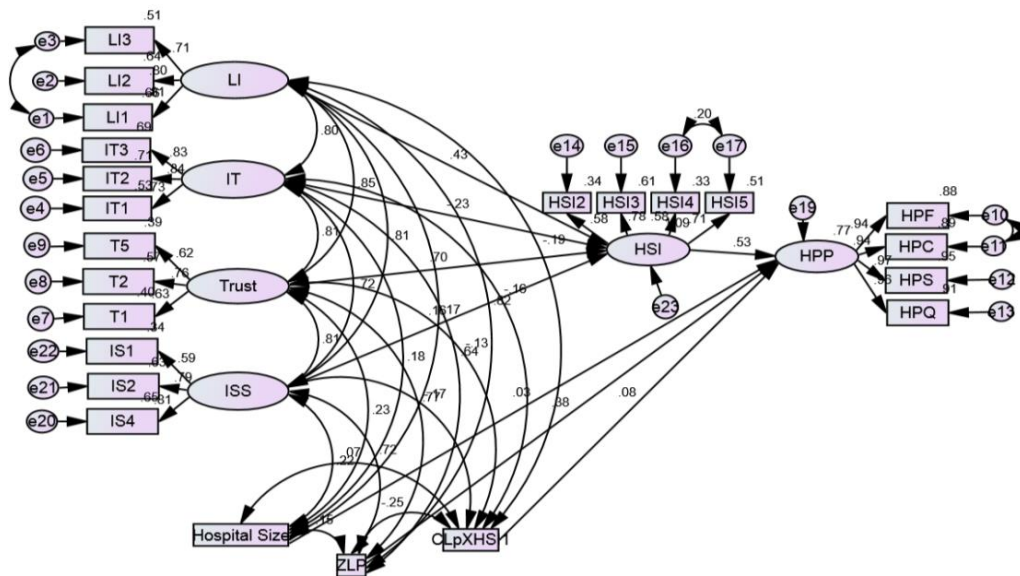
Figure 6.4 Structural full model

Table 6.10: Path analysis

Hypothesis	Estimates	S.E	Z-value	p-value	Accepted/Rejected
LI → HSI	0.43	0.111	-2.081	0.001**	H1 accepted
IT → HSI	-0.231	0.096	5.103	0.004**	H2 Rejected
ISS → HSI	0.162	0.108	6.099	0.005**	H3 accepted
T → HSI	0.72	0.154	0.140	0.001**	H4 accepted
HSI → HP	0.53	0.064	6.547	0.001**	H5 accepted
HSI*LP → HP	0.084	0.021	3.309	0.002**	H6 accepted
HSZ → HP	0.03	0.020	1.732	0.103	H7 Rejected

** < 0.01, * < 0.05
Note: HSI = Hospital supply integration, LI = Logistic integration, IT = Information technology, ISS = Information sharing, T = Trust, HP = Hospital performance, LP = Lean practice, HSZ = Hospital size

Table 6.11: A comparison of the final hypothesised structural model

Model	$\chi 2$/df $\leq 5.00^a$	CFI $\geq 0.90^a$	GFI $\geq 0.90^a$	RMSR $\leq 0.10^a$	IFI $\geq 0.90^a$	NFI $\geq 0.90^a$	TLI $\geq 0.90^a$	RMSEA $\leq 0.08^a$
Measurement Model	3.50	0.94	0.90	0.035	0.919	0.92	0.92	0.070

Note: a - Recommended value

196
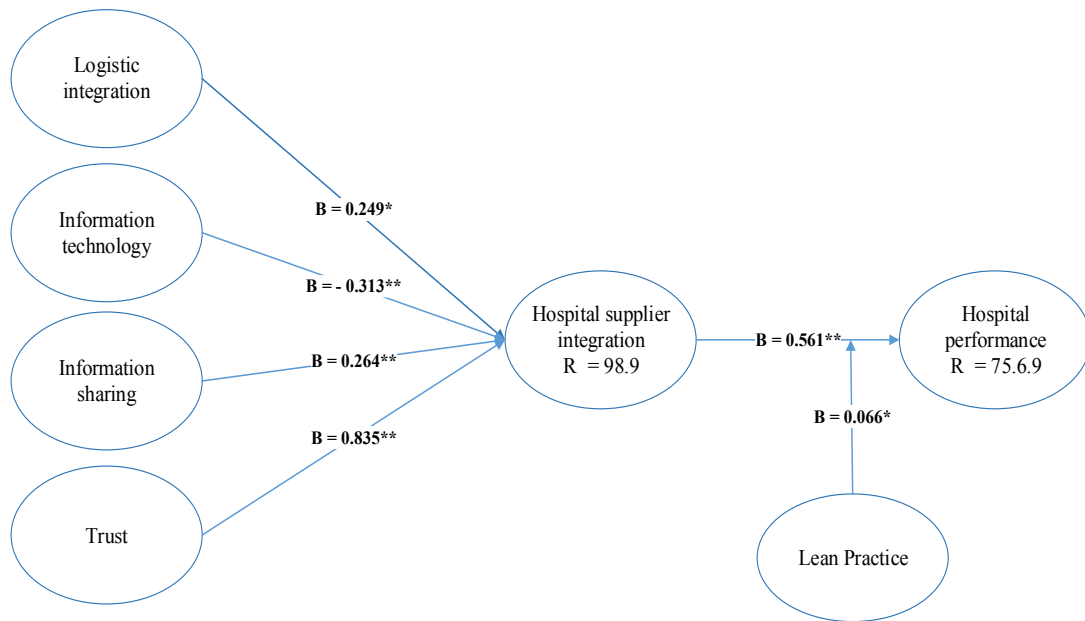
Figure 6.5 Path model for the final hypothesised structural model
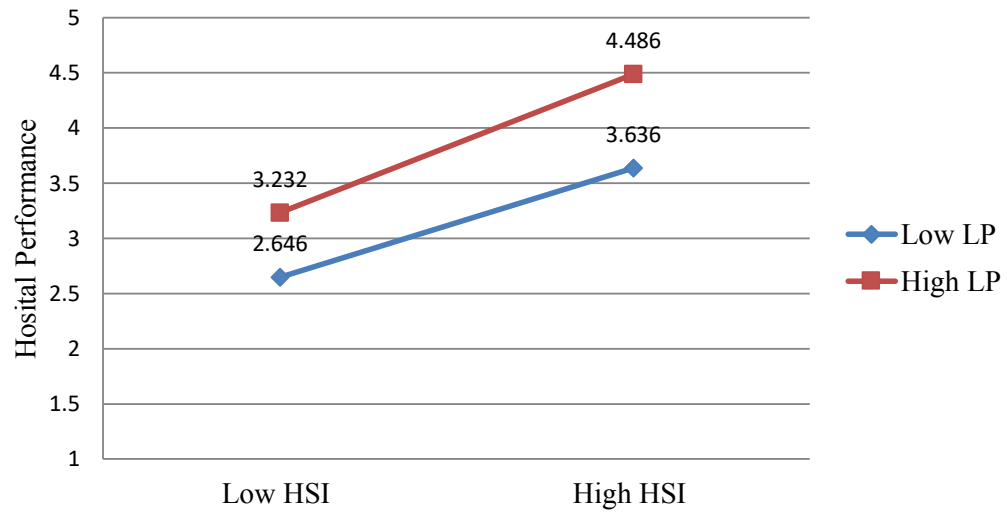
Figure 6.6 Interaction effect of lean practices as a moderator

6.3.6 Private and public hospitals: a comparison

A multigroup analysis provides a powerful tool to evaluate and measure the equality, differences and similarities between groups(Cole & Maxwell 1985; Millsap & Hartog 1988; Reise, Widaman & Pugh 1993; Schmitt 1982; Vandenberg & Lance 2000). This study used a multigroup analysis to compare the final structural model between private and public hospitals. The main aim of this study was to compare regression coefficients for each path between both models. This was performed in several steps.

6.3.6.1 Configural invariance

First, the Configural invariance of the model was assessed. This step is essential to ensure that the final model applies to both private and public hospitals. In order to determine if parameter estimates are the same or different between both models, it must be established that the configural model is reasonable because the following steps will apply certain constraints to the model. Indices like Tucker-Lewis Index or RMSEA index can be used to assess that the model applies to both groups. In this current study, the results showed that the suggested model applies to both private and public hospitals as indicated by the TLI (0.92), C_{min} (3), and RMSEA (0.7)—all indicated a good model fit. Thus, configural invariance can be assumed for both private and public hospitals.

6.3.6.2 Pairwise comparison of coefficients

Once configural invariance is assumed, the next step was to compare the coefficients between both models using critical ratios (Z scores). Critical ratios (Z score) were calculated for the difference between parameters in public and private hospitals and were used for pairwise comparisons between parameters. The significance (P value) for these

critical ratios (CR) was then calculated. P values less than 0.05 indicated that there was a

statistically significant difference in the parameters between private and public hospitals.
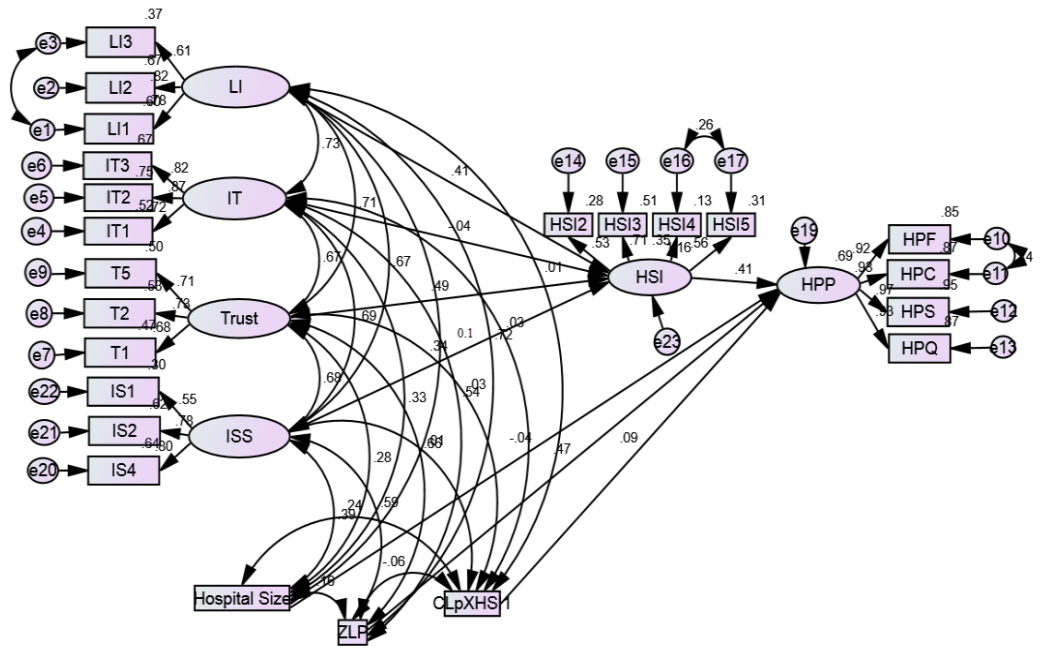
Figure 6.7 Model for public hospitals
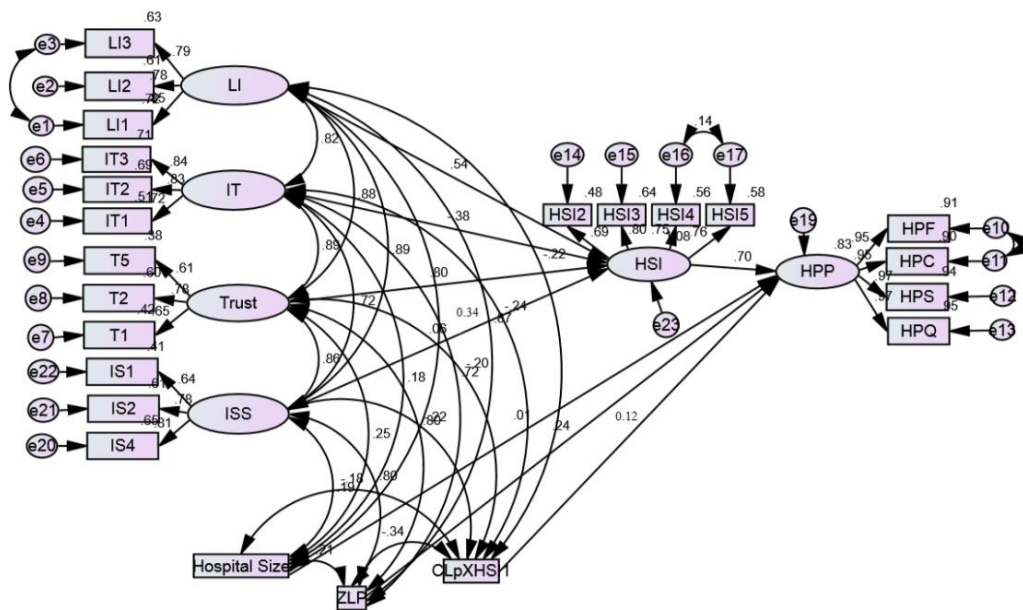
Figure 6.8 Model for private hospitals

Table 6.12: Pairwise comparisons between private and public hospitals

Hypothesis	Public Hospitals		Private hospitals			
	Estimate	p-value	Estimate	p-value	z-score	Accepted or rejected
IT → HSI	-0.04	0.606	-0.384	0.05	-0.3	Rejected
LI → HSI	0.407	0.001**	0.544	0.001**	1.96	Accepted
T → HSI	0.49	0.03*	0.802	0.001**	2.5	Accepted
ISS→ HSI	0.1	0.01*	0.341	0.001**	1.98	Accepted
HSI → HP	0.41	0.001**	0.701	0.001**	3.284	Accepted
HSI*LP → HP	0.085	0.01*	0.119	0.002**	2.5	Accepted
HSZ → HP	-0.04	0.39	0.01	0.858	-0.2	Rejected

** < 0.01, * < 0.05

Note: HSI = Hospital supply integration, LI = Logistic integration, IT = Information technology, ISS = Information sharing, T = Trust, HP = Hospital performance, LP = Lean practice, HSZ = Hospital size

The results from the study indicate that there were many differences between private and public hospitals (Table 6.12). The positive effect of HSI was stronger across private hospitals compared to public hospitals (Z score = 3.284, p< 0.01). The regression coefficient for the relationship between HSI and hospital performance was higher in private hospitals (β = 0.701, p < 0.01) compared to public hospitals (β = 0.41, p< 0.01). The statistically significant Z score indicates that this difference between both regression coefficients was significant. The difference in the relationship between IT and HSI across both hospital types was not statistically significant (Z score = -0.3, p> 0.05). Although the coefficient for the association between IT and HSI was lower across private hospitals (β = -0.384, p = 0.05 compared to public hospitals (β = -0.04, P = 0.606), this difference was not significant (Z score = 0.3, p> 0.05). Regarding the association between logistic integration and HSI, results show that the association was stronger in private hospitals compared to public hospital (β = 0.407, p< 0.01 in public hospitals vs. β = 0.544, p< 0.01 in private hospitals). The Z score was statistically significant (Z = 1.96, p < 0.05), which indicates that the difference is statistically significant.

The results also show that the association between trust and HSI was stronger in private hospitals compared to public hospital (β = 0.49, p = 0.03, in public hospitals vs. β = 0.802, p< 0.01 in private hospitals). The Z score was statistically significant (Z = 2.5, p< 0.05), which indicates that the difference was significant regarding the association between trust and HSI (it is found to be stronger in private hospitals compared to public hospitals). The effects of information sharing were also stronger in private hospitals compared to public

hospital ($\beta = 0.1$, $p = 0.01$ in public hospitals compared to $\beta = 0.341$, $p < 0.01$ in private hospitals). Again, the Z score was statistically significant ($Z = 1.98$, $p < 0.05$), which indicates that the difference between information sharing and HSI was stronger in private hospitals compared to public hospitals. Finally, the moderating effect of lean practices was stronger in private hospitals ($\beta = 0.119$, $p = 0.002$) compared to public hospitals ($\beta = 0.085$, $p = 0.01$). The critical ratio (Z score) was also statistically significant at the 0.05 level ($Z = 2.5$, $p < 0.05$), which indicates that the moderating effect of lean practices was stronger in public hospitals. Hospital size was not significantly associated with performance in any of the two models ($\beta = 0.01$ and -0.04 for private and public hospitals, respectively. The difference was not statistically significant at the 0.05 level ($Z = -0.2$, $p > 0.05$).

In general, the results of this research show two possible outcomes. First, that logistics integration, information sharing, trust, lean practice, and the relationship between HSI and hospital performance were positively supported. Second, that IT and hospital size were not positively associated with HSI. The results also showed that private hospitals provided better healthcare compared with public hospitals.

6.4 Summary

This chapter presented some of the general trends observed through the correlation analysis of public and private hospitals. These trends are as follows: (1) logistics integration, information sharing, and trust are all positively correlated with HSI. This supports the hypothesis that the level of logistics integration, information sharing and the level of trust between hospitals and suppliers is positively associated with HSI. However,

IT was not found to be positively associated with better HSI as was hypothesised in the study; (2) HSI is positively correlated with all aspects of hospital performance and the overall hospital performance. This supports the hypothesis that HSI is positively associated with hospital performance; and (3) lean practices are positively associated with HSI and the overall hospital performance. This result indicates that lean practices may play a moderating role between HSI and hospital performance.

Hospital size—as a control variable—was not found to play any role in determining the impact of HSI on hospital performance. Our results also show that the association of information sharing, logistics integration and trust with HIS was stronger in private hospital compared to public hospitals. They also show that HSI, affects the performance of private hospital compared to public hospitals. The moderating effect of lean practice on the relationship between logistics integration and HSI was also stronger in private hospitals compared to public hospitals.

CHAPTER 7: DISCUSSION ON THE FINDINGS

7.1 Introduction

This chapter provides a dissection of the analysis and is structured in eight sections. Section 7.2 presents an overview of the study with a focus on the development of the structural. Section 7.3 discusses the valid dimensions of the HSI. Section 7.4 discusses the impact of HSI on hospital performance as was found in this study. The moderating role of lean practices between HSI and hospital performance will be presented in Section 7.5. This will be followed by Section 7.6, which discusses that hospital size as a control variable has an impact on the relationship between HSI and hospital performance. In addition, Section 7.7 discusses the comparison between public and private hospitals in Saudi Arabia. Finally, the chapter summary is presented in Section7. 8.

7.2 Overview of the thesis

The increasing cost of healthcare, together with the need to improve the quality of care to achieve enhanced positive outcomes, are two of the major concerns of today's healthcare sector (Mcbride & Tietze 2018). Healthcare costs occur at three levels: the personal level, the provider level and the national level. A major part of healthcare costs occurs at hospitals, contributing to 50-60% of total costs. According to literature, out of the total US$ 1.9 trillion spent on healthcare in the USA, approximately half is spent on hospital costs. Increasing inflation and innovation in diagnostic and treatment technologies will further increase hospital costs in the future (Kim & Miller 2013).Other studies concur that increasing inflation and innovations in diagnostic and treatment technologies will further

increase hospital costs in the future (Dieleman et al. 2018). A report from the Australian Institute of Health and Welfare (2016)revealed that the total expenditure on healthcare in Australia in 2003-2004 was about US$68 billion -, which increased to US$111 billion in 2013-2014. Another report from the Australian Institute of Health and Welfare (2017)revealed that the total contribution on healthcare costs was about US$129 billion in 2016.

In Saudi Arabia, there was a sharp increase in total expenditure on healthcare from about US$ 6 billion in 2007 to around US$ 20 billion in 2017, indicating that it almost increased threefold within ten years (Ministry of Health in Saudi Arabia 2018).

Healthcare managers are concerned about the rapidly rising costs and want to implement management solutions for cost reduction, whereas clinicians are concerned with reducing medical errors and increasing the quality of care, irrespective of cost implications. Thus, there is an apparent conflict of interest between hospital managers and clinicians. In most hospitals, clinicians are the primary decision-makers regarding the purchasing of supplies.

One strategy for cost minimisation is the use of SCM. Many research findings report on the effectiveness of cost reduction that results from using SCM(Chen, Preston & Xia 2013). A supply chain reduces costs through a variety of mechanisms and effects (Mentzer et al. 2001). The current literature shows that these are applicable to hospital supply chains and supply chain management, subject to the existence of a prudent HSI.

As discussed in Chapter 3, IT integration and information sharing between hospitals and their suppliers plays a key role in gaining competitive success and acting as a strategic resource for SCM (Hora & Klassen 2013; Hult et al. 2006; Klein 2007; Wang, Yan & Wei 2013). Thus, there has been a wider recognition of their importance in both research and industry (Lotfi et al. 2013; Wu, Chuang & Hsu 2014). Literature defines inter-organisational information sharing between hospitals and their key suppliers as the extent to which the hospital shares information about transactions in the business to generate specialized knowledge(Zhang & Chen 2013). The research also acknowledges the role of information sharing practices in shaping both the organisational structure and its information systems structure.

Moreover, researchers have placed information sharing as the connecting link between an organisational structure and its information systems structure (Bell, Bryman & Harley 2018; Zikmund et al. 2013). They have also applied this concept to healthcare organisations. However, the concept does not directly link information sharing with suppliers. In a survey of hospitals and their purchase alliance organisations, a study included information sharing as an aspect of the questionnaire's components (Burns & Lee 2008). Information of different types such as products and prices, emerging trends and innovations, disclosures of vital data, clinical data supports, education programmes, experience sharing and networking, cross-reference materials were shared amongst hospitals and purchasing organisations.

Hence, the objective of this research is to develop a theoretical model that conceptualises the factors affecting HSI and its impact on hospital performance in both public and private

settings in the context of Saudi Arabia. So that a comparison can be made between the impact of HSI on hospital performance in the private sector and the public sector. Underpinned by the relational view of competitive advantage and lean thinking, and based on an extensive literature review, the constructs were developed, and a conceptual model was proposed in Chapter 2.

The research questions that arse from the conceptual model will be discussed in detail in the following sections. The proposed hypotheses were tested using SEM as previously described. The results of testing these hypotheses are summarised in Table7.1.

Table 7.1: The results of testing the hypotheses of the research

Research questions	Research hypothesis	Findings
How does logistics integration, information technology, information, information sharing, and trust affect hospital supplier integration?	**H1:** Logistics integration is positively associated with hospital-supplier integration.	Supported
	H2: The level of IT integration between a hospital and its suppliers is positively associated with hospital-supplier integration.	Rejected
	H3: The level of information sharing between a hospital and its supplier is positively associated with hospital-supplier integration	Supported

Research questions	Research hypothesis	Findings
	H4: Trust between hospitals and their suppliers is positively associated with hospital-supplier integration	Supported
What is the impact of hospital supplier integration on hospital performance in the Saudi context?	**H5:** Hospital-supplier integration is positively associated with hospital performance	Supported
Do lean practices enhance the impact of hospital-supplier integration on hospital performance?	**H6:** Lean practices play a moderating role between hospital-supplier integration and hospital performance.	Supported
Does hospital size, as a control variable, have an impact on the relationship between hospital-supplier integration and hospital performance?	**H7:** Hospital size as a control variable has an impact on the relationship between hospital-supplier integration and hospital performance	Rejected

7.3 Hospital-supplier integration model

The extensive literature review performed in this study in the area of HSI resulted in a conceptual framework comprised of four factors that may have an impact on HSI, namely: logistics integration, IT integration, information sharing and trust. A thorough discussion of each of these factors was provided earlier in this thesis. Therefore, this study aims to confirm whether each of these factors has an impact on HSI. Hence, it was hypothesised

in the proposed model that these factors were positively associated with HSI, which resulted in the first four hypotheses of this thesis. The data that was collected was analysed using SEM with an IBM SPSS AMOS version 23.

The relationship between the subscale item scores and the respective latent variables was confirmed using CFA. Subsequently, a full CFA model was fit to the data to validate the conceptual framework developed for this research. The results from the analysis found that, out of logistics integration, IT, information sharing and trust, only IT was not positively associated with HSI (B= -0.23). Trust was found to be more strongly associated with hospital performance (B = 0.72) compared to logistics integration (B= -0.43).

These results are in line with the identified findings by previous research around HSI. Logistics integration in healthcare covers the configuration of the distribution network, distribution strategies, inventory control, supply contracts, supply chain integration along with strategic partnering, outsourcing and procurement strategies, IT and decision support systems and customer value (Privett & Gonsalvez 2014). Additionally, researchers have found that logistics integration enhancesHSI(Ivan Su, Gammelgaard & Yang 2011). Furthermore, it has been found that SCM streamlines all these activities holistically, cost-effectively and in a standardised manner (Chan, Lettice & Durowoju 2012). The results of this study showed a positive association between logistics integration and HSI (H1).

The level of IT integration between hospitals and their suppliers was found to be positively associated with HSI (H2). Research on the relationship between IT, trust and

209

social change in Saudi Arabia has found that, due to the traditional control state of information media in Saudi Arabia, more reliance is placed on oral and unofficial means of communication as opposed to IT system driven communications (Fandy 2000).The literature shows that this is expected for Saudi Arabia due to its own definitive characteristics and the level of IT adopted. However, Saudi Arabia is a developing country and it may not have a very developed and robust IT infrastructure and/or acceptance that enables advanced levels of IT integration between different organisations.

In addition, studies have researched the implementation of organisational factors in the IT departments of Saudi Arabia hospitals (Almarshad 2013). Establishment of a strong hospital and supplier integration has emerged as an important challenge for the healthcare institutions across the globe, as it reduces the cost of operation and enhances the quality of provided services (Sjödin & Eriksson 2010). Therefore, hospitals across the world have concentrated on developing strong IT integration for accomplishing desired objectives. However, both private and public hospitals in Saudi Arabia have faced challenges in establishing strong a HSI by introducing IT applications (Albejaidi 2010). Khalifa (2013) contends that several factors including human, political, technical, legal and financial have not allowed IT integration process to achieve desired level of success in Saudi Arabia However, some regulations have not allowed hospitals or suppliers to enjoy that facility, which has created a negative attitude towards IT integration. A lack of organisational procedure related to IT integration have also created challenges for both suppliers and hospitals in developing strong relationship with each other. Lack of policies have created confusion regarding the way data should be managed or utilised for

communication and decision-making procedures within the healthcare sector. According to Chen, Preston and Xia (2013)a lack of communication or clarity related with responsibilities do not help in establishing strong integration between two parties. Saudi Arabia's healthcare sector is facing similar challenges, which in turn restricts hospitals to rely heavily on IT integration for achieving success. A majority of the healthcare industry suppliers across the Saudi Arabia market are not even aware of the significance of using IT based applications. Therefore, these suppliers often show negative attitude towards the introduction of any IT application, which in turn damages the integration level between hospitals and suppliers (Almalki, Fitzgerald & Clark 2012).

Apart from that, technological deficiency or lack of knowledge about advances in IT infrastructure, due to the position of Saudi Arabia as a developing country, have forced suppliers to develop negative attitude towards the introduction of any IT application. According to Abdo, Sanai and Al-Faleh (2012)a lack of knowledge can create challenges in keeping up with new processes, which is exactly what has happened in the Saudi Arabia healthcare sector (Albejaidi 2010). Again, such technology knowledge related gaps have restricted hospitals from using IT applications for establishing strong hospital-supplier relationship. Saudi Arabia's economy has always maintained a restrictive approach towards its importing and exporting activities (Ramady 2010). In fact, many products are still being restricted by the government and cannot be imported within the country. Similarly, the healthcare sector in Saudi Arabia has faced challenges in adopting

advanced foreign technologies for fulfilling all the requirements of operational procedures (Elolemy & Albedah 2012).

In addition, protective rules and regulations have increased the cost associated with the inclusion of any new technologies, which again has generated financial challenges for the establishment of HSIs. This is in contrast with the primary objective behind the inclusion of IT technologies, which is to reduce the cost of operations (Al-Sobhi, Weerakkody & Mustafa Kamal 2010). Hence, the maturity of IT adoption in Saudi Arabia is still developing and emerging as a new strategy to enhance organisational performance. This level of internal maturity within organisations can also be extended to realise the poor IT integration inter-organisationally between Saudi Arabia hospitals and their suppliers. It is also possible that the lack of IT integration between hospitals and suppliers could also act as a constraint for information sharing, which will be the subject of further analysis to capture any possible justification of the current results.

One way to look at the results of H3 and H4 is to consider them in context. The multiple roles of the MOH within the Saudi Arabia healthcare system places this institution in charge of all the regulations around information sharing and trust among different levels of organisations. In other words, the healthcare system in Saudi Arabia is highly restricted and controlled by the MH, not only at the public sector level, but also at the private sector. Moreover, all suppliers are urged and required to abide by the strict instructions of the MOH regarding information sharing and trust (Albejaidi 2010; Almalki, Fitzgerald & Clark 2011b)

In this current study, the results revealed information sharing practices and their impact on the overall level of integration between hospitals and their suppliers. They also revealed the importance of trust on HSI, which is in line with prior research that recognised the importance of trust in maintaining the integration between hospitals and their suppliers. Prajogo, Oke and Olhager (2016)showed the need for inter-organisational information sharing, and that trust is critical to ensure smooth and efficient information sharing and exchange between hospitals and their suppliers. For instance, researchers have found that trust has a positive impact on HSI, while trust not only has a positive impact on the quality of inter-organisational interaction and structuring, but it also reduces the fear of information misappropriation and encourages openness in relationships (Bhakoo & Chan 2011; Chan, Lettice & Durowoju 2012; Mcevily, Perrone & Zaheer 2003). In fact, trust was found to be more strongly associated with HSI (B=0.72) compared to logistics integration and information sharing.

In conclusion, this study, developed a comprehensive model to cover the factors that are positively associated with HSI based on an extensive literature review. These factors were logistics integration, IT integration, information sharing and trust. The results indicated that logistics integration, information sharing, and trust were, as expected, positively associated with HSI, whereas IT integration was not. By taking this result in context— and recognising that Saudi Arabia is a developing country and may still lack an IT infrastructure that supports a superior inter-organisational digital integration—may help to understand why this hypothesis was not supported.

213

7.4 Impact of hospital-supplier integration on hospital performance

The findings of the structural model also confirmed that HSI is positively and significantly associated with better hospital performance (B= -0.53). Some of the measures of hospital performance include delivery speed, dependability and other aspects (Vickery et al. 2003). Therefore, as per the findings of the model, it is safe to conclude that higher levels of HSI lead to superior service delivery speed and higher dependability. From a practical standpoint, these findings can be used by hospitals to improve their performance by focusing on improving the various aspects of HSI. In Saudi Arabia, the government has given high priority to the enhancement, development and improvement of healthcare services and increasing the performance of the healthcare system. In other words, if a hospital attempts to enhance its logistics integration, IT systems, information sharing and the level of trust with its suppliers then this should translate to better hospital performance.

7.5 Moderating role of lean thinking

The structural model also found that adopting lean practices to enhance the overall performance of the respective hospitals, seem to play a moderating role between HSI and hospital performance.

The results of this study showed that this role is positively associated with better hospital performance (B= -0.08). This implies that, lean practices moderate the relationship between HSI and hospital performance, which is consistent with much of the literature

(Mazzocato et al. 2012). Lean practices can be implemented by hospitals to improve their supplier integration and performance. There is potential to apply lean practices to various aspects of hospital management, including service delivery time and patient satisfaction (So & Sun 2011; Womack, Jones & Roos 1990). The findings from this study are important from a practical perspective as they indicate, that if lean practices are applied to the measures of HSI—logistics integration, IT, information sharing and trust—then this can facilitate improvement in hospital performance.

Examining the moderating role of lean practices on the interaction between HSI and hospital performance revealed that applying these practices significantly enhanced the overall performance of the hospital, irrespective of hospital size or hospital type. More specifically, without taking hospital size and hospital type into consideration as the control variables, HSI led to a value of 2.94 with low lean practices in place. This value rose to 3.88, where a high level of lean practices was found. Similarly, lean practices enhanced the overall performance of the studied hospitals from 2.92 to 3.86 when assigning hospital size as the control variable, and from 3.16 to 3.96 when assigning both hospital size and hospital type as control variables simultaneously (see Figure 6.6).

In summary, lean practices strengthen the positive relationship between HSI and hospital performance. The results of the structural model found that hospital size did not have any impact on the results (B= -0.03). While the literature lacks any supporting studies on this aspect in the context of Saudi Arabia, the researcher's experience in this system could be

215

used to offer some explanations. Most of the surveyed hospitals were under the control of the MOH, which has strict regulations for managing the relationships with suppliers. For instance, if a supplier does not deliver good service to smaller hospitals then the MOH may not pay their invoices or may even penalise them. Thus, hospital size does not matter as it is beyond the control of individual hospitals. It would have been useful to compare the hospitals under the control of the MOH with hospitals under other ministries, such as higher education or national security. This is one of the recommended directions for future research. These findings can be used to optimise the costs associated with healthcare supply chains.

7.6 Hospital size as a control variable

This section highlights the results related to the hospital size as a control variable, which had an impact on the relationship between HSI and hospital performance. HSI is the process of developing a long-term relationship between two concerned parties for producing better output (Abdo, Sanai & Al-Faleh 2012). The results of the structural model found that hospital size did not have any impact on the results (B= -0.03). The results were not positively and significantly associated with better HSI. These findings should be viewed and used with caution. The various aspects of HSI must improve together with a growing hospital for better hospital performance to be evident. Furthermore, the use of lean practices can assist in enhancing hospital performance.

Several external and internal factors contribute in the development of a professional relationship between two corporate entities. According to Yeates (2012)the size of a hospital can be the initial influential factor for a supplier to integrate with a particular

216

hospital. Generally, larger sized hospitals allow suppliers to deliver products or services consistently, which in turn ensures higher profits for them. However, developing partnerships with larger sized organisations might not always guarantee a greater percentage of profit for the suppliers. As per the study conducted by Sweis et al. (2013), large players—within any industry—tend to consume the maximum share of the profit margin, which is also applicable in healthcare sector. Therefore, suppliers might feel that they have not received enough benefits or credits with respect to their contribution, which will in turn affect the integration level with hospitals.

The demand for healthcare services is increasing across the entire Saudi Arabia economy at a rapid rate (Phichitchaisopa & Naenna 2013). Therefore, it is expected that suppliers will receive enough business opportunities to achieve their desired levels of profit. At the same time, it will provide suppliers a considerable amount of bargaining power at the time of establishing long-term relationships with hospitals (Lee, Lee & Schniederjans 2011). Larger sized hospitals, on the other hand, are expected to take the lead with supply chain activities across the healthcare industry. Therefore, conflict of interest is likely to occur between two concerned parties, which will result in failure (Leuschner, Rogers & Charvet 2013). In addition, increasing demand within the supply chain industry will create pressure on the suppliers regarding timely delivery of the ordered products. Therefore, supply chain flexibility will play an important role for hospitals to keep suppliers loyal and associated for longer timeframes. Thus, the evaluation clearly reflects that the size of hospital cannot determine the integration level between suppliers and

217

hospitals because several other factors need to be considered for maintaining a desired relationship.

In spite of that, it needs to be mentioned that hospital size is not the prime factor that determines the integration or bonding level between hospitals and suppliers. Rather several other external factors including environmental uncertainty, transport infrastructure, flexibility, government rules and regulations and communicational flow determine the eventual integration level between suppliers and hospitals (Silvestre 2015). Environmental uncertainty increases the risk level associated with the supply chain procedure (Wong, Boon-Itt & Wong 2011). Therefore, suppliers often remain circumspective about the development of a long-term relationship with a particular healthcare institution. Similarly, lack of transport infrastructure enhances the cost associated with the supply chain activities for any supplier (Boon-Itt & Yew Wong 2011). Therefore, hospitals—regardless of their size—might have to provide greater incentives to the suppliers in order to keep them associated for a longer timeframe. However, payment of such additional incentives might induce hospitals to look for better alternative suppliers, which again is likely to create adverse effects on the long-term relationship.

7.7 Private and public hospitals: a comparison

This section highlights the results of testing presented in section 6.3.6 related to determining the impact of HSI on performance of hospitals in Saudi Arabia. Results show that there were many differences between private and public hospitals. The positive effect of HSI was stronger across private hospitals compared to public hospitals (Z score = 3.284, $p < 0.01$). The regression coefficient for the relationship between HSI and hospital

performance was higher in private hospitals ($\beta = 0.701$, p< 0.01) compared to public hospitals ($\beta = 0.41$, p< 0.01). The statistically significant Z score indicates that this difference between both regression coefficients was statistically significant. The difference in the relationship between IT and HSI across hospital types was not statistically significant at the 0.05 level (Z score = -0.3, p> 0.05). Although the coefficient for the association between IT and HSI was lower across private hospitals ($\beta = -0.384$, p = 0.05 compared to public hospitals ($\beta = -0.04$, p = 0.606), this difference was not statistically significant (Z score = 0.3, p> 0.05). Regarding the association between logistic integration and HSI, the results showed that the association was stronger in private hospitals compared to public hospitals ($\beta = 0.407$, p< 0.01 in public hospitals vs. $\beta = 0.544$, p< 0.01 in private hospitals). The Z score was statistically significant at the 0.05 level (Z = 1.96, p< 0.05), which indicates that the difference was statistically significant.

The results also showed that the association between trust and HSI was stronger in private hospitals compared to public hospitals ($\beta = 0.49$, p = 0.03, in public hospitals vs. $\beta = 0.802$, p< 0.01 in private hospitals). The Z score was statistically significant at the 0.05 level (Z = 2.5, p< 0.05), which indicates that the difference was statistically significant (the association between trust and HSI is stronger in private hospitals compared to public hospitals). The effect of information sharing was also stronger in private hospitals compared to public hospitals ($\beta = 0.1$, p = 0.01 in public hospitals compared to $\beta = 0.341$, p< 0.01 in private hospitals). Again, the Z score was statistically significant at the 0.05

219

level (Z = 1.98, p< 0.05), which indicates that the difference was statistically significant (the association between information sharing and HSI is stronger in private hospitals compared to public hospitals). Finally, the moderating effect of lean practices were stronger in private hospitals (β = 0.119, p = 0.002) compared to public hospitals (β = 0.085, p = 0.01). The critical ratio (Z score) was statistically significant at the 0.05 level(Z = 2.5, p < 0.05), which indicates that the moderating effects of lean practices is stronger in public hospitals. Hospital size was not significantly associated with performance in any of the two models (β = 0.01 and -0.04 for private and public hospitals, respectively. The difference was not statistically significant at the 0.05 level (Z = 0.2, p > 0.05).

In general, the economy of Saudi Arabia has always maintained high per capita GDP, which has assisted the economy in establishing supreme quality health care infrastructure (Trading Economics 2018).In Saudi Arabia, both private and public hospitals have made considerable progress in order to ensure appropriate treatments for all patients. In spite of that, it can be said that private hospitals are providing healthcare services better than public hospitals. There are many services that are not available in the public hospitals but can be seen in the private hospitals in Saudi Arabia. For instance, private wards and waiting areas are still not available in public hospitals due to lack of space. Thus, it is clear that private sector hospitals are providing better services in the Saudi healthcare market (Debusmann 2018). Several factors have contributed in this conclusion.

7.8 Summary

This chapter was designed to present the hypothesised structural model and report on the results of the hypotheses. The hypothesised model was tested using SEM, which included

seven proposed hypotheses (H1 to H7). The choice of SEM was based on its ability to enable the exploration of various relationships among a set of constructs, and to test hypothesised models with sample data (Breckler 1990; Kline 2015). As hypothesised—H1: Logistics integration is positively associated with hospital-supplier integration, H3: The level of information sharing between a hospital and its supplier is positively associated with hospital-supplier integration and H4: Trust between hospitals and their suppliers is positively associated with hospital-supplier integration were supported. However, H2: The level of IT integration between a hospital and its suppliers is positively associated with hospital-supplier integration was not supported. In addition, the HSI was also found to be positively associated with better hospital performance (H5). This relationship was found to be moderated by lean practices (H6). Hospital size was found not to have any impact on the relationship between HSI and hospital performance, which rejectedH7.

The next chapter will discuss the contribution of the study and research implications on both the theory and practice, as well as the limitations in this study and possible future research directions. The overall research helped in discovering that HSI can help in increasing the overall level and the quality of services provided by hospitals. Suppliers play a critical role in ensuring that the quality of services is maintained. Hospital suppliers provide technology, tools, systems, and techniques. All of these are used to enhance the quality of service offered to patients according to their needs. It is critical for hospitals to ensure that they set standards of quality and maintain a strict system to continuously analyse and evaluate their services and quality. This current study showed the importance

of the relationship between hospitals and suppliers, which positively influences healthcare services delivered to patients.

In Saudi Arabia, it has been observed that healthcare organisations have undergone various change and developments. These changes were influenced by the changing needs and demands of the patients and the environment. It is impossible to survive in this challenging and competitive environment without bringing timely changes. As the field of SCM has evolved, the need for effective integration between partners involved in the supply chain have increased. If they fail to manage the connectivity and coordination, it can affect the performance and level of services negatively. Hence, this current study has shown the importance of building and maintaining relationships with suppliers so that the level of coordination and connectivity can be managed. This also has a direct impact on the delivery of services and influences the performance of the organisation.

CHAPTER 8: IMPLICATIONS AND CONCLUSIONS

8.1 Introduction

This study attempted to develop a model for HSI in Saudi Arabia and investigate the impact of this integration on hospital performance, and moderating roles for lean practices. The following section addresses the research questions based on the findings derived in Chapter 7. In this chapter, a readdressing of the research questions will be presented to develop a comprehensive model for the HSI. In Section 8.3, the contributions of the study are discussed, including the theoretical, methodological and managerial approaches, while Section 8.4 presents the limitations of this study. Afterwards, the recommendations for future research are detailed in Section 8.5. Finally, a brief conclusion is presented in Section 8.6.

8.2 Readdressing the research questions

This study has met the requirements to develop a comprehensive conceptual model for HSI in the context of Saudi Arabia. Given the increased spending on healthcare purchases in this developing country, the need for such a model is apparent. Although academic research on organisation-supplier integration is relatively extensive, the healthcare industry seems to lag behind in this respect. In addition, the extensive literature review performed in this study showed that this lag is more apparent in developing countries. The objective of this research, as discussed in 1.10 was to develop a theoretical model that conceptualises the factors affecting HSI and its impact on hospital performance in

223

both public and private settings in the context of Saudi Arabia. A comparison was made between the impact of HSI on hospital performance in the private and public sector. To achieve the main purpose of the study, several research questions were formulated, as can be seen in Table 8.1.

Table 8.1: Answering the research questions for this study

Research question	Answer
• The literature review on hospital-supplier integration in Chapter 3 clearly shows the need to construct a model that takes various factors that may have an impact on hospital-supplier integration into consideration. Hence, the first research question was created to identify these factors. • How do logistics integration, information technology, information sharing, and trust affect hospital supplier-integration?	The literature suggested four factors, namely; logistics integration, information technology, information sharing and trust. These factors were identified based on the relational view of competitive advantage as theoretical underpinning and through the extensive literature review process as discussed in Chapter 3. Each of these factors was assigned a hypothesis to examine the impact of these factors on the level of hospital-supplier integration. As discussed in Chapter 6 and Chapter 7, the hypotheses regarding logistics integration, information sharing, and trust were supported, whereas the hypothesis regarding information technology was not supported. Chapter 6 thoroughly discussed these findings and how align with the literature. In light of these results, the answer for the research question is that: logistics integration,

Research question	Answer
	information sharing, and trust are the factors that affect hospital supplier-integration in Saudi Arabia.
• What is the impact of hospital-supplier integration on the overall performance of Saudi Arabia hospitals?	The findings of the structural model also confirmed that hospital-supplier integration is positively and significantly associated with better hospital performance (B= -0.561). Some of the measures of hospital performance include delivery speed, dependability and other aspects (Vickery et al. 2003). Therefore, as per the findings of the model, it is safe to conclude that higher levels of hospital supplier- integration would lead to a superior service delivery speed and higher dependability.
• Do lean practices enhance the impact of hospital-supplier integration on hospital performance?	The results show that adopting lean practices to enhance the overall performance of the respective hospitals seems to play a moderating role between hospital-supplier integration and hospital performance. The results of this study show that this role is positively associated with better

Research question	Answer
	hospital performance (B= -0.066). This implies that, as hypothesised earlier, lean practices moderate the relationship between hospital-supplier integration and hospital performance which is consistent with the literature review (Mazzocato et al. 2012).
• What is the impact of hospital size on determining the impact of hospital-supplier integration on hospital performance in Saudi Arabia?	The results of the structural model found that hospital size is not positively and significantly associated with better hospital supplier integration. Larger hospitals have higher levels of hospital supplier-integration and vice versa.

8.3 Research implications

This study has several implications for both theory and practice in HSI.

8.3.1 Theoretical implications

The most significant contribution the study makes in the field of HSI is that the study attempted to develop a robust framework, that was underpinned by the relational view of competitive advantage (Zhang & Chen 2013). In addition, this current study showed that lean thinking plays a moderating role between HSI and hospital performance. According to Womack, Jones and Roos (1990),lean thinking is comprised of principles and practices that aim to transform the way businesses are done by reducing waste, minimising the cost

of delivery and ensuring a high-level of customer satisfaction that can help in overcoming challenges. The implications for theory, include developing a robust framework for HSI and its impact on hospital performance. In doing so, the framework notes the primary constructs of HSI, namely logistics integration, IT integration, information sharing, and trust. Furthermore, one of the clear contributions of this study is the moderating role of lean practices between HSI and hospital performance. This is particularly crucial as this study addresses the role of HSI in developing countries. In addition, this study examined the validity of the relational view of competitive advantage theory in developing countries. To the best of the researcher's knowledge, this study is the first of its kind that uses both lean thinking and the relational view of the competitive advantage theory combined, in order to examine the moderating role of lean practices on the inter-organisational relationships in Saudi Arabia.

8.3.2 Practical implications

This study used a quantitative-based research methodology. To enhance the statistical techniques and solve the research problem, data analyses were used, which ranged from basic to advanced. In HSIs, research that has used difficult statistical approaches is restricted. The implications for practices are also far reaching, as the sample comprises of two types of hospitals currently operating in Saudi Arabia: private, and public. The implications include:

  a. To include enabling managers and decision-makers to find the best practices to manage relationships with their suppliers, devising a system

that enhances hospital performance through the adoption of the right level of lean practices in their hospitals, as well as reducing the overall cost by ultimately enhancing the management of materials and supplies. In the hospitals, the supply chain managers must pay more attention to increasing the level of coordination and communication between the supply chain partners as they are the primary stakeholders.

b. To meet the needs of the end users, the supply chain activities must be managed and organised in the best possible manner.

c. The use of advanced and modern techniques and approaches can significantly assist in creating a strong connection between the suppliers and the service providers. Suppliers are the providers of necessary supplies to manage the level of services. Hence, building and maintaining relationships with the suppliers must be effectively managed using modern approaches.

The field of supply chain has enhanced and improved with time. So, it is recommended that the supply chain managers of hospitals take advantage of modern methods. It would positively influence the organisation's performance and capability to compete and grow in the market.

8.4 Research limitations

Despite the theoretical and practical contributions of this study, there exist a number of limitations. First, the data was only collected from one country, namely Saudi Arabia. Thus, the findings may only be relevant in the context of Saudi Arabia and not to other

developing countries. This is given the fact that different countries have different healthcare systems, within which the processes of purchasing health materials may be significantly different. Not only the healthcare systems are different, but also all the other aspects of the national economies, where more pressure may be placed on purchasing health materials.

Second, the data was collected from the hospitals' point of view but not that of the suppliers. Therefore, the latter's perspectives on the factors covered here are not known. This is critical to study, as many aspects of enablers, barriers or other issues may contribute to the facilitation of better HSIs, which may be revealed by taking the suppliers' perspective into consideration.

Finally, the study focused on operational budget items, such as drugs/ medications, medical accessories and non-medical purchases. Although these are key components in the health purchases of Saudi Arabia hospitals, there are other purchases that are not part of this process and were not included in the study. Some examples include advanced biomedical technology (MRI, ECG, X-Ray, Pathology technology), furniture (office equipment, desks, cabins, printers, computers), vehicles, electricity generators and air conditioners. These items are generally part of a broader category of purchases that are bought under special budgets or through national tenders.

8.5 Future research directions

Although there were some limitations, this study works as a baseline to direct future research in the following areas:

a. Future research directions can potentially address the limitations of this study. One of the recommended research directions is to check the validity of the model in various developing countries, whose healthcare systems have different characteristics, and therefore, relationships between hospitals and their suppliers may follow different governance models. Another recommendation is to a conduct comparative analysis between various sub-types on hospitals in Saudi Arabia. These include National Guard hospitals, Armed Forces hospitals, Security Forces hospitals, tertiary hospitals, and specialised medical centres, as well as the hospitals under the auspice of the MOH.

b. While carrying out the research, several limitations were faced, which also affected the findings and results of the study. This study did not include the supplier's perspective.

c. While carrying out the research, several limitations were faced, which also affected the findings and results of the study. It was carried out in a limited time frame, which had an impact on the findings. Other than this, it was found that the study involved only one data collection instrument. The large sample size and maintaining the reliability and validity was a major challenge. The study involved the use of different research and analysis conducted in the past. So, the overall

evaluation and comparison of the primary and secondary data was restricted due to the limited time.

8.6 Summary

This chapter discussed and concluded the findings of the study. A clear picture and understanding from the outcomes of HSI implementation, the theoretical and practical implications were discussed. The research questions were readdressed by comparing the assumptions with the findings generated in Chapter 7. Nevertheless, this study acknowledges some limitations and provides potential opportunities based on future recommendations. Finally, this chapter concluded with a brief summary.

REFERENCES

Abdo, AA, Sanai, FM & Al-Faleh, FZ 2012, 'Epidemiology of viral hepatitis in Saudi Arabia: are we off the hook?', *Saudi Journal of Gastroenterology: Official Journal of the Saudi Gastroenterology Association*, vol. 18, no. 6, pp. 349–357.

Abdulsalam, Y, Gopalakrishnan, M, Maltz, A & Schneller, E 2015, 'The emergence of consolidated service centers in health care', *Journal of Business Logistics*, vol. 36, no. 4, pp. 321-334.

Abdulsalam, Y & Schneller, E 2017, 'Hospital supply expenses: An important ingredient in health services research', *Medical Care Research and Review*, vol. 74, no. 4, pp. 1-13.

Acock, AC 2005, 'Working with missing values', *Journal of Marriage and Family*, vol. 67, no. 4, pp. 1012-1028.

Adebanjo, D, Laosirihongthong, T & Samaranayake, P 2016, 'Prioritizing lean supply chain management initiatives in healthcare service operations: a fuzzy AHP approach', *Production Planning & Control*, vol. 27, no. 12, pp. 953-966.

Ajami, S, Rajabzadeh, A & Ketabi, S 2014, 'A Review on influencing criteria for selecting supplier of information technology services in the hospital', *J Educ Health Promot*, vol. 3, no. 1, pp. 1-108.

Al-Sobhi, F, Weerakkody, V & Mustafa Kamal, M 2010, 'An exploratory study on the role of intermediaries in delivering public services in Madinah City: Case of Saudi Arabia', *Transforming Government: People, Process and Policy*, vol. 4, no. 1, pp. 14-36.

Al-Tit, A 2016, 'The impact of lean supply chain on productivity of saudi manufacturing firms in al-qassim region', *Polish Journal of Management Studies*, vol. 14, no. 1, pp. 18-27.

Alahmad, G & Silverman, H 2017, 'Research ethics governance in the arab region--saudi arabia', *In Research Ethics in the Arab Region*, vol. 5, no. 1, pp. 229-235.

Albejaidi, FM 2010, 'Healthcare system in Saudi Arabia: An analysis of structure, total quality management and future challenges', *Journal of Alternative Perspectives in the Social Sciences*, vol. 2, no. 2, pp. 794-818.

Ali, A & Salehi, N 2016, 'Supplier selection in closed loop supply chain by an integrated simulation-Taguchi-DEA approach', *Journal of Enterprise Information Management*, vol. 29, no. 3, pp. 302-326.

Aljadhey, H, Mahmoud, MA, Alshammari, TM, Al-Dhaeefi, M, Le Louet, H, Perez-Gutthann, S & Pitts, PJ 2015, 'A qualitative exploration of the major challenges facing pharmacovigilance in Saudi Arabia', *Saudi Medical Journal*, vol. 36, no. 9, p. 1097.

Aljuaid, M, Mannan, F, Chaudhry, Z, Rawaf, S & Majeed, A 2016, 'Quality of care in university hospitals in Saudi Arabia: a systematic review', *BMJ Open*, vol. 6, no. 2, pp. 1-10.

Alkhamis, A, Hassan, A & Cosgrove, P 2014, 'Financing healthcare in Gulf Cooperation Council countries: a focus on Saudi Arabia', *The International Journal of Health Planning and Management*, vol. 29, no. 1, pp. 64-82.

Alkhamis, AM 2012, 'Health care system in Saudi Arabia: An overview', *Eastern Mediterranean Health Journal*, vol. 18, no. 10, pp. 784-793.

Almalki, M, Fitzgerald, G & Clark, M 2011a, 'Health care system in Saudi Arabia: an overview', *Eastern Mediterranean Health Journal*, vol. 17, no. 10, pp. 784-793.

Almalki, M, Fitzgerald, G & Clark, M 2011b, 'Health care system in Saudi Arabia: an overview', *Eastern Mediterranean Health Journal*, vol. 17, no. 10, pp. 784-791.

Almalki, MJ, Fitzgerald, G & Clark, M 2012, 'Quality of work life among primary health care nurses in the Jazan region, Saudi Arabia: a cross-sectional study', *Human Resources for Health*, vol. 10, no. 1, pp. 1-13.

Almarshad, A 2013, The it performance in saudi arabian hospitals, Doctor of Philosophy Thesis, De Montfort University, UK.

Alrasheedy, AA, Hassali, MA, Wong, ZY, Aljadhey, H, Al-Tamimi, SK & Saleem, F 2017, *Pharmaceutical Policy in Saudi Arabia*, Springer, Saudi Arabia

Alturki, N, Bosua, R & Kurnia, S 2013, 'Exploring information sharing problems in nursing handover: an activity theory perspective', in R University (ed.), *inproceedings*, Melbourne, Australia, RMIT University, pp. 1-11.

Arbuckle, JL & Wothke, W 2003, *AMOS 5.0 (computer software). Chicago, IL: SPSS*, Inc.

Aronsson, H, De Vries, J, Abrahamsson, M & Spens, K 2011, 'Developing lean and agile health care supply chains', *Supply Chain Management: An International Journal*, vol. 16, no. 3, pp. 176-183.

Arunanondchai, J & Fink, C 2007, *Trade in health services in the ASEAN region*, The World Bank, East Asia and Pacific.

Australian Institute of Health and Welfare 2016, *Health expenditure Australia*, viewed 12/10/2018, <https://www.aihw.gov.au/getmedia/e8d37b7d-2b52-4662-a85f-01eb176f6844/aihw-hwe-74.pdf.aspx?inline=true>.

Australian Institute of Health and Welfare 2017, *Australia's welfare*, viewed 12/07/2018, <https://www.aihw.gov.au/getmedia/088848dc-906d-4a8b-aa09-79df0f943984/aihw-aus-214-aw17.pdf.aspx?inline=true>.

Bagchi, PK, Chun Ha, B, Skjoett-Larsen, T & Boege Soerensen, L 2005, 'Supply chain integration: a European survey', *The International Journal of Logistics Management*, vol. 16, no. 2, pp. 275-294.

Bai, G, Coronado, F & Krishnan, R 2010, 'The role of performance measure noise in mediating the relation between task complexity and outsourcing', *Journal of Management Accounting Research*, vol. 22, no. 1, pp. 75-102.

Bailey, G 2015, Developing sustainable supply chains for healthcare, PhD Thesis, University of Southampton, England.

Bailey, G, Cherrett, T, Waterson, B, Breen, L & Long, R 2014, 'Boxed up and locked up, safe and tight! Making the case for unattended electronic locker bank logistics for an innovative solution to NHS hospital supplies (UK)', *International Journal of Procurement Management*, vol. 8, no. 1-2, pp. 104-125.

Barclay, S, Todd, C, Finlay, I, Grande, G & Wyatt, P 2002, 'Not another questionnaire! Maximizing the response rate, predicting non-response and assessing non-response bias in postal questionnaire studies of GPs', *Family Practice*, vol. 19, no. 1, pp. 105-111.

Barlow, R 2010, 'Manifesting destiny in supply chain's Wild West 2010', *Healthcare Purchasing News*, vol. 34, no. 7, pp. 10-14.

Baruch, Y & Holtom, BC 2008, 'Survey response rate levels and trends in organizational research', *Human Relations*, vol. 61, no. 8, pp. 1139-1160.

Belkoski, DA 2008, 'Stop the supply chain insanity retail as a model for hospitals: the healthcare industry needs to follow the example of its retail counterparts and implement a product data utility system', *Healthcare Financial Management*, vol. 62, no. 4, pp. 60-65.

Bell, E, Bryman, A & Harley, B 2018, *Business research methods*, Oxford University Press, England, UK.

Bendato, I, Cassettari, L, Mosca, R & Rolando, F, 2015, '*Improving the Efficiency of a hospital ED according to lean management principles through system dynamics and discrete event simulation combined with quantitative methods'*, UK, Springer, pp. 555-572.

Bentler, PM 1990, 'Comparative fit indexes in structural models', *Psychological Bulletin*, vol. 107, no. 2, p. 238.

Berg, N 2005, 'Non-response bias', *Encyclopedia of Social Measurement*, vol. 2, no. 1, pp. 865-873.

Bhakoo, V & Chan, C 2011, 'Collaborative implementation of e-business processes within the health-care supply chain: the Monash Pharmacy Project', *Supply Chain Management: An International Journal*, vol. 16, no. 3, pp. 184-193.

Bhakoo, V & Choi, T 2013, 'The iron cage exposed: Institutional pressures and heterogeneity across the healthcare supply chain', *Journal of Operations Management*, vol. 31, no. 6, pp. 432-449.

Bidhandi, HM & Yusuff, RM 2011, 'Integrated supply chain planning under uncertainty using an improved stochastic approach', *Applied Mathematical Modelling*, vol. 35, no. 6, pp. 2618-2630.

Blaikie, N & Priest, J 2019, *Designing Social Research: The logic of anticipation*, John Wiley & Sons, Cambridge, UK.

Boon-Itt, S & Yew Wong, C 2011, 'The moderating effects of technological and demand uncertainties on the relationship between supply chain integration and customer delivery performance', *International Journal of Physical Distribution & Logistics Management*, vol. 41, no. 3, pp. 253-276.

Bornbusch, A, Dickens, T, Hart, C & Wright, C 2014, 'A stewardship approach to shaping the future of public health supply chain systems', *Glob Health Sci Pract*, vol. 2, no. 4, pp. 403-409.

Bowden, A, Fox-Rushby, J, Nyandieka, L & Wanjau, J 2002, 'Methods for pre-testing and piloting survey questions: illustrations from the KENQOL survey of health-related quality of life', *Health Policy and Planning*, vol. 17, no. 3, pp. 322-330.

Brace, I 2018, *Questionnaire design: How to plan, structure and write survey material for effective market research*, Kogan Page Publishers, London, UK.

Bradburn, NM, Sudman, S & Wansink, B 2004, *Asking questions: the definitive guide to questionnaire design--for market research, political polls, and social and health questionnaires*, John Wiley & Sons, New Jersey, US.

Bravo, P, Edwards, A, Barr, PJ, Scholl, I, Elwyn, G & Mcallister, M 2015, 'Conceptualising patient empowerment: a mixed methods study', *BMC Health Services Sesearch*, vol. 15, no. 1, pp. 1-14.

Breckler, SJ 1990, 'Applications of covariance structure modeling in psychology: Cause for concern?', *Psychological bulletin*, vol. 107, no. 2, pp. 260-273.

Brot-Goldberg, ZC, Chandra, A, Handel, BR & Kolstad, JT 2017, 'What does a deductible do? The impact of cost-sharing on health care prices, quantities, and spending dynamics', *The Quarterly Journal of Economics*, vol. 132, no. 3, pp. 1261-1318.

Bryman, A & Bell, E 2011, *Business Research Methods 3e*, OUP Oxford, Oxford, UK.

Buchanan, PD & Bryman, PA 2009, *The Sage Handbook of Organizational Research Methods*, Sage Publications (CA), London, UK.

Burgess, N & Radnor, Z 2013, 'Evaluating Lean in healthcare', *International Journal of Health Care Quality Assurance*, vol. 26, no. 3, pp. 220-235.

Burns, LR & Lee, JA 2008, 'Hospital purchasing alliances: utilization, services, and performance', *Health Care Management Review*, vol. 33, no. 3, pp. 203-215.

Burt, T 2006, 'Seeing the future: innovative supply chain management strategies', *Healthc Exec*, vol. 21, no. 1, pp. 16-21.

Cagliano, R, Caniato, F & Spina, G 2006, 'The linkage between supply chain integration and manufacturing improvement programmes', *International Journal of Operations & Production Management*, vol. 26, no. 3, pp. 282-299.

Casey, JT, Brinton, TS & Gonzalez, CM 2009, 'Utilization of lean management principles in the ambulatory clinic setting', *Nat Clin Pract Urol*, vol. 6, no. 3, pp. 146-153.

Chadha, R, Singh, A & Kalra, J 2012, 'Lean and queuing integration for the transformation of health care processes: a lean health care model', *Clinical Governance: An International Journal*, vol. 17, no. 3, pp. 191-199.

Chahal, H, Dangwal, R & Raina, S 2014, 'Antecedents and consequences of strategic green marketing orientation', *Journal of Global Responsibility*, vol. 5, no. 2, pp. 338-362.

Chan, HK, Lettice, F & Durowoju, OA 2012, *Decision-Making for Supply Chain Integration*, Decision Engineering, Springer, London, UK.

Chan, M, Pang, V, Bunker, D & Smith, S 2006, 'What Do We Mean by E-Procurement?-A Private Hospital Perspective in Australia', *PACIS 2006 Proceedings*, vol. 21, no. 11, pp. 1252-1361.

Chandra, C & Kachhal, SK 2004, 'Managing health care supply chain: trends, issues, and solutions from a logistics perspective', *Proceedings of the Sixteenth Annual Society of Health Systems Management Engineering Forum, February*, vol. 2, no. 6, pp. 1-9.

Chao, C-M, Yu, C-T, Cheng, B-W & Chuang, P-C 2013, 'Trust and commitment in relationships among medical equipment suppliers: Transaction cost and social exchange theories', *Social Behavior and Personality: An International Journal*, vol. 41, no. 7, pp. 1057-1069.

Chaudhry, B, Wang, J, Wu, S, Maglione, M, Mojica, W, Roth, E, Morton, SC & Shekelle, PG 2006, 'Systematic review: impact of health information technology on quality, efficiency, and costs of medical care', *Annals of internal medicine*, vol. 144, no. 10, pp. 742-752.

Chen, DQ, Preston, DS & Xia, W 2013, 'Enhancing hospital supply chain performance: A relational view and empirical test', *Journal of Operations Management*, vol. 31, no. 6, pp. 391-408.

Chen, IJ & Paulraj, A 2004, 'Towards a theory of supply chain management: the constructs and measurements', *Journal of Operations Management*, vol. 22, no. 2, pp. 119-150.

Chiarini, A 2012, 'Risk management and cost reduction of cancer drugs using Lean Six Sigma tools', *Leadership in Health Services*, vol. 25, no. 4, pp. 318-330.

Chiu, M & Lin, G 2004, 'Collaborative supply chain planning using the artificial neural network approach', *Journal of Manufacturing Technology Management*, vol. 15, no. 8, pp. 787-796.

Chopra, S & Sodhi, M 2014, 'Reducing the risk of supply chain disruptions', *MIT Sloan Management Review*, vol. 55, no. 3, pp. 72-80.

Christopher, M 2016, *Logistics & supply chain management*, Pearson, UK.

Christopher, M & Gattorna, J 2005, 'Supply chain cost management and value-based pricing', *Industrial Marketing Management*, vol. 34, no. 2, pp. 115-121.

Clemons, EK, Reddi, SP & Row, MC 1993, 'The impact of information technology on the organization of economic activity: The "move to the middle" hypothesis', *Journal of Management Information Systems*, vol. 10, no. 2, pp. 9-35.

Cole, DA & Maxwell, SE 1985, 'Multitrait-multimethod comparisons across populations: A confirmatory factor analytic approach', *Multivariate Behavioral Research*, vol. 20, no. 4, pp. 389-417.

Coles, JW & Hesterly, WS 1998, 'Transaction costs, quality, and economies of scale: examining contracting choices in the hospital industry', *Journal of Corporate Finance*, vol. 4, no. 4, pp. 321-345.

Collar, RM, Shuman, AG, Feiner, S, Mcgonegal, AK, Heidel, N, Duck, M, Mclean, SA, Billi, JE, Healy, DW & Bradford, CR 2012, 'Lean management in academic surgery', *Journal of the American College of Surgeons*, vol. 214, no. 6, pp. 928-936.

Colquitt, JA, Scott, BA & Lepine, JA 2007, 'Trust, trustworthiness, and trust propensity: a meta-analytic test of their unique relationships with risk taking and job performance', *J Appl Psychol*, vol. 92, no. 4, pp. 909-927.

Conway, JM & Lance, CE 2010, 'What Reviewers Should Expect from Authors Regarding Common Method Bias in Organizational Research', *Journal of Business and Psychology*, vol. 25, no. 3, pp. 325-334.

Corsten, D & Felde, J 2005, 'Exploring the performance effects of key-supplier collaboration: an empirical investigation into Swiss buyer-supplier relationships', *International Journal of Physical Distribution & Logistics Management*, vol. 35, no. 6, pp. 445-461.

Costello, AB & Osborne, JW 2005, 'Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis', *Practical Assessment, Research &Evaluation*, vol. 10, no. 7, pp. 1-9.

Cousins, PD, Lawson, B & Squire, B 2008, 'Performance measurement in strategic buyer-supplier relationships: the mediating role of socialization mechanisms', *International Journal of Operations & Production Management*, vol. 28, no. 3, pp. 238-258.

Coustasse, A, Tomblin, S & Slack, C 2013, 'Impact of radio-frequency identification (RFID) technologies on the hospital supply chain: a literature review', *Perspect Health Inf Manag*, vol. 10, no. 1, pp. 1-17.

Craighead, CW, Ketchen, DJ, Dunn, KS & Hult, GTM 2011, 'Addressing Common Method Variance: Guidelines for Survey Research on Information Technology, Operations, and Supply Chain Management', *IEEE Transactions on Engineering Management*, vol. 58, no. 3, pp. 578-588.

Creswell, JW & Creswell, JD 2017, *Research design: Qualitative, quantitative, and mixed methods approaches*, Sage publications, Zadar, Croatia.

Croes, R, Krabbe-Alkemade, Y & Mikkers, M 2018, 'Competition and quality indicators in the health care sector: empirical evidence from the Dutch hospital sector', *The European Journal of Health Economics*, vol. 19, no. 1, pp. 5-19.

Danese, P 2013, 'Supplier integration and company performance: A configurational view', *Omega*, vol. 41, no. 6, pp. 1029-1041.

Danese, P & Romano, P 2011, 'Supply chain integration and efficiency performance: a study on the interactions between customer and supplier integration', *Supply Chain Management: An International Journal*, vol. 16, no. 4, pp. 220-230.

De Koning, H, Verver, JP, Van Den Heuvel, J, Bisgaard, S & Does, RJ 2006, 'Lean six sigma in healthcare', *Journal for Healthcare Quality*, vol. 28, no. 2, pp. 4-11.

De Vaus, D 2013, *Surveys in social research*, Routledge, Australia.

Debusmann, B 2018, *Saudi Arabia will need an additional 20,000 hospital beds to meet demand*, viewed 5/6/2018, <https://www.arabianbusiness.com/healthcare/397747-saudi-arabia-will-need-an-additional-20000-hospital-beds-to-meet-demand>.

Dejohn, P 2009, 'Moving up...to the c-suite', *materials management in health care*, vol. 18, no. 7, pp. 18-22.

Denton, BT 2013, *Handbook of healthcare operations management*, Springer New York.

Devaraj, S, Krajewski, L & Wei, J 2007, 'Impact of eBusiness technologies on operational performance: The role of production information integration in the supply chain', *Journal of Operations Management*, vol. 25, no. 6, pp. 1199-1216.

Dieleman, JL, Sadat, N, Chang, AY, Fullman, N, Abbafati, C, Acharya, P, Adou, AK, Kiadaliri, AA, Alam, K & Alizadeh-Navaei, R 2018, 'Trends in future health financing and coverage: future health spending and universal health coverage in 188 countries, 2016–40', *The Lancet*, vol. 391, no. 10132, pp. 1783-1798.

Dornberger, R 2018, *Business Information Systems and Technology 4.0: New Trends in the Age of Digital Change*, Springer, New York, US.

Douglas, M 2011, 'Healthcare supply chain costs: a tough pill to swallow', *Inbound Logistics*, vol. 31, no. 11, pp. 49-50.

Eastwood, EJ 2011, 'How sharing information can make the system work better', vol. 136, no. 18, pp. 1-100.

Economou, C, Kaitelidou, D, Kentikelenis, A, Maresso, A & Sissouras, A 2015, *The impact of the crisis on the health system and health in Greece*, European Observatory on Health Systems and Policies, United State

Ellram, LM & Cooper, MC 2014, 'Supply chain management: it's all about the journey, not the destination', *Journal of Supply Chain Management*, vol. 50, no. 1, pp. 8-20.

Elmuti, D, Khoury, G, Omran, O & Abou-Zaid, AS 2013, 'Challenges and opportunities of health care supply chain management in the US', *Health Mark Q*, vol. 30, no. 2, pp. 128-143.

Elolemy, AT & Albedah, AM 2012, 'Public knowledge, attitude and practice of complementary and alternative medicine in Riyadh region, Saudi Arabia', *Oman Medical Journal*, vol. 27, no. 1, p. 20.

Fandy, M 2000, 'Information technology, trust, and social change in the Arab world', *The Middle East Journal*, vol. 54, no. 3, pp. 378-394.

Farahani, RZ, Rezapour, S, Drezner, T & Fallah, S 2014, 'Competitive supply chain network design: An overview of classifications, models, solution techniques and applications', *Omega*, vol. 45, pp. 92-118.

Fawcett, SE, Croom, S, Osterhaus, P, Magnan, GM, Brau, JC & Mccarter, MW 2007, 'Information sharing and supply chain performance: the role of connectivity and willingness', *Supply Chain Management: An International Journal*, vol. 12, no. 5, pp. 358-368.

Fedorowicz, J, Gogan, JL & Ray, AW 2004, 'The ecology of interorganizational information sharing', *Journal of International Information Management*, vol. 13, no. 2, pp. 73-86.

Fink, A 2015, *How to conduct surveys: A step-by-step guide*, Sage Publications, London, UK.

Flynn, BB, Huo, B & Zhao, X 2010, 'The impact of supply chain integration on performance: A contingency and configuration approach', *Journal of Operations Management*, vol. 28, no. 1, pp. 58-71.

Frohlich, MT & Westbrook, R 2001, 'Arcs of integration: an international study of supply chain strategies', *Journal of Operations Management*, vol. 19, no. 2, pp. 185-200.

Furterer, SL 2014, *Lean Six Sigma Case Studies in the Healthcare Enterprise*, Springer, London.

Garvin, K 2006, 'The time is right for the healthcare supply chain to reap the benefits of data synchronization', *Healthcare Purchasing News*, vol. 30, no. 5, pp. 48-49.

Gavirneni, S, Kapuscinski, R & Tayur, S 1999, 'Value of Information in Capacitated Supply Chains', *Management science*, vol. 45, no. 1, pp. 16-24.

Geary, S, Disney, SM & Towill, DR 2006, 'On bullwhip in supply chains—historical review, present practice and expected future impact', *International Journal of Production Economics*, vol. 101, no. 1, pp. 2-18.

Gelderman, CJ, De Jonge, J, Schijns, J & Semeijn, J 2018, 'Investigating cooperative purchasing performance-a survey of purchasing professionals in Dutch hospitals', *The Central European Review of Economics and Management*, vol. 2, no. 1, pp. 133-153.

Germain, R, Davis-Sramek, B, Lonial, SC & Raju, P 2011, 'The impact of relational supplier exchange on financial performance: A study of the hospital sector', *Journal of Business Logistics*, vol. 32, no. 3, pp. 240-253.

Gowrisankaran, G, Nevo, A & Town, R 2015, 'Mergers when prices are negotiated: Evidence from the hospital industry', *American Economic Review*, vol. 105, no. 1, pp. 172-203.

Graddy, EA & Chen, B 2006, 'Influences on the Size and Scope of Networks for Social Service Delivery', *Journal of Public Administration Research and Theory*, vol. 16, no. 4, pp. 533-552.

Haig, BD 2018, *The Philosophy of Quantitative Methods*, Oxford University Press, Oxford, UK.

Hair, Anderson, RE, Tatham, RL & William, C, Black. 2010, *Multivariate Data Analysis*, 7th edn, Prentice Hall, New Jersey, US.

Hair, J, Wolfinbarger, M, Money, A, Samouel, P & Page, M 2015, *Essentials of business research methods*, Routledge, UK

Harrison, JR, Lin, Z, Carroll, GR & Carley, KM 2007, 'Simulation modeling in organizational and management research', *Academy of Management Review*, vol. 32, no. 4, pp. 1229-1245.

Haszlinna Mustaffa, N & Potter, A 2009, 'Healthcare supply chain management in Malaysia: a case study', *Supply Chain Management: An International Journal*, vol. 14, no. 3, pp. 234-243.

Healy, M & Perry, C 2000, 'Comprehensive criteria to judge validity and reliability of qualitative research within the realism paradigm', *Qualitative market research: An International Journal*, vol. 3, no. 3, pp. 118-126.

Heck, RH & Thomas, SL 2015, *An introduction to multilevel modeling techniques: MLM and SEM approaches using Mplus*, Routledge, New York, United State.

Hong, IB 2002, 'A new framework for interorganizational systems based on the linkage of participants' roles', *Information &Management*, vol. 39, no. 4, pp. 261-270.

Hora, M & Klassen, RD 2013, 'Learning from others' misfortune: Factors influencing knowledge acquisition to reduce operational risk', *Journal of Operations Management*, vol. 31, no. 1-2, pp. 52-61.

Houchens, N & Kim, CS 2014, 'The application of Lean in the healthcare sector: theory and practical examples', in *Lean Thinking for Healthcare . , , NY*, Springer, New York, pp. 43-53.

Huang, SH, Sheoran, SK & Keskar, H 2005, 'Computer-assisted supply chain configuration based on supply chain operations reference (SCOR) model', *Computers & Industrial Engineering*, vol. 48, no. 2, pp. 377-394.

Hult, GTM, Ketchen, DJ, Cavusgil, ST & Calantone, RJ 2006, 'Knowledge as a strategic resource in supply chains', *Journal of Operations Management*, vol. 24, no. 5, pp. 458-475.

Iannone, R, Lambiase, A, Miranda, S, Riemma, S & Sarno, D 2015, 'Cost savings in hospital materials management: Look-back versus look-ahead inventory policies', *International Journal of Services and Operations Management*, vol. 22, no. 1, pp. 60-85.

Imperial, MT 2005, 'Using collaboration as a governance strategy: lessons from six watershed management programs', *Administration & Society*, vol. 37, no. 3, pp. 281-320.

Improta, G, Romano, M, Di Cicco, MV, Ferraro, A, Borrelli, A, Verdoliva, C, Triassi, M & Cesarelli, M 2018, 'Lean thinking to improve emergency department throughput at AORN Cardarelli hospital', *BMC Health Services Research*, vol. 18, no. 1, p. 914.

Ivan Su, S-I, Gammelgaard, B & Yang, S-L 2011, 'Logistics innovation process revisited: insights from a hospital case study', *International Journal of Physical Distribution & Logistics Management*, vol. 41, no. 6, pp. 577-600.

Johnson, JE, Smith, AL & Mastro, KA 2012, 'From Toyota to the bedside: nurses can lead the lean way in health care reform', *Nursing Administration Quarterly*, vol. 36, no. 3, pp. 234-242.

Kale, P, Singh, H & Perlmutter, H 2000, 'Learning and protection of proprietary assets in strategic alliances: building relational capital', *Strategic Management Journal*, vol. 21, no. 3, pp. 217-237.

Kane, M, Chui, K, Rimicci, J, Callagy, P, Hereford, J, Shen, S, Norris, R & Pickham, D 2015, 'Lean manufacturing improves emergency department throughput and patient satisfaction', *Journal of Nursing Administration*, vol. 45, no. 9, pp. 429-434.

Katou, AA & Budhwar, PS 2010, 'Causal relationship between HRM policies and organisational performance: Evidence from the Greek manufacturing sector', *European Management Journal*, vol. 28, no. 1, pp. 25-39.

Katz, MH 2011, *Multivariable analysis: a practical guide for clinicians and public health researchers*, University Press, Cambridge, UK.

Kelloway, EK 1995, 'Structural equation modelling in perspective', *Journal of Organizational Behavior*, vol. 16, no. 3, pp. 215-224.

Khan, TM, Emeka, P, Suleiman, AK, Alnutafy, FS & Aljadhey, H 2016, 'Pharmaceutical Pricing Policies and Procedures in Saudi Arabia: A Narrative Review', *Therapeutic Innovation & Regulatory Science*, vol. 50, no. 2, pp. 236-240.

Kim, M 2010, *Impact of strategic sourcing, e-procurement and integration on supply chain risk mitigation and performance*, State University of New York at Buffalo, New York, United State.

Kim, SW 2009, 'An investigation on the direct and indirect effect of supply chain integration on firm performance', *International Journal of Production Economics*, vol. 119, no. 2, pp. 328-346.

Kim, T & Miller, S 2013, 'Hospital economics and healthcare reform: no free lunch (in fact, I might go hungry)', *LEK Consulting Executive Insights*, vol. 15, no. 10, pp. 1-6.

Klein, R 2007, 'Customization and real time information access in integrated eBusiness supply chain relationships', *Journal of Operations Management*, vol. 25, no. 6, pp. 1366-1381.

Kline, RB 2015, *Principles and practice of structural equation modeling*, 4th edn, Guilford publications, New York, United State.

Klug, F 2013, 'The internal bullwhip effect in car manufacturing', *International Journal of Production Research*, vol. 51, no. 1, pp. 303-322.

Koçoğlu, I, İmamoğl, SZ, İnc, H & Keskin, H 2011, 'The effect of supply chain integration on information sharing:enhancing the supply chain performance', *Procedia - Social and Behavioral Sciences*, vol. 24, no. 3, pp. 1630-1649.

Kuo, AM-H, Borycki, E, Kushniruk, A & Lee, T-S 2011, 'A healthcare Lean Six Sigma System for postanesthesia care unit workflow improvement', *Quality Management in Healthcare*, vol. 20, no. 1, pp. 4-14.

Laganga, LR 2011, 'Lean service operations: Reflections and new directions for capacity expansion in outpatient clinics', *Journal of Operations Management*, vol. 29, no. 5, pp. 422-433.

Lapierre, SD & Ruiz, AB 2007, 'Scheduling logistic activities to improve hospital supply systems', *Computers & Operations Research*, vol. 34, no. 3, pp. 624-641.

Lau, KH & Wang, J 2013, 'Application of lean thinking in supply chain management by the small and medium sized manufacturers in china', *International Journal of Information Systems and Supply Chain Management*, vol. 6, no. 4, pp. 1-17.

Lavastre, O, Gunasekaran, A & Spalanzani, A 2012, 'Supply chain risk management in French companies', *Decision Support Systems*, vol. 52, no. 4, pp. 828-838.

Lee, HL, Padmanabhan, V & Whang, S 2004, 'Information distortion in a supply chain: the bullwhip effect', *Management Science*, vol. 50, no. 12, pp. 1875-1886.

Lee, SM, Lee, D & Schniederjans, MJ 2011, 'Supply chain innovation and organizational performance in the healthcare industry', *International Journal of Operations & Production Management*, vol. 31, no. 11, pp. 1193-1214.

Lengnick-Hall, ML, Lengnick-Hall, CA & Rigsbee, CM 2013, 'Strategic human resource management and supply chain orientation', *Human Resource Management Review*, vol. 23, no. 4, pp. 366-377.

Leuschner, R, Rogers, DS & Charvet, FF 2013, 'A meta-analysis of supply chain integration and firm performance', *Journal of Supply Chain Management*, vol. 49, no. 2, pp. 34-57.

Li, G, Yang, H, Sun, L & Sohal, AS 2009, 'The impact of IT implementation on supply chain integration and performance', *International Journal of Production Economics*, vol. 120, no. 1, pp. 125-138.

Lii, P & Kuo, F-I 2016, 'Innovation-oriented supply chain integration for combined competitiveness and firm performance', *International Journal of Production Economics*, vol. 174, no. 7, pp. 142-155.

Lin, RH & Ho, PY 2014, 'The study of CPFR implementation model in medical SCM of Taiwan', *Production Planning & Control*, vol. 25, no. 3, pp. 260-271.

Liu, C & Lee, M 2018, 'Integration, supply chain resilience, and service performance in third-party logistics providers', *The International Journal of Logistics Management*, vol. 29, no. 1, pp. 5-21.

Liu, J, Zhang, S & Hu, J 2005, 'A case study of an inter-enterprise workflow-supported supply chain management system', *Information & management*, vol. 42, no. 3, pp. 441-454.

Lopes De Sousa Jabbour, AB, Gomes Alves Filho, A, Backx Noronha Viana, A & José Chiappetta Jabbour, C 2011, 'Relationships between company size, production system and supply chain', *Journal of Advances in Management Research*, vol. 8, no. 1, pp. 30-52.

Lotfi, Z, Mukhtar, M, Sahran, S & Zadeh, AT 2013, 'Information sharing in supply chain management', *Procedia Technology*, vol. 11, no. 3, pp. 298-304.

Lyberg, L & Weisberg, H 2016, *Total survey error: a paradigm for survey methodology*, Sage, London, UK.

Lynn, MR 1986, 'Determination and quantification of content validity', *Nursing research*, vol. 6, no. 2, pp. 382-385.

Mackey, A 2015, *Second Language Research*, Routledge, UK.

Mantzana, V, Themistocleous, M, Irani, Z & Morabito, V 2017, 'Identifying healthcare actors involved in the adoption of information systems', *European Journal of Information Systems*, vol. 16, no. 1, pp. 91-102.

Marasco, A 2008, 'Third-party logistics: A literature review', *International Journal of Production Economics*, vol. 113, no. 1, pp. 127-147.

Mark Saunders and Paul Tosey 2013, *Te Layers of Research Design*, viewed 10/04/2018, <http://www.academia.edu/4107831/The_Layers_of_Research_Design>.

Matopoulos, A & Michailidou, L 2013, 'Implementing collaborative practices in the healthcare supply chain: insights into hospital-vendor operations', *International Journal of Logistics Systems and Management*, vol. 15, no. 2-3, pp. 288-303.

Mazzocato, P, Holden, RJ, Brommels, M, Aronsson, H, Bäckman, U, Elg, M & Thor, J 2012, 'How does lean work in emergency care? A case study of a lean-inspired intervention at the Astrid Lindgren Children's hospital, Stockholm, Sweden', *BMC Health Services Research*, vol. 12, no. 1, p. 28.

Mcbride, S & Tietze, M 2018, *Nursing Informatics for the Advanced Practice Nurse: Patient Safety, Quality, Outcomes, and Interprofessionalism*, Springer Publishing New York, US.

Mcevily, B, Perrone, V & Zaheer, A 2003, 'Trust as an organizing principle', *Organization Science*, vol. 14, no. 1, pp. 91-103.

Mentzer, JT, Dewitt, W, Keebler, JS, Min, S, Nix, NW, Smith, CD & Zacharia, ZG 2001, 'Defining supply chain management', *Journal of Business Logistics*, vol. 22, no. 2, pp. 1-25.

Mettler, T & Rohner, P 2009, 'Supplier relationship management: a case study in the context of health care', *Journal of Theoretical and Applied Electronic Commerce Research*, vol. 4, no. 3, pp. 58-71.

Michael, FM, Jonathan, EA & James, RM 2013, 'Assessing unsubsidized self-supply groundwater systems in eastern Madagascar', *Water Alternatives*, vol. 6, no. 3, pp. 424-438.

Millsap, RE & Hartog, SB 1988, 'Alpha, beta, and gamma change in evaluation research: A structural equation approach', *Journal of Applied Psychology*, vol. 73, no. 3, p. 574.

Ministry of Health in Saudi Arabia 2018, *MOH Vision of Statistics and Indicators*, Saudi Arabia, <https://www.moh.gov.sa/en/Ministry/Statistics/Pages/default.aspx>.

Mohamed Binti Sayuti, N 2013, Antecedents of supply chain relationships between MNC's and SME's in agile environment, PhD Thesis, RMIT University, Australia.

Mohammed, Y 2016, 'Saudi Arabia', *Nature*, vol. 532, no. 7600, pp. 1-16.

Moorman, C, Zaltman, G & Deshpande, R 1992, 'Relationships between providers and users of market research: The dynamics of trust', *Journal of Marketing Research*, vol. 29, no. 3, pp. 314-328.

Morita, M, Machuca, JaD, Flynn, EJ & Pérez De Los Ríos, JL 2015, 'Aligning product characteristics and the supply chain process – A normative perspective', *International Journal of Production Economics*, vol. 161, no. 161, pp. 228-241.

Motors, G 2018, *About GM*, General Motors Company, viewed <https://www.gm.com/our-company/about-gm.html>.

Msimangira, KA 2010, Supply chain integration, supplier commercial relationships, and order fulfilment practices in public hospitals, PhD Thesis, Auckland University of Technology, New Zealand.

Muangchoo, S & Kritchanchai, D 2015, 'National drug information sharing in the thailand health care supply chain', *Ther Innov Regul Sci*, vol. 49, no. 6, pp. 920-928.

Muenjohn, N 2017, *Transformational leaders in saudi arabia*, Palgrave Macmillan London, UK.

Nachtmann, H & Pohl, EA 2009, *The state of healthcare logistics: Cost and quality improvement opportunities*, Center for Innovation in Healthcare Logistics, Fayetteville, United State.

Naidu, G, Parvatiyar, A, Sheth, JN & Westgate, L 1999, 'Does relationship marketing pay? An empirical investigation of relationship marketing practices in hospitals', *Journal of Business Research*, vol. 46, no. 3, pp. 207-218.

Narayanan, S, Marucheck, AS & Handfield, RB 2009, 'Electronic data interchange: research review and future directions', *Decision Sciences*, vol. 40, no. 1, pp. 121-163.

Nardi, PM 2018, *Doing Survey Research: A guide to quantitative methods*, 4th edn, Routledge, New York, United State.

Niemeijer, GC, Flikweert, E, Trip, A, Does, RJ, Ahaus, KT, Boot, AF & Wendt, KW 2013, 'The usefulness of lean six sigma to the development of a clinical pathway for hip fractures', *Journal of Evaluation in Clinical Practice*, vol. 19, no. 5, pp. 909-914.

Nis 2008, *HOSP_BEDSIZE - Bedsize of hospital*, viewed 8 October, <https://www.hcup-us.ahrq.gov/db/vars/hosp_bedsize/nisnote.jsp>.

Nollet, J & Beaulieu, M 2003, 'The development of group purchasing: an empirical study in the healthcare sector', *Journal of Purchasing and Supply Management*, vol. 9, no. 1, pp. 3-10.

Nooteboom, B 1992, 'Information technology, transaction costs and the decision to 'make or buy'', *Technology Analysis & Strategic Management*, vol. 4, no. 4, pp. 339-350.

Nyberg, A, Grossmann, IE & Westerlund, T 2013, 'An efficient reformulation of the multiechelon stochastic inventory system with uncertain demands', *AIChE Journal*, vol. 59, no. 1, pp. 23-28.

Oecd 2013, *OECD Global Value Chains indicators*, viewed <https://stats.oecd.org/Index.aspx?DataSetCode=GVC_INDICATORS>.

Oruezabala, G & Rico, J-C 2012, 'The impact of sustainable public procurement on supplier management — The case of French public hospitals', *Industrial Marketing Management*, vol. 41, no. 4, pp. 573-580.

Ott, RL & Longnecker, MT 2015, *An introduction to statistical methods and data analysis*, Nelson Education.

Ozcan, YA 2008, *Health Care Benchmarking and Performance Evaluation*, Springer, New York, United State.

Pan, ZX & Pokharel, S 2007, 'Logistics in hospitals: a case study of some Singapore hospitals', *Leadership in Health Services*, vol. 20, no. 3, pp. 195-207.

Paparoidamis, NG, Katsikeas, CS & Chumpitaz, R 2017, 'The role of supplier performance in building customer trust and loyalty: A cross-country examination', *Industrial Marketing Management*, vol. 8, no. 4, pp. 1-15.

Paul, M, Tailor, A, Malhotra, A, Dhingra, P & Kumar, A 2018, *Systems and methods for determining and attributing network costs and determining routing paths of traffic flows in a network*, US Patent App. 15/262,508.

Phichitchaisopa, N & Naenna, T 2013, 'Factors affecting the adoption of healthcare information technology', *EXCLI Journal*, vol. 12, no. 2, pp. 413-436.

Pirnejad, H, Bal, R, Stoop, AP & Berg, M 2007, 'Inter-organisational communication networks in healthcare: centralised versus decentralised approaches', *International Journal of Integrated Care*, vol. 7, no. 2, pp. 1-12.

Pocha, C 2010, 'Lean Six Sigma in health care and the challenge of implementation of Six Sigma methodologies at a Veterans Affairs Medical Center', *Quality Management in Healthcare*, vol. 19, no. 4, pp. 312-318.

Podsakoff, PM, Mackenzie, SB, Lee, JY & Podsakoff, NP 2003, 'Common method biases in behavioral research: a critical review of the literature and recommended remedies', *J Appl Psychol*, vol. 88, no. 5, pp. 879-903.

Poksinska, B 2010, 'The current state of lean implementation in health care: literature review', *Quality Management in Healthcare*, vol. 19, no. 4, pp. 319-329.

Prajogo, D, Oke, A & Olhager, J 2016, 'Supply chain processes', *International Journal of Operations & Production Management*, vol. 36, no. 2, pp. 220-238.

Prajogo, D & Olhager, J 2011, 'Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration', *International Journal of Production Economics*, vol. 135, no. 1, pp. 514-522.

Prajogo, D & Olhager, J 2012, 'Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration', *International Journal of Production Economics*, vol. 135, no. 1, pp. 514-522.

Prajogo, D, Toy, J, Bhattacharya, A, Oke, A & Cheng, T 2018, 'The relationships between information management, process management and operational performance: Internal and external contexts', *International Journal of Production Economics*, vol. 199, no. 11, pp. 95-103.

Press, S 2011, *Structural equation modelling reference manual*, College Station: Stata Press, United State

Preuss, GA 2003, 'High performance work systems and organizational outcomes: the mediating role of information quality', *Industrial & Labor Relations Review*, vol. 56, no. 4, pp. 590-605.

Privett, N & Gonsalvez, D 2014, 'The top ten global health supply chain issues: Perspectives from the field', *Operations Research for Health Care*, vol. 3, no. 4, pp. 226-230.

Radnor, ZJ, Holweg, M & Waring, J 2012, 'Lean in healthcare: the unfilled promise?', *Social Science &Medicine*, vol. 74, no. 3, pp. 364-371.

Rahimnia, F & Moghadasian, M 2010, 'Supply chain leagility in professional services: how to apply decoupling point concept in healthcare delivery system', *Supply Chain Management: An International Journal*, vol. 15, no. 1, pp. 80-91.

Rahman, S, Ahsan, K, Yang, L & Odgers, J 2017, 'An Investigation into critical challenges for multinational third-party logistics providers operating in China', vol. 6, pp. 1-13.

Ramady, MA 2010, *The Saudi Arabian economy: Policies, achievements, and challenges*, 2 edn, Springer Science & Business Media, Saudi Arabia.

Rattray, J & Jones, MC 2007, 'Essential elements of questionnaire design and development', *Journal of Clinical Nursing*, vol. 16, no. 2, pp. 234-243.

Reise, SP, Widaman, KF & Pugh, RH 1993, 'Confirmatory factor analysis and item response theory: two approaches for exploring measurement invariance', *Psychological Bulletin*, vol. 114, no. 3, pp. 552-566.

Rick, B 2010, 'Navigating the c-scape in supply chain management', *Healthcare Purchasing News*, vol. 34, pp. 8-12.

Rivard-Royer, H, Landry, S & Beaulieu, M 2002, 'Hybrid stockless: A case study: Lessons for health-care supply chain integration', *International Journal of Operations & Production Management*, vol. 22, no. 4, pp. 412-424.

Roark, DC 2005, 'Managing the healthcare supply chain', *Nurs Manage*, vol. 36, no. 2, pp. 36-40.

Robbins, J, Garman, AN, Song, PH & Mcalearney, AS 2012, 'How high-performance work systems drive health care value: an examination of leading process improvement strategies', *Quality Management in Healthcare*, vol. 21, no. 3, pp. 188-202.

Robinson, S, Radnor, ZJ, Burgess, N & Worthington, C 2012, 'SimLean: Utilising simulation in the implementation of lean in healthcare', *European Journal of Operational Research*, vol. 219, no. 1, pp. 188-197.

Roller, MR & Lavrakas, PJ 2015, *Applied qualitative research design: A total quality framework approach*, Guilford Publications, New York, United State.

Rotaru, K, Wilkin, C & Ceglowski, A 2014, 'Analysis of SCOR's approach to supply chain risk management', *International Journal of Operations & Production Management*, vol. 34, no. 10, pp. 1246-1268.

Saedi, S, Kundakcioglu, OE & Henry, AC 2016, 'Mitigating the impact of drug shortages for a healthcare facility: An inventory management approach', *European Journal of Operational Research*, vol. 251, no. 1, pp. 107-123.

Saeed, KA, Malhotra, MK & Grover, V 2011, 'Interorganizational system characteristics and supply chain integration: an empirical assessment', *Decision Sciences*, vol. 42, no. 1, pp. 7-42.

Salah, S, Rahim, A & Carretero, JA 2011, 'Implementation of Lean Six Sigma (LSS) in supply chain management (SCM): an integrated management philosophy', *International Journal of Transitions and Innovation Systems*, vol. 1, no. 2, pp. 138-162.

Sale, JE, Lohfeld, LH & Brazil, K 2002, 'Revisiting the quantitative-qualitative debate: Implications for mixed-methods research', *Quality and Quantity*, vol. 36, no. 1, pp. 43-53.

Saleh Shatat, A & Mohamed Udin, Z 2012, 'The relationship between ERP system and supply chain management performance in Malaysian manufacturing companies', *Journal of Enterprise Information Management*, vol. 25, no. 6, pp. 576-604.

Sambamurthy, Bharadwaj & Grover 2003, 'Shaping agility through digital options: reconceptualizing the role of information technology in contemporary firms', *MIS Quarterly*, vol. 27, no. 2, pp. 237-263.

Sameer, SS 2014, 'Simulation: analysis of single server queuing model', *International Journal on Information Theory*, vol. 3, no. 3, pp. 47-54.

Sampaio, M & Csillag, J 2010, 'Supply chain management integration', *RAI*, vol. 7, no. 1, pp. 109-130.

Sanders, N 2007, 'An empirical study of the impact of e-business technologies on organizational collaboration and performance', *Journal of Operations Management*, vol. 25, no. 6, pp. 1332-1347.

Sankowska, A 2013, 'Relationships between organizational trust, knowledge transfer, knowledge creation, and firm's innovativeness', *The Learning Organization*, vol. 20, no. 1, pp. 85-100.

Santos, JRA 1999, 'Cronbach's alpha: A tool for assessing the reliability of scales', *Journal of Extension*, vol. 37, no. 2, pp. 1-5.

Saraf, N, Langdon, CS & Gosain, S 2007, 'IS application capabilities and relational value in interfirm partnerships', *Information Systems Research*, vol. 18, no. 3, pp. 320-339.

Saranga, H, Mukherji, A & Shah, J 2015, 'Inventory trends in emerging market supply chains: Evidence from the Indian automotive industry', *IIMB Management Review*, vol. 27, no. 1, pp. 6-18.

Sargent, J 2010, 'GS1 standards will transform US healthcare supply chain-and improve patient care', *Healthcare Purchasing News*, vol. 34, no. 2, pp. 1-40.

Satorra, A & Bentler, PM 2001, 'A scaled difference chi-square test statistic for moment structure analysis', *Psychometrika*, vol. 66, no. 4, pp. 507-514.

Saxena, S, Sharan, P, Garrido, M & Saraceno, B 2006, 'World Health Organization's mental health atlas 2005: implications for policy development', *World psychiatry*, vol. 5, no. 3, pp. 179-184.

Schermelleh-Engel, K, Moosbrugger, H & Müller, H 2003, 'Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures', *Methods of Psychological Research Online*, vol. 8, no. 2, pp. 23-74.

Schmitt, N 1982, 'The use of analysis of covariance structures to assess beta and gamma change', *Multivariate Behavioral Research*, vol. 17, no. 3, pp. 343-358.

Schonberger, RJ 2007, 'Japanese production management: An evolution—With mixed success', *Journal of Operations Management*, vol. 25, no. 2, pp. 403-419.

Sebai, ZA, Milaat, WA & Al-Zulaibani, AA 2001, 'Health care services in Saudi Arabia: Past, present and future', *Journal of Family &Community Medicine*, vol. 8, no. 3, pp. 19-23.

Seidmann, A & Sundararajan, A 1997, 'The effects of task and information asymmetry on business process redesign', *International Journal of Production Economics*, vol. 50, no. 2-3, pp. 117-128.

Sekaran, U & Bougie, R 2016, *Research methods for business: A skill building approach*, John Wiley & Sons, UK.

Sekhri, N & Savedoff, W 2005, 'Private health insurance: implications for developing countries', *Bulletin of the World Health Organization*, vol. 83, no. 3, pp. 127-134.

Shah, R & Ward, PT 2003, 'Lean manufacturing: context, practice bundles, and performance', *Journal of Operations Management*, vol. 21, no. 2, pp. 129-149.

Sheikh, K & Mattingly, S 1981, 'Investigating non-response bias in mail surveys', *Journal of Epidemiology & Community Health*, vol. 35, no. 4, pp. 293-296.

Silvestre, BS 2015, 'Sustainable supply chain management in emerging economies: Environmental turbulence, institutional voids and sustainability trajectories', *International Journal of Production Economics*, vol. 167, no. 21, pp. 156-169.

Simon, RW & Canacari, EG 2012, 'A practical guide to applying lean tools and management principles to health care improvement projects', *AORN journal*, vol. 95, no. 1, pp. 85-103.

Sjödin, DR & Eriksson, P-E 2010, 'Procurement procedures for supplier integration and open innovation in mature industries', *International Journal of Innovation Management*, vol. 14, no. 04, pp. 655-682.

So, S & Sun, H 2011, 'An extension of IDT in examining the relationship between electronic-enabled supply chain integration and the adoption of lean production', *International Journal of Production Research*, vol. 49, no. 2, pp. 447-466.

Spithoven, A, X00e & Knockaert, M 2011, 'The role of business centres in firms' networking capabilities and performance', *Science and Public Policy*, vol. 38, no. 7, pp. 569-580.

Squire, B, Cousins, PD & Brown, S 2009, 'Cooperation and knowledge transfer within buyerâ"supplier relationships: the moderating properties of trust, relationship duration and supplier performance*', *British Journal of Management*, vol. 20, no. 4, pp. 461-477.

Staemmler, M 2008, 'Integrated information systems', *eBusiness in Healthcare*, vol. 5, no. 10, pp. 249-254.

Stank, TP, Keller, SB & Closs, DJ 2001, 'Performance benefits of supply chain logistical integration', *Transportation Journal*, vol. 41, no. 2, pp. 32-46.

Stanley, LL & Wisner, JD 2001, 'Service quality along the supply chain: implications for purchasing', *Journal of Operations Management*, vol. 19, no. 3, pp. 287-306.

Stark, E & Mangione, T 2004, 'Top issues facing the hospital supply chain today', *Health*, vol. 28, no. 11, pp. 74-75.

Stock, GN, Greis, NP & Kasarda, JD 2000, 'Enterprise logistics and supply chain structure: the role of fit', *Journal of Operations Management*, vol. 18, no. 5, pp. 531-547.

Surbone, A, Zwitter, M, Rajer, M & Stiefel, R 2013, *New Challenges in Communication with Cancer Patients*, Springer, New York, United State.

Sweeney, E, Grant, DB & Mangan, DJ 2018, 'Strategic adoption of logistics and supply chain management', *International Journal of Operations & Production Management*, vol. 38, no. 3, pp. 852-873.

Sweis, RJ, Al-Mansour, A, Tarawneh, M & Al-Dweik, G 2013, 'The impact of total quality management practices on employee empowerment in the healthcare sector in Saudi Arabia: a study of King Khalid Hospital', *International Journal of Productivity and Quality Management*, vol. 12, no. 3, pp. 271-286.

Syahrir, I, Suparno, S & Vanany, I 2018, 'Strategic management for logistics and supply chain operation in healthcare', *IPTEK Journal of Proceedings Series*, vol. 6, no. 3, pp. 10-15.

Tabachnick, BG & Fidell, LS 2007, *Using multivariate statistics*, Allyn & Bacon/Pearson Education.

Teichgräber, UK & De Bucourt, M 2012, 'Applying value stream mapping techniques to eliminate non-value-added waste for the procurement of endovascular stents', *European Journal of Radiology*, vol. 81, no. 1, pp. 47-52.

Toussaint, JS & Berry, LL 2013, 'The promise of Lean in health care', *Mayo clinic proceedings*, vol. 88, no. 1, pp. 74-82.

Trading Economics 2018, *Saudi Arabia- Economic Indicators*, viewed <https://tradingeconomics.com/saudi-arabia/indicators>.

Vandenberg, RJ & Lance, CE 2000, 'A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research', *Organizational Research Methods*, vol. 3, no. 1, pp. 4-70.

Vanvactor, JD 2008, 'RFID tags and healthcare supply chain management', *Healthcare Purchasing News*, vol. 32, no. 2, pp. 54-55.

Vickery, SK, Jayaram, J, Droge, C & Calantone, R 2003, 'The effects of an integrative supply chain strategy on customer service and financial performance: an analysis of direct versus indirect relationships', *Journal of Operations Management*, vol. 21, no. 5, pp. 523-539.

Walsham, G 1995, 'Interpretive case studies in IS research: nature and method', *European Journal of Information Systems*, vol. 4, no. 2, pp. 74-81.

Walston, S, Al-Harbi, Y & Al-Omar, B 2008, 'The changing face of healthcare in Saudi Arabia', *Ann Saudi Med*, vol. 28, no. 4, pp. 243-250.

Wang, HW, Yan, YS & Wei, L 2013, 'A holistic incentive model of information sharing in supply chain', *Applied Mechanics and Materials*, vol. 457-458, no. 25, pp. 1403-1406.

Wang, WY, Chan, HK & Pauleen, DJ 2010, 'Aligning business process reengineering in implementing global supply chain systems by the SCOR model', *International Journal of Production Research*, vol. 48, no. 19, pp. 5647-5669.

Wang, Y, Kung, L & Byrd, TA 2018, 'Big data analytics: Understanding its capabilities and potential benefits for healthcare organizations', *Technological Forecasting and Social Change*, vol. 126, no. 3, pp. 3-13.

Watkins, MW 2018, 'Exploratory factor analysis: a guide to best practice', *Journal of Black Psychology*, vol. 44, no. 3, pp. 219-246.

Watts, C & Freudmann, A 2014, 'Healthcare in saudi arabia: increasing capacity, improving quality?', *The Economist Intelligence Unit*, vol. 88, no. 1, pp. 74-82.

Wild, T 2017, *Best practice in inventory management*, Routledge, London.

Williams, B, Onsman, A & Brown, T 2010, 'Exploratory factor analysis: A five-step guide for novices', *Australasian Journal of Paramedicine*, vol. 8, no. 3, pp. 1-13.

Willis, GB 2004, *Cognitive interviewing: A tool for improving questionnaire design*, Sage Publications, UK.

Wirtz, J & Zeithaml, V 2018, 'Cost-effective service excellence', *Journal of the Academy of Marketing Science*, vol. 46, no. 1, pp. 59-80.

Wisner, JD 2003, 'A structural equation model of supply chain management strategies and firm performance', *Journal of Business Logistics*, vol. 24, no. 1, pp. 1-26.

Womack, J, Jones, DT & Roos, D 1990, *The Machine that Changed the World: Based on the Massachusetts Institute of Technology $5 million 5-year study on the future of the automobile*, New York, Rawson.

Womack, JP & Jones, DT 1997, 'Lean thinking—banish waste and create wealth in your corporation', *Journal of the Operational Research Society*, vol. 48, no. 11, pp. 1148-1148.

Won Lee, C, Kwon, I-WG & Severance, D 2007, 'Relationship between supply chain performance and degree of linkage among supplier, internal integration, and customer', *Supply Chain Management: An International Journal*, vol. 12, no. 6, pp. 444-452.

Wong, CY, Boon-Itt, S & Wong, CW 2011, 'The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance', *Journal of Operations Management*, vol. 29, no. 6, pp. 604-615.

Woodcock, A 2006, 'Jacques Maritain, natural law and the universal declaration of human rights', *Journal of the History of International Law*, vol. 8, no. 2, pp. 245-266.

World Health Organization 2013, *Country cooperation strategy for WHO and Saudi Arabia 2012-2016*, <http://www.who.int/iris/handle/10665/113227>.

World Health Organization 2015, *World Health Statistics 2015*, WH Organization, <http://www.who.int/gho/publications/world_health_statistics/2015/en/>.

Worley, J & Doolen, T 2006, 'The role of communication and management support in a lean manufacturing implementation', *Management Decision*, vol. 44, no. 2, pp. 228-245.

Wu, I-L, Chuang, C-H & Hsu, C-H 2014, 'Information sharing and collaborative behaviors in enabling supply chain performance: A social exchange perspective', *International Journal of Production Economics*, vol. 148, no. 1, pp. 122-132.

Wynd, CA, Schmidt, B & Schaefer, MA 2003, 'Two quantitative approaches for estimating content validity', *Western Journal of Nursing Research*, vol. 25, no. 5, pp. 508-518.

Yang, C-S, Lu, C-S, Haider, JJ & Marlow, PB 2013, 'The effect of green supply chain management on green performance and firm competitiveness in the context of container shipping in Taiwan', *Transportation Research Part E: Logistics and Transportation Review*, vol. 55, no. 3, pp. 55-73.

Yao, J 2017, 'Supply chain resources integration optimisation in B2C online shopping', *International Journal of Production Research*, vol. 55, no. 17, pp. 5079-5094.

Yeates, N 2012, 'Global care chains: a state-of-the-art review and future directions in care transnationalization research', *Global Networks*, vol. 12, no. 2, pp. 135-154.

Yeung, JHY, Selen, W, Zhang, M & Huo, B 2009, 'The effects of trust and coercive power on supplier integration', *International Journal of Production Economics*, vol. 120, no. 1, pp. 66-78.

Youn, S, Yang, MG, Hong, P & Park, K 2013, 'Strategic supply chain partnership, environmental supply chain management practices, and performance outcomes: an empirical study of Korean firms', *Journal of Cleaner Production*, vol. 56, no. 2, pp. 121-130.

Young, ST 1989, 'Prime vendor/hospital purchasing relationships', *International Journal of Physical Distribution & Materials Management*, vol. 19, no. 9, pp. 27-30.

Yousef Alkhateeb, TT, Sultan, ZaS & Ahmad, NaA 2017, 'Oil price and employment nexus in saudi arabia', *International Journal of Energy Economics and Policy*, vol. 7, no. 3, pp. 277-281.

Yu, W 2015, 'The effect of IT-enabled supply chain integration on performance', *Production Planning & Control*, vol. 26, no. 12, pp. 945-957.

Zacharia, ZG, Sanders, NR & Nix, NW 2011, 'The emerging role of the third-party logistics provider (3pl) as an orchestrator', *Journal of Business Logistics*, vol. 32, no. 1, pp. 40-54.

Zajac, EJ & Olsen, CP 1993, 'From transaction cost to transactional value analysis: implications for the study of interorganizational strategies*', *Journal of Management Studies*, vol. 30, no. 1, pp. 131-145.

Zeng, Y, Wang, L, Deng, X, Cao, X & Khundker, N 2012, 'Secure collaboration in global design and supply chain environment: Problem analysis and literature review', *Computers in Industry*, vol. 63, no. 6, pp. 545-556.

Zhang, J & Chen, J 2013, 'Coordination of information sharing in a supply chain', *International Journal of Production Economics*, vol. 143, no. 1, pp. 178-187.

Zhang, M & Huo, B 2013, 'The impact of dependence and trust on supply chain integration', *International Journal of Physical Distribution & Logistics Management*, vol. 43, no. 7, pp. 544-563.

Zhang, M, Lettice, F, Chan, HK & Nguyen, HT 2018, 'Supplier integration and firm performance: the moderating effects of internal integration and trust', *Production Planning & Control*, vol. 29, no. 10, pp. 802-813.

Zhu, Q, Sarkis, J & Lai, K-H 2008, 'Confirmation of a measurement model for green supply chain management practices implementation', *International Journal of Production Economics*, vol. 111, no. 2, pp. 261-273.

Zikmund, WG, Babin, BJ, Carr, JC & Griffin, M 2013, *Business Research Methods*, 9th edn, Cengage Learning, Mason, US.

APPENDICES

APPENDIX 1 – Notice of Ethics Approval

RMIT UNIVERSITY

Business College Human
Ethics Advisory Network
(BCHEAN)

Building 108, Level 11
239 Bourke Street
Melbourne VIC 3000

GPO Box 2476V
Melbourne VIC 3001
Australia

Tel. +61 3 9925 5555
Fax +61 3 9925 5624

Notice of Approval

Date:	18 December 2014
Project number:	19090
Project title:	*Hospital-Supplier Integration and Hospital Performance in Saudi Arabian Context: Investigating the Role of Lean Practices*
Risk classification:	Negligible risk
Principal Investigator:	Professor Shams Rahman
Student Investigator:	Mr Saad Al Shahrani
Other Investigator:	Professor Caroline Chan
Project Approved:	**From: 18 December 2014 To: 3 March 2018**

Terms of approval:

Responsibilities of the principal investigator
It is the responsibility of the principal investigator to ensure that all other investigators and staff on a project are aware of the terms of approval and to ensure that the project is conducted as approved by BCHEAN. Approval is only valid while the investigator holds a position at RMIT University.

1. *Amendments*
   Approval must be sought from BCHEAN to amend any aspect of a project including approved documents. To apply for an amendment submit a request for amendment form to the BCHEAN secretary. This form is available on the Human Research Ethics Committee (HREC) website. Amendments must not be implemented without first gaining approval from BCHEAN.
2. *Adverse events*
   You should notify BCHEAN immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
3. *Participant Information and Consent Form (PICF)*
   The PICF must be distributed to all research participants, where relevant, and the consent form is to be retained and stored by the investigator. The PICF must contain the RMIT University logo and a complaints clause including the above project number.
4. *Annual reports*
   Continued approval of this project is dependent on the submission of an annual report.
5. *Final report*
   A final report must be provided at the conclusion of the project. BCHEAN must be notified if the project is discontinued before the expected date of completion.
6. *Monitoring*
   Projects may be subject to an audit or any other form of monitoring by BCHEAN at any time.
7. *Retention and storage of data*
   The investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.

Regards,

A/Professor Cathy Brigden
Acting Chairperson   RMIT BCHEAN

APPENDIX 2 – Participation Information

School of Business IT and Logistics

INVITATION TO PARTICIPATE IN A RESEARCH PROJECT

PARTICIPANT INFORMATION

Project Title:

Hospital-Supplier Integration and Hospital Performance in Saudi Arabia Context

Investigators:

PhD Candidate

Saad Salem Alshahrani, RMIT University

Senior Supervisor

Prof Shams Rahman, RMIT University

Associate Supervisor

Prof Caroline Chan, RMIT University

Dear Potential Participant,

You are invited to participate in a research project conducted by RMIT University (Australia). This information sheet describes the project. Please read this sheet carefully and be confident that you understand its contents before deciding whether to participate. If you have any questions about the project, please contact one of the investigators identified above.

Who is involved in this research project? Why is it being conducted?

The researcher of this project, Saad Salem Alshahrani, is a student from RMIT University in Australia, supervised by Professor Shams Rahman and Professor Caroline Chan from the School of Business IT and Logistics at RMIT University. This research is being

conducted as part of a doctoral degree and has been approved by the RMIT Human Research Ethics Committee.

Why have you been approached?

Healthcare organisations are dealing with immense pressure to enhance their performance using their limited set of resources. Given that a considerable portion of these resources are dedicated to purchasing medical resources and equipment, both practitioners and academics are interested in exploring the potential possibilities that may be utilised to enhance the overall performance of healthcare organisations by improving the integration between hospitals and their key suppliers. The designed questionnaire targets the human capital involved in the hospital-supplier integration of the Saudi Arabia context. A set of recommendations have been proposed to improve the overall performance of Saudi Arabia hospitals. To our knowledge, this research is one of the first to address the hospital-supplier integration in Saudi Arabia. The study has proved the critical role that hospital-supplier integration plays in managing the level and quality of healthcare services provided to patients. The level of demand in the healthcare sector has increased, hence it has become important for the healthcare organisations to build and maintain relationships with the suppliers so that they can obtain the required quantity of supplies. Therefore, this can assist in managing the overall services provided to patients by considering their needs and demands.

What is the project about? What are the questions being addressed?

The objective of this research is to develop a theoretical model that conceptualises the factors affecting hospital-supplier integration and its impact on hospital performance in both private and public settings, in the context of Saudi Arabia.

In order to address the main objective, the following research questions have been constructed:

261

1) What are the factors that affect hospital-supplier integration?

2) How does logistics integration, information technology, information sharing and trust affect hospital-supplier integration?

3) What is the impact of hospital-supplier integration on the overall performance of Saudi Arabia hospitals?

4) Do lean practices enhance the impact of hospital-supplier integration on hospital performance?

5) Does hospital size make any difference in hospital-supplier integration?

6) What difference do public/private sectors make in determining the impact of hospital-supplier integration on the performance of hospitals in Saudi Arabia?

The researcher expects that 2175 participants will participate in the study.

If I agree to participate, what will I be required to do?

If you agree to take part in this research, which is entirely your personal choice, a survey question will be physically delivered to you and the questionnaire will take approximately 50 minutes to complete. One week will be given to complete the questionnaire. Once you have completed the questionnaire, the researcher will come and collect the completed questionnaire. As you are not being identified in any way, your views will remain anonymous. Information generated in the survey will be kept securely and analysed by the researcher.

What are the possible risks or disadvantages?

The topic will focus on the concept of the Hospital-Supplier Integration and Hospital Performance in Saudi Arabia Context: Investigating the Moderating Role of Lean Practices. No sensitive questions (e.g. company identity, revenue, profit) will be asked in the survey and you will have the right to not answer any question you deem inappropriate. Your name and your company will not be mentioned within the research. The obtained information will be handled discreetly.

What will happen to the information I provide?

The result of the study will be disseminated in the PhD thesis. The research paper will be subjected for publication or presentation at conferences. The research data will be securely kept at RMIT University for a period of five (5) years.

What are my rights as a participant?

If you choose to participate in this research, you have the right to:

- ☐ Withdraw your participation at any time.

- ☐ Have any unprocessed data withdrawn and destroyed, provided it can be reliably identified and doing so induce any risks for the participant.

- ☐ Have any question answered at any time.

What other issues should I be aware of before deciding whether to participate?

There are no other issues you need to be aware of.

Thank you very much for your contribution to this research.

Yours sincerely

_____

Saad Salem Alshahrani,

PhD Candidate,

School of Business IT and Logistics, College of Business,

Royal Melbourne Institute of Technology University, Australia,

_____

Professor Shams Rahman

Senior Supervisor,

MSc (MEngg), ME (IndEngg), PhD(OR)

School of Business IT and Logistics, College of Business,

Royal Melbourne Institute of Technology University, Australia,

---

Professor Caroline Chan
Associate Supervisor,

BENG, MENG, PhD (Information System)

School of Business IT and Logistics, College of Business,

 Royal Melbourne Institute of Technology University, Australia,

APPENDIX 3 – Consent Form

CONSENT FORM

1. I have had the project explained to me, and I have read the information sheet

2. I agree to participate in the research project as described

3. I agree:

   - to complete a questionnaire

4. I acknowledge that:

   (a) I understand that my participation is voluntary and that I am free to withdraw from the project at any time and to withdraw any unprocessed data previously supplied (unless follow-up is needed for safety).

   (b) The project is for the purpose of research. It may not be of direct benefit to me.

   (c) The privacy of the personal information I provide will be safeguarded and only disclosed where I have consented to the disclosure or as required by law.

   (d) The security of the research data will be protected during and after completion of the

Participant: ——————————   Date: ——————————

*Participants should be given a photocopy of this PICF after it has been signed.

APPENDIX 4 – Questionnaire for Main Survey (English Version)

College of Business | School of Business IT and Logistics

INVITATION TO PARTICIPATE IN A RESEARCH PROJECT

PROJECT INFORMATION STATEMENT

Project Title:

Hospital-Supplier Integration and Hospital Performance in Saudi Arabia Context

Investigators:

Mr. Saad Al Shahrani (PhD candidate)

Professor Shams Rahman (Supervisor)

Dear Participant,

You are cordially invited to participate in a research project being conducted by RMIT University. This survey will take approximately 35 minutes. This letter provides you with an overview of the proposed research. Please read these pages carefully and be confident that you understand its contents before deciding whether to participate. Because of the nature of data collection, we are not obtaining written informed consent from you. Instead, we assume that you have given implied consent by completion and return of the

questionnaire. If you have any questions about the project, please ask any of the investigators identified above.

Who is involved in this research project?

I am Saad Al shahrani, currently a research student in the school of Business IT and Logistics at RMIT University, Melbourne, Australia. This project is conducted as a part of my PhD degree. My supervisor for this project is Professor Shams Rahman. This project has been approved by the RMIT Business Human Resource Ethics Committee under Reference Number (19090).

Why is it being conducted?

The aim of the project is to understand the integration between the Saudi hospitals and their suppliers, and its role in improving the hospital performance in the context of Saudi Arabia.

Why have you been approached?

You firstly have been approached to participate in this research project as you work for a Saudi hospital. Second, due to the nature of your position at the hospital you work for, as you ideally deal with health purchases, and have regular communications with key suppliers for your hospital. This would enrich our understanding of the relationship between Saudi hospitals and their suppliers.

What is the project about? What are the questions being addressed?

The project is about extending the understanding of the relationship between hospitals and their suppliers, and its impact on the overall performance of hospitals. This relationship has long been studied in the literature. However, there is no studies on this topic in the context of Saudi Arabia. Conducting this research is expected to answer a

number of questions about the factors that affect this relationship, whether it is integrative and productive or not. These questions are about the factors that affect hospital-supplier integration in the context of Saudi Arabia, the impact of logistics integration on hospital-supplier integration, information technology, knowledge sharing, and trust affect hospital supplier integration, and what is the impact of hospital-supplier integration on overall performance in Saudi hospitals? Two more details are quite important in this regard: the potential of lean practices, and the role of hospital size to determine the impact of hospital –supplier integration on the overall performance of the studied hospitals.

If I agree to participate, what will I be required to do?

If you agree to participate, you will be required to spend approximately 35 minutes to complete this questionnaire. You will need to answer a few basic demographic questions about your job at your hospital and also respond to questions about health purchases and managing the relationships with the key suppliers of your hospital.

What are the possible risks or disadvantages?

There is no risk associated with participating in this survey. However, if you are unduly concerned about your responses to any of the questionnaire items or if you find participation in the project distressing, you should contact Professor Shams Rahman as soon as convenient. Shams will discuss your concerns with you confidentially and suggest appropriate follow-up, if necessary.

What will happen to the information I provide?

Your privacy and confidentiality will be strictly maintained in such a manner that you will not be identified in the thesis report or any related publication. Any information that you provide can be disclosed only if (1) it is to protect you or others from harm, (2) if specifically required or allowed by law, or (3) you provide the researchers with written permission. Data will be only seen by my supervisors and examiners who will also protect you from any risk.

To ensure that data collected is protected; data will be saved on the university network system where only the researcher/s will have access to the data. Findings of this study will be disseminated in a PhD thesis, presented at conferences and published in journals. The final thesis and published research papers will remain in RMIT online repository as an Appropriate Durable Record (ADR).

What are my rights as a participant?

As a participant you have right to withdraw from participation at any time, can request for any record cease and have right to have any questions answered at any time. The unprocessed data can be withdrawn and destroyed, provided it can be reliably identified and provided that does not increase the risk for the participant.

I am assuring you that responses will remain confidential and anonymous.

Thank you very much for your contribution to this research.

Yours Sincerely,

Saad Al Shahrani

PhD Candidate

School of Business IT and Logistics

RMIT University

This questionnaire is the key part of this study on understanding the impact of hospital-supplier integration on the overall performance of Saudi hospitals.

ALL INFORMATION WILL REMAIN STRICTLY CONFIDENTIAL

To maintain anonymity, please do not write your name on the questionnaire. However, if you would like a summary of results, please contact Saad Al Shahrani by phone, fax or email as per contact details provided in the email.

The instructions below will assist you in completing the questionnaire:

- Below is an example how to complete the questionnaire:

Code	Measurement Item	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
LI#1	Our hospital recognise the importance of logistics integration with our suppliers	1	2	3	4	5	6	7

By circling 4, your response is more towards strongly agree that your hospital recognises

the importance of logistics integration with its suppliers.

- It is important that you PLEASE ANSWER ALL QUESTIONS to the best of your knowledge, even if some may appear to be similar. Your answers to all sections of this questionnaire are vital to the success of this study. Unfortunately, partly answered surveys are not useable. Therefore, please do not leave questions unanswered.

- There are no right or wrong answers.

- If you wish to comment on any of the questions, please use the space provided at the end of the questionnaire.

- The findings of this study will be reported in an aggregated form, so no organization, department or individual respondent can be identified.

We appreciate highly your time and effort to participate in this research project. If you would like a copy of the findings sent to you, please phone, fax or send your business card separately to the questionnaire. The answers to the survey will be kept in strict confidence.

The names of participating individuals, departments and companies will not be released.

Section 1: You and Your Hospital

The following information requires some details of the respondents and the hospital.

Please answer the following questions.

1. **Which department are you associated to?**
   o Procurement
   o Supply chain
   o Medical administration
   o General administration
   o Quality administration
   o Others, please specify: _____
2. **What is your level of education?**
   o Post- Secondary/Secondary
   o Diploma
   o Graduate/Bachelors
   o Post-graduate/Masters
   o PhD
   o Fellowship/ postdoctoral
3. **What is your gender?**
   o Male
   o Female
4. **How many years of managerial experience you have?**
   o Less than 5 years
   o 6-10 years
   o 11-15 years
   o 16- 20 years
   o Above 20 years
5. **How many years of your managerial experience are in healthcare?**
   o Less than 5 years
   o 6-10 years
   o 11-15 years

6. **Is your hospital:**
   - o Public
   - o Private
7. **What is the size of your hospital?**
   - o 100 beds or less
   - o 101-299 beds
   - o 300-499 beds
   - o 500 beds or more
8. **Number of employees in your organisation:**
   - o Less than 500
   - o 501-999
   - o 1000-1499
   - o 1500-1999
   - o 2000-2499
   - o 2500-2999
   - o 3000-3499
   - o 3500 and more

o 16- 20 years
o Above 20 years

Section 2: Hospital-Supplier Integration, Lean practices and Hospital Performance

Part A: Logistics integration

The essence of logistics integration is well-coordinated flow of materials from suppliers which allow firms to have a smooth production process. Such coordination produces a seamless connection between firms and suppliers in such a way that the boundary of activities between the two parties is being blurred.

Code	Measurement Item	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
LI#1	Our hospital recognise the importance of logistics integration with our suppliers	1	2	3	4	5	6	7
LI#2	Our logistics activities are well integrated with suppliers' logistics activities	1	2	3	4	5	6	7
LI#3	Our hospital has a seamless integration of logistics activities with our suppliers	1	2	3	4	5	6	7

272

Code	Measurement Item	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
LI#4	Our inbound and outbound distribution of hospital supplies with our vendors/suppliers is well integrated	1	2	3	4	5	6	7

Part B: Information Technology

There has been a wide agreement that IT integration between hospitals and their suppliers has direct and indirect impacts on hospital-supplier integration and on the overall performance of supply chain. This set of questions aims at understanding the impact of information technology on the relationship between your hospital and its key suppliers.

Code	Measurement Item	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
IT#1	Our hospital has information systems that work seamlessly across our key suppliers/ vendors	1	2	3	4	5	6	7
IT#2	Most of the invoices, purchase orders, funds, and other transactional processes with our suppliers are done electronically	1	2	3	4	5	6	7
IT#3	Our hospital has advanced information systems that enable online tracking for orders and shipments	1	2	3	4	5	6	7
IT#4	We have electronic mailing capabilities with our key suppliers	1	2	3	4	5	6	7

273

Part C: Information Sharing

Inter-organisational information sharing between hospitals and their key suppliers can be defined as the extent to which the hospital shares information about transaction in the business to generate 'specialized knowledge'. This set of questions aims at evaluating the impact of this sharing on the integration between your hospital and its key suppliers.

Code	Measurement Item	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
ISS#1	We share sensitive information (financial, production, design, research, and/ or competition) with our key suppliers	1	2	3	4	5	6	7
ISS#2	Suppliers are provided with any information that might help them	1	2	3	4	5	6	7
ISS#3	We keep each other informed about events or changes that may affect the other party	1	2	3	4	5	6	7
ISS#4	Exchange of information takes place frequently, informally and/ or in a timely manner	1	2	3	4	5	6	7
ISS#5	We have frequent face-to-face planning/ communication	1	2	3	4	5	6	7

Part D: Trust

The required information sharing between hospitals and their suppliers is a risky practice, as giving outsiders access to information about the internal activities of a hospital needs to be treated carefully. Prior research in this area recognise the important of trust in maintaining the integration between hospitals and their suppliers.

Code	Measurement Item	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
TR#1	Our hospital believes that our key suppliers would act in the best interest of the hospital	1	2	3	4	5	6	7

Code	Measurement Item	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
TR#2	There is a wide agreement across our hospital that our key suppliers are competent and effective in their interaction with the hospital	1	2	3	4	5	6	7
TR#3	Our suppliers keep their commitments	1	2	3	4	5	6	7
TR#4	Our suppliers are interested in our organisation's well-being and not just their own.	1	2	3	4	5	6	7

Part D: Hospital-Supplier Integration

The extent to which the business processes between a hospital and its key suppliers are strategically coupled and unified as a whole.

Code	Measurement Item	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
HSI#1	Our logistics integration with our suppliers can be noted by having excellent distribution, transportation and warehousing facilities	1	2	3	4	5	6	7
HSI#2	Inter-organisational coordination is achieved	1	2	3	4	5	6	7
HSI#3	Exchange of information takes place frequently, informally and/ or in a timely manner	1	2	3	4	5	6	7
HSI#4	We exchange performance feedback	1	2	3	4	5	6	7
HSI#5	Our suppliers trust the processes of the hospital and update the hospital should any complain comes up	1	2	3	4	5	6	7

275

Part E: Lean Practices

Lean is a management practice that attempts to classify operations and activities according to the values they generate into two distinctive groups: value adding activities and no-value adding. Lean practices can be defined as "the systematic removal of waste by all members of the organisation from all areas of the value stream".

Code	Measurement Item	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
LP#1	At our hospital, reducing waste is key strategy	1	2	3	4	5	6	7
LP#2	At our hospital, we have the readiness to reengineer processes to eliminate waste	1	2	3	4	5	6	7
LP#3	At our hospital, the flow of materials from the inventory to the physicians is quick and smooth	1	2	3	4	5	6	7
LP#4	At our hospital, removing bottlenecks from our activities is very important	1	2	3	4	5	6	7

Part F: Hospital Performance

Hospital-supplier integration can be defined as the extent to which the business processes between a hospital and its key suppliers are strategically coupled and unified as a whole. There has been general agreement that this integration positively affects the overall performance of hospitals. This set of questions aims at taking your perspectives and experiences in your hospital.

Code	Measurement Item	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
Qual#01	The quality of the order fulfilment process in our hospital is getting better with time	1	2	3	4	5	6	7

Code	Measurement Item	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
Qual#02	We have seen an improvement in the quality of the order fulfilment process with time	1	2	3	4	5	6	7
Qual#03	Based on our knowledge of the order fulfilment process, we think it is of high quality	1	2	3	4	5	6	7
Spe#1	The length of the order fulfilment process in our hospital is getting shorter with time	1	2	3	4	5	6	7
Spe#2	We have seen an improvement in the cycle time of the order fulfilment process with time	1	2	3	4	5	6	7
Spe#3	Based on our knowledge of the order fulfilment process, we think it is short and efficient	1	2	3	4	5	6	7
Cst#1	The cost associated with the order fulfilment process in our hospital is getting better with time	1	2	3	4	5	6	7
Cst#2	We have seen an improvement in the cost associated with the order fulfilment process with time	1	2	3	4	5	6	7
Cst#3	Based on our knowledge of the order fulfilment process, we think it is cost efficient	1	2	3	4	5	6	7
Flex#1	The flexibility of the order fulfilment process in our hospital is getting better with time	1	2	3	4	5	6	7
Flex#2	We have seen an improvement in the flexibility of the order fulfilment process with time	1	2	3	4	5	6	7
Flex#3	Based on our knowledge of the order fulfilment process, we think it is flexible	1	2	3	4	5	6	7

Thank you

APPENDIX 5 – Questionnaire for Main Survey (Arabic Version)

College of Business | School of Business IT and Logistics

دعوة للمشاركة في مشروع بحثي

معلومات المشروع

1. موضوع البحث:

آثر التكامل بين المستشفيات والموردين: استكشاف دور الادارة الرشيدة في تحسين اداء القطاع الصحي في المملكة العربية السعودية

2. الباحثون

الباحث: سعد سالم الشهراني

المشرف: البروفيسور شمس رحمن

عزيزي المشارك،

أنت مدعو للمشاركة في مشروع بحثي تقوم به جامعة RMIT في أستراليا. سوف تستغرق منك هذه الدراسة ما يقرب 35 دقيقة. هذه الرسالة توفر لك لمحة عامة عن هذا البحث. يرجى قراءة هذه الصفحات بعناية، وتأكد من فهمك لمحتوياته قبل ان تقرر ما اذا كنت ستشارك. بسبب طبيعة جمع البيانات، فإننا لا نسعى للحصول على موافقة خطية منك. بدلاً من ذلك، فإننا نفترض أنك أعطيتنا موافقة ضمنية من خلال تعبئة الاستبيان وإعادته. إذا كان لديك أي أسئلة حول هذا المشروع، يرجى التواصل مع أي من الباحثين المحددة أسماؤهم أعلاه .

3. من هم المعنيون في هذا البحث

أنا سعد الشهراني، حالياً طالب باحث في كلية إدارة الأعمال تكنولوجيا المعلومات والنقل والإمداد في جامعة RMIT في ملبورن، أستراليا. وأنا أقوم بهذا البحث كجزء من دراستي لنيل شهادة الدكتوراه. مشرفي لهذا المشروع هو

البروفيسور شمس رحمن. وقد تمت الموافقة على هذا المشروع من قبل لجنة RMIT المتخصصة بأخلاقيات البحث العلمي، وقد حازت على الرقم 19090.

4. ما هو الغرض من هذا البحث؟

الهدف من هذا المشروع هو لفهم التكامل بين المستشفيات في المملكة العربية السعودية ومورديهم الأساسيين، ودور هذا التكامل في تحسين أداء المستشفيات السعودية.

5. لماذا تم التواصل معك؟

أولاً تم التواصل معك للمشاركة في هذا المشروع البحثي لأنك تعمل في مستشفى سعودي. ثانياً، نظراً لطبيعة عملك في المستشفى الذي تعمل به، إذ أنك تتعامل مع مواضيع المشتريات ويفترض أن تكون لديك اتصالات منتظمة مع الموردين الرئيسيين للمستشفى الذي تعمل به، وهذا من شأنه إثراء فهمنا للعلاقة بين المستشفيات السعودية ومورديها.

6. ما هو المشروع؟ وما هي الأسئلة التي يحول الإجابة عليها؟

هذا المشروع هو حول التوسع في فهم العلاقة بين المستشفيات ومورديها، وتأثيرها على الأداء العام للمستشفيات. تم التطرق لهذا الموضوع مراراً في الأبحاث المتخصصة. ومع ذلك، ليس هناك دراسات حول هذا الموضوع في سياق المملكة العربية السعودية. القيام بمثل هذا البحث من المتوقع أنه سيجيب على عدد من الأسئلة حول العوامل التي تؤثر على هذه العلاقة، فيما اذا كانت تكاملية ومفيدة أم لا. هذه الأسئلة هي عن العوامل التي تؤثر في تكامل موارد المستشفى في سياق المملكة العربية السعودية، وأثر التكامل اللوجستي في تكامل موارد المستشفى، وتكنولوجيا المعلومات، وتبادل المعرفة، والثقة بين المستشفيات ومورديهم، وما هو تأثير تكامل موارد المستشفى على الأداء العام في المستشفيات السعودية. اثنان من أكثر التفاصيل اهمية في هذا الصدد: إمكانات الممارسات الرشيدة، ودور حجم المستشفى لتحديد أثر تكامل موارد المستشفى على الأداء العام للمستشفيات الجاري دراستها.

7. إذا وافقت على المشاركة، فما هي الأشياء المترتبة على ذلك؟

إذا وافقت على المشاركة، سيطلب منك قضاء ما يقرب 35 دقيقة لإكمال هذا الاستبيان الذي يتضمن بعض الأسئلة الديموغرافية الأساسية عن عملك في المستشفى الذي تعمل به، وكذل كالرد على أسئلة عامة حول مشتريات الصحة وإدارة العلاقات مع الموردين الرئيسيين للمستشفى الذي تعمل به.

8. ما هي المخاطر أو الخسائر المحتملة؟

لا يوجد أي خطر على المشاركين في هذا الاستبيان. ومع ذلك، إذا كنت تشعر بالقلق على نحو غير ملائم حول ردودكم على أي بند من بنود الاستبيان، أو إذا وجدت مشاركة في المشروع يثير قلقك، يرجى الاتصال بالبروفيسور شمس رحمن في أقرب وقت. شمس سوف يناقش مخاوفك بسرية تامة واقتراح المناسب للمتابعة، إذا لزم الأمر.

9. ماذا سيحدث للمعلومات التي أقدمها؟

سيتم الحفاظ على خصوصيتك وسريتك بدقة وبالطريقة المحددة في تقرير البحث أو أي منشورات ذات صلة. أي معلومات تقدمها لا يمكن الكشف عنها إلا إذا كان ذلك لحمايتك انت او غيرك من الأذى اذا لزم الأمر على وجه التحديد أو يسمح به القانون، أو من خلال حصول الباحثين على إذن كتابي. سيتبين البيانات فقط من قبل المشرفين والممتحنين الذين يأخذون امر حمايتك على محمل الجد أيضا.

للتأكد من أن البيانات التي تم جمعها محمية بشكل جيد؛ سيتم حفظ البيانات على نظام شبكة الجامعة بشكل آمن. وسيتم نشر نتائج هذه الدراسة في أطروحة الدكتوراه، التي ستقدم كذلك في المؤتمرات والمجلات البحثية المتخصصة. الأطروحة النهائي والأوراق البحثية المنشورة ستبقى في RMIT كسجل دائم.

10. ما هي حقوقي كمشارك؟

كمشارك لديك الحق في الانسحاب من المشاركة في أي وقت، أن تطلب سحب أي سجل أو معلومة اعطيتها للباحثين. كما أن لك الحق في الرد على أي سؤال في أي وقت. البيانات غير المعالجة يمكن سحبها شريطة ان يتم طلبها من الشخص صاحب العلاقة بشكل مباشر. وأنا أؤكد لكم أن الاجابات ستبقى سرية ومجهولة المصدر.

شكرا جزيلاً لك على مساهمتك بهذا البحث.

تفضلوا بقبول فائق الاحترام،

سعد الشهراني (المرشح للدكتوراه)

كلية إدارة الأعمال تكنولوجيا المعلومات والنقل والإمداد، جامعة RMIT.

> **آثر التكامل بين المستشفيات والموردين في تحسين اداء القطاع الصحي في المملكة العربية السعودية**

هذا الاستبيان هو جزء أساسي من هذه الدراسة على فهم تأثير تكامل موارد المستشفى على الأداء العام في المستشفيات السعودية؟

جميع المعلومات سابقة سرية للغاية

للحفاظ على عدم الكشف عن هويتك، من فضلك لا تكتب اسمك على الاستبيان. ومع ذلك، إذا كنت ترغب في الحصول على ملخص للنتائج، يرجى الاتصال بسعد الشهراني عن طريق الهاتف أو الفاكس أو البريد الإلكتروني حسب معلومات الاتصال   الموجودة في البريد الإلكتروني.

التعليمات التالية سوف تساعدك في ملء الاستبيان:

- فيما يلي مثال عن كيفية إكمال الاستبيان

موافق بشدة	موافق	موافق إلى حد ما	محايد	غير موافق إلى حد ما	غير موافق	غير موافق بشدة	عناصر التقييم	الرمز
7	6	5	4	3	2	1	مستشفانا يدرك اهمية التكامل اللوجستية مع موردينا	LI#1

- من خلال رسم دائرة حول الرقم 4، تكون استجابتك نحو أوافق بشدة أن المستشفى يدرك أهمية التكامل اللوجستي مع مورديها. من المهم أن الرد على جميع الأسئلة بناء على معلوماتك، حتى لو كان البعض منها قد يظهر مشابهة. الإجابة على كافة اجزاء هذا الاستبيان مهمة لنجاح هذه الدراسة. الإجابات الجزئية سيتم استبعادها ولن يمكننا استخدامها مع الأسف.
- لذلك، من فضلك لا تترك الأسئلة دون إجابة.
- لا توجد إجابات صحيحة أو خاطئة.
- إذا كنت ترغب في التعليق على أي من الأسئلة، يرجى استخدام المكان المخصص في نهاية الاستبيان.

- سيتم نشر نتائج هذه الدراسة عند الانتهاء منها بشكل لا يظهر هوية المستشفيات والافراد المشاركين في هذه الدراسة.

إن وقتكم ومشاركتكم في هذا البحث لها كبير التقدير من قبل الباحثين.. وفي هذا الوقت، نرحب بطلباتكم للحصول على نسخة من النتائج لدى الانتهاء من هذا البحث. من أجل ذلك يرجى الاتصال على الهاتف أو الفاكس أو البريد الإلكتروني.

الجزء الأول: معلومات عنك وعن المستشفى الذي تعمل به

تتطلب المعلومات التالية بعض التفاصيل عن المشاركين في هذا البحث والمستشفى الذي يعملون به. الرجاء الإجابة على الأسئلة التالية:

1. **ما هو القسم الذي تعمل به ؟**
   المشتريات
   التموين
   الإدارة الطبية
   إدارة المستشفى
   إدارة الجودة
   آخر (يرجى التحديد):...

2. **ما هو مستواك التعليمي ؟**
   مرحلة ما بعد الثانوية / الثانوية
   دبلوم
   البكالوريوس
   الماجستير
   الدكتوراه
   الزمالة

3. **ما هو الجنس:**
   ذكر
   أنثى

4. **كم عدد سنوات الخبرة الإدارية لديك؟**
   أقل من 5 سنوات
   6-10 سنوات
   11-15 سنة
   16-20 سنة
   أكثر من 20 سنة

5. **كم عدد السنوات الخبرة الإدارية الخاصة بك في القطاع الصحي؟**
   أقل من 5 سنوات
   6-10 سنوات

11-15 سنة
16-20 سنة
أكثر من 20 سنة

6. **ما هو نوع المستشفى الذي تعمل به؟**
قطاع عام (تابع لوزارة الصحة)
قطاع عام (تابع للوزارات الأخرى)
قطاع خاص

7. **ما هو حجم المستشفى الذي تعمل به؟**
100 سرير فأقل
101-299 سرير
300-499 سرير
500 سرير فأعلى

8. **عدد العاملين في المستشفى الذي تعمل به ؟**
500 فأقل
501-999
1000-1499
1500-1999
2000-2499
2500-2999
3000-3499
3500 فأعلى

الجزء الثاني: التكامل بين المستشفيات والموردين والادارة الرشيدة في تحسين اداء القطاع الصحي

أ ـ التكامل اللوجستي

جوهر التكامل اللوجستي هو تأمين تدفق جيد ومنسّق للمواد من الموردين إلى المستشفيات بما يمكنها من تأدية دورها على نحو سلس. هذا التنسيق ينتج ربطاً سلساً بين المستشفيات والموردين بحيث تتلاشى عملياً الحدود بين انشطة المستشفيات وانشطة الموردين.

موافق بشدة	موافق	موافق إلى حد ما	محايد	غير موافق إلى حد ما	غير موافق	غير موافق بشدة	عناصر التقييم	الرمز
7	6	5	4	3	2	1	مستشفانا يدرك أهمية التكامل اللوجستي مع مورّدينا	**LI#1**
7	6	5	4	3	2	1	أنشطتنا اللوجستية متكاملة بشكل جيد مع الأنشطة اللوجستية للموردين	**LI#2**
7	6	5	4	3	2	1	مستشفانا لديه اندماج متكامل للأنشطة اللوجستية مع مورّدينا	**LI#3**

| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | التكامل اللوجستي لدينا مع موردينا يمكن ملاحظته من خلال توافر خدمات ممتازة تتعلق بالنقل والتوزيع وإدارة المستودعات. | **LI#4** |

ب ـ نظم المعلومات

كان هناك توافق واسع على أن التكامل بين تكنولوجيا المعلومات للمستشفيات ومورديها له تأثيرات مباشرة وغير مباشرة على التكامل بين المستشفى المورد، وعلى الأداء العام لسلسلة التوريد. هذه المجموعة من الأسئلة تهدف إلى إثراء فهم تأثير تكنولوجيا المعلومات على العلاقة بين المستشفى والموردين الرئيسيين.

موافق بشدة	موافق	موافق الى حد ما	محايد	غير موافق الى حد ما	غير موافق	غير موافق بشدة	عناصر التقييم	الرمز
7	6	5	4	3	2	1	لدى مستشفانا انظمة معلومات تعمل بسلاسة مع الموردين الرئيسيين / البائعين	**IT#1**
7	6	5	4	3	2	1	أغلب الفواتير وطلبيات الشراء والحوالات وغيرها من المعاملات مع موردينا تجري بشكل إلكتروني	**IT#2**
7	6	5	4	3	2	1	تتوفر لدى المستشفى انظمة معلومات متقدمة تساعد على متابعة الطلبيات الطبية عبر الانترنت	**IT#3**
7	6	5	4	3	2	1	التنسيق مع المؤسسات والشركات الأخرى يتم بشكل إلكتروني	**IT#4**
7	6	5	4	3	2	1	تتوفر لدينا امكانيات للتواصل عبر البريد الإلكتروني مع موردينا الأساسيين	**IT#5**

ج ـ تبادل المعلومات

يمكن تعريف تبادل المعلومات بين المستشفيات والموردين الأساسيين على أنه الحد الذي إليه تسمح الشركات بمشاركة المعلومات حول الفعاليات التي تقوم بها بما يولد نوع من المعرفة المتخصصة. هذه المجموعة من الأسئلة تهدف الى تقييم أثر هذا التبادل للمعلومات بين المستشفى والموردين الاساسيين لها على اداء المستشفى

موافق بشدة	موافق	موافق الى حد ما	محايد	غير موافق الى حد ما	غير موافق	غير موافق بشدة	عناصر التقييم	الرمز
7	6	5	4	3	2	1	نحن وبشكل دائم نشارك المعلومات الحساسة (المالية، والتصميم، والإحصاءات، والمنافسة) مع الموردين الرئيسيين لدينا	IS#1
7	6	5	4	3	2	1	دائما نزود الموردين بأي معلومات قد تساعدهم على اداء مهامهم تجاهنا	IS#2
7	6	5	4	3	2	1	تبادل المعلومات يحدث بشكل دائم ومنتظم وبشكل رسمي او غير رسمي	IS#3
7	6	5	4	3	2	1	المستشفى والموردون يسعون إلى اعلام الطرف الأخر حول اي احداث او تغييرات طارئة قد تؤثر على انشطتهم المتبادلة	IS#4
7	6	5	4	3	2	1	لدينا اجتماعات متكررة وجها لوجه مع الموردين لمناقشة الخطط والفعاليات المشتركة	IS#5
7	6	5	4	3	2	1	المستشفى والموردون يتبادلون معلومات عن الأداء	IS#6

د ـ الثقة

تبادل المعلومات بين المستشفيات ومورديها قد يكون محفوفاً بالمخاطر، ولذلك فإن إعطاء الغرباء القدرة على الوصول إلى المعلومات حول الأنشطة الداخلية للمستشفى يحتاج إلى أن يعامل بعناية. إنّ الابحاث السابقة في هذا المجال تدرك أهمية ذلك في الحفاظ على التكامل بين المستشفيات ومورديها.

موافق بشدة	موافق	موافق الى حد ما	محايد	غير موافق الى حد ما	غير موافق	غير موافق بشدة	عناصر التقييم	الرمز
7	6	5	4	3	2	1	مستشفانا يعتقد أن الموردين الرئيسيين يعملون ما بوسعهم من أجل مصلحة المستشفى	TR#1
7	6	5	4	3	2	1	يوجد هناك اتفاقية واسعة النطاق في ما يخص مستشفانا وهي ان الموردين الرئيسيين لدينا لديهم الكفاءة والفعالية في تفاعلهم معا لمستشفى	TR#2
7	6	5	4	3	2	1	لدى موردينا الثقة بفعاليات المستشفى، وحتى اذا كان لديهم أي شكوى فإنهم سرعان ما يخبرون المستشفى بذلك	TR#3
7	6	5	4	3	2	1	موردونا يحافظون على تعهداتهم والتزاماتهم مع المستشفى	TR#4

7	6	5	4	3	2	1	موردونا مهتمون بسلامة أداء مستشفانا.. وليس فقط بسلامة أدائهم	TR#5

هـ ــ تكامل المستشفيات

يمكن تعريف تبادل المعلومات بين المستشفيات والموردين الأساسيين على أنه الحد الذي إليه تسمح الشركات بمشاركة المعلومات حول الفعاليات التي تقوم بها بما يولد نوع من المعرفة المتخصصة. هذه المجموعة من الأسئلة تهدف الى تقييم أثر هذا التبادل للمعلومات بين المستشفى والموردين الاساسيين لها على اداء المستشفى

موافق بشدة	موافق	موافق الى حد ما	محايد	غير موافق الى حد ما	غير موافق	غير موافق بشدة	عناصر التقييم	الرمز
7	6	5	4	3	2	1	نحن وبشكل دائم نشارك المعلومات الحساسة (المالية، والتصميم، والإحصاءات، والمنافسة) مع الموردين الرئيسيين لدينا	HSI#1
7	6	5	4	3	2	1	دائما نزود الموردين بأي معلومات قد تساعدهم على اداء مهامهم تجاهنا	HSI#2
7	6	5	4	3	2	1	تبادل المعلومات يحدث بشكل دائم ومنتظم وبشكل رسمي او غير رسمي	HSI#3
7	6	5	4	3	2	1	المستشفى والموردون يسعون إلى اعلام الطرف الأخر حول اي احداث او تغييرات طارئة قد تؤثر على انشطتهم المتبادلة	HSI#4
7	6	5	4	3	2	1	لدينا اجتماعات متكررة وجها لوجه مع الموردين لمناقشة الخطط والفعاليات المشتركة	HSI#5

و ــ الممارسات الرشيدة

الممارسات الرشيدة هي ممارسة الإدارة التي تقوم على تصنيف العمليات والأنشطة إلى أنشطة ذات قيمة مضافة، وأخرى ليست ذات قيمة مضافة. ويمكن تعريف الممارسات الرشيد ب "إزالة الهدر من قبل جميع أعضاء المنظمة من كل اجراءات العمل".

موافق بشدة	موافق	موافق الى حد ما	محايد	غير موافق الى حد ما	غير موافق	غير موافق بشدة	عناصر التقييم	الرمز
7	6	5	4	3	2	1	في مستشفانا، الحد من الهدر هو استراتيجية رئيسية	LP#1
7	6	5	4	3	2	1	لدينا في مستشفانا الجاهزية لإعادة تصميم اجراءات العمل بهدف الحد من الهدر	LP#2

7	6	5	4	3	2	1	يتوفر في مستشفانا تدفق سلس وسريع للمواد الطبية من المستودعات إلى العيادات	LP#3
7	6	5	4	3	2	1	يقوم مستشفانا بإجراءات صيانة وقائية واستباقية	LP#4
7	6	5	4	3	2	1	إزالة المعوقات في مختلف الإجراءات بمستشفانا هي سياسة مهمة	LP#5

ز- أداء المستشفى

التكامل بين المستشفى والمورد يمكن تعريفه بأنه الحد الذي تقترن به العمليات التجارية بين مستشفى والموردين الرئيسيين ككل. هناك اتفاق عام على أن هذا التكامل يؤثر إيجابا على الأداء العام للمستشفيات. هذه المجموعة من الأسئلة تهدف إلى أخذ وجهات النظر والخبرات الخاصة بك في المستشفى الذي تعمل به.

موافق بشدة	موافق	موافق إلى حد ما	محايد	غير موافق إلى حد ما	غير موافق	غير موافق بشدة	عناصر التقييم	الرمز
7	6	5	4	3	2	1	هناك تحسن مستمر لنوعية انجاز طلبات الشراء	Qual#01
7	6	5	4	3	2	1	كان باستطاعتنا ان نرى تحسن لنوعية انجاز طلبات الشراء في المستشفى	Qual#02
7	6	5	4	3	2	1	نعتقد أن اجراءات انجاز طلبات الشراء على درجة عالية من الكفاءة	Qual#03
7	6	5	4	3	2	1	هناك اختصار دائم في الزمن اللازم لإنجاز طلبات الشراء	Spe#1
7	6	5	4	3	2	1	كان باستطاعتنا ان نرى تحسناً في اجراءات انجاز طلبات الشراء في المستشفى	Spe#2
7	6	5	4	3	2	1	نعتقد أن اجراءات انجاز طلبات الشراء مختصرة وفعالة	Spe#3
7	6	5	4	3	2	1	هناك توفير مستمر في التكاليف اللازمة لإنجاز طلبات الشراء	Cst#1
7	6	5	4	3	2	1	كان باستطاعتنا ان نرى توفيراً مستمراً في التكاليف اللازمة لإنجاز طلبات الشراء في المستشفى	Cst#2
7	6	5	4	3	2	1	نعتقد أن اجراءات انجاز طلبات الشراء غير مكلفة وفعالة	Cst#3

7	6	5	4	3	2	1	هناك تحسن مستمر في مرونة إنجاز طلبات الشراء	**Flex#1**
7	6	5	4	3	2	1	كان باستطاعتنا ان نرى تحسناً مستمراً في مرونة إنجاز طلبات الشراء في المستشفى	**Felx#2**
7	6	5	4	3	2	1	نعتقد أن اجراءات انجاز طلبات الشراء مرنة	**Flex#3**

شكراً لكم