ASSESING THE IMPACT OF INFORMATION TECHNOLOGY GOVERNANCE ON OUTCOME QUALITY & SUPPLY CHAIN AGILITY IN HOSPITALS: THE MEDIATING ROLE OF INFORMATION SHARING CAPABILITY

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No portion of the work referred to in the dissertation has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

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Abstract

Patients worldwide are becoming ever more demanding for the timely provision of superior-quality health services. Information technology (IT) has become a bottleneck resource in many industries including hospitals as an enabler of delivering the required level of service quality. However, IT governance determines an organization's information-sharing capability with its suppliers and customers, thus making the supply chain agile and improving outcome quality. This study examines the effect of IT governance on outcome quality and supply chain agility with the mediating role of information-sharing capability. A purposively drawn sample of 185 supply chain professionals from hospitals in Pakistan was selected for cross-sectional data. A five-point Likert scale was used to evaluate the responses on a self-administered questionnaire. Statistical Package for Social Scientists (SPSS) and PROCESS Macro were used to analyze the data. The results show the information-sharing capability's significant mediating role in the relationship between IT governance and outcome quality and supply chain agility. The novelty of this research lies in developing a framework that tests the relationships between the variables that play a pivotal role in the hospital's strategy for delivering service quality. Moreover, this study offers practical implications for the administrators and policymakers of hospitals to recognize the importance of investing in and effectively utilizing IT resources to leverage their efforts to improve hospital performance and service quality.

Keywords: Healthcare, IT governance, information sharing capability, supply chain agility, outcome quality.

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Table of Abbreviations

Acronyms	**Abbreviations**
SC	Supply Chain
ITG	Information Technology Governance
IT	Information Technology
ISC	Information Sharing Capability
SCA	Supply Chain Agility
OQ	Outcome Quality

Chapter 1 INTRODUCTION

1.1 Hospital Supply Chains

The revolution of technology in the 21st century is a sign of development. The economy, politics, education, and with no exception, hospitals are all desperately accepting new ways and techniques to improve their manifest and latent functions. Such a change has marked a shift from traditional information sharing and preserving forms to information technology (Regin, 2023). The pandemic of Covid-19 impacted hospitals globally, as their capacity was exhausted. It demanded that healthcare be more agile and leverage information technology to ensure patient satisfaction. This included combatting the spread of COVID-19 through virtual clinics (Dhahri et al., 2020), remote patient monitoring, contacting through text messages, and teleconferencing (Keesara et al., 2020). The learnings from the COVID-19 pandemic reassure us that agile healthcare is required, tailored toward patient needs (Adelaja et al., 2020).

Patients are becoming increasingly inquisitive and concerned about the availability of healthcare services because of the emergence of global competition (Luther et al., 2016). The increasing focus and growing emphasis on fulfilling health requirements have significantly improved the healthcare service for general populations. The recent development in the worldwide competitive service ecosystem has touched healthcare services. Because of growing patient expectations, hospitals must provide exceptional healthcare services and meet their needs. As a result of the constantly rising competition among hospitals, patients are encouraged to make the best decision possible when choosing a hospital, and hospitals have started to emphasize the excellent level of medical quality (Mitropoulos et al., 2018).

Global supply chains have been severely disrupted by COVID-19, particularly in hospitals (Ivanov, 2020). In the future, there will be pandemics that will cause more disruptions in SCs (Supply Chain) (Supply Chain) and the delivery of healthcare services globally (Govindan et al., 2020). Understanding a hospital's SC resilience to pandemic-related disruptions is crucial. SC processes are a crucial component in the delivery of health care benefits. The delivery of goods and services to the patient in the case of hospitals is made possible by SCs, which are a crucial, life-saving component (Scala & Lindsay, 2021). While SC disruption in a business setting could

result in lost profit, the stakes in hospitals are far higher and could result in human life being put in danger (Getele et al., 2019).

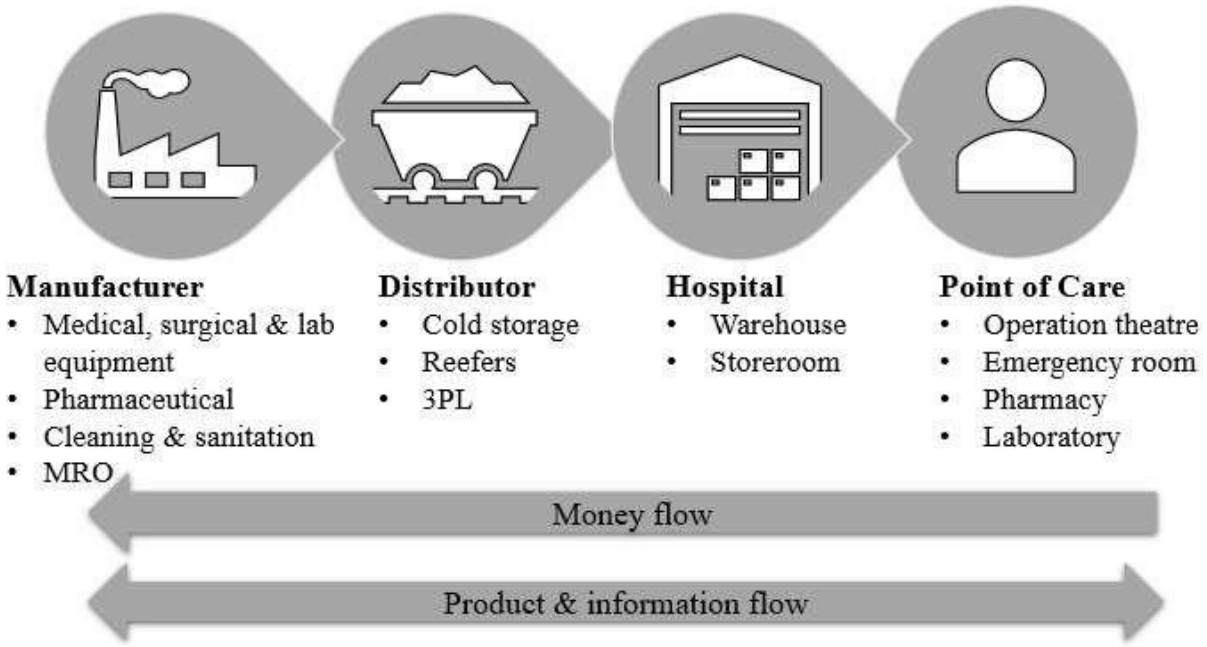

Figure 1.1 A typical hospital supply chain

Figure 1.1 illustrates a hospital supply chain in Pakistan. Money flows from the point of care (pharmacy and other services) to hospitals, distributors, and manufacturers. On the other hand, the information flow is bi-directional, and hence it is central to the success of a healthcare supply chain. Supply Chain (SC) processes are crucial in providing health services, which are a crucial, life-saving component for patients (Scala & Lindsay, 2021). While SC disruption in a business setting could result in lost profit, the stakes in hospitals are far higher and could result in human life being put in danger (Getele et al., 2019). The hospitals function on the back of their SC. Even minor flaws in SC multiply the hindrances of the healthcare sector. Global SCs have been severely disrupted by COVID-19, particularly in hospitals. The size, location, diversity, and different specializations of a hospital all influence the landscape of its business and, consequently, the needs of its SC (Scala & Lindsay, 2021). Supply chain agility, therefore, is a decisive factor in the value of hospital services. It is necessary for healthcare setups to revamp their supply chains with flexibility and responsiveness to help stakeholders improve efficiency, reduce cost, save time, and fulfill dynamic patient needs (Ivanov, 2020).

One of the important avenues to excel in healthcare services is adopting Information Technology (IT). IT has transformed hospital operations. The documentation, organization, and sharing of health records have improved since the switch from paperwork to electronic data (Carvalho et al., 2021). A long-term organization-wide IT strategy can significantly improve the impact and efficiency of the information technology (IT) infrastructure in place (Blondiau, 2015). The IT department's goals are to ensure that the hospital's IT infrastructure is performing at a sufficient level, to expand the amalgamation of the hospital's IT applications, to create and implement the best sourcing strategy for IT applications, to manage the deployment of those programs across the hospital's clinical and administrative units, to assist the hospital's departments and staff in increasing productivity and streamlining the system by creating IT-enabled administrative, managerial, and clinical procedures (Guillemette et al, 2022).

Efficient information sharing and process coordination can help maximize the enormous influx of inputs to the hospital and their out-processing (Yu et al., 2021). A principal element of information sharing in hospitals is supplies information, patient data, and the streamlined flow of information within an organization. Such sensitive information must be dealt with securely and transparently, for which Information Technology Governance (ITG) is mandatory. ITG also looks forth to the set of activities and policies that are exercised by managers, inclusive of monitoring and control to make the IT setup of an organization sustain and extend the objectives of the organization (Abu Khadra et al, 2009)

The outcome quality is an important performance metric of healthcare, and it corresponds to the competitiveness and effectiveness of healthcare. In a healthcare system, reduced patient waiting time, increased patient satisfaction, and loyalty are measured as the outcome quality (Chahal & Kumari, 2010). The atmosphere of competition demands rapid technological transition due to the increasing expectations of patients from the hospitals (Karamat et al., 2019). The importance of patients' satisfaction can be assessed from several viewpoints. Firstly, competition is not only between private and public hospitals, but intra-private sectors are also diversifying and overgrowing (Mitropoulos et al., 2018). Secondly, the desire to attract patients is on the rise. Thirdly, retention is believed to be cheaper than attracting new clients (Cambra-Fierro et al., 2021). For this reason, the focus is being placed on loyalty, which is cost-effective and enables the business to survive and grow positively (Pekovic & Rolland, 2020).

1.2 Research Problem

The impact of Covid-19 on hospitals was substantial which disrupted the hospital operations globally and exhausted the capacity of hospitals. A huge influx of patients was recorded worldwide, and the healthcare sector was unable to respond to the diversified needs of patients. Coordinated processes are required to manage huge influx of patients. This requires the governance of IT infrastructure in hospitals to ensure adequate information sharing for patient satisfaction. In addition to this, having agile supply chains is essential to help stakeholders improve efficiency, reduce costs, and save time. Currently, hospitals in Pakistan are underutilizing the true potential of IT infrastructure to achieve supply chain agility and deliver superior healthcare service.

These key questions are what this research will address.

RQ1: How does the governance of IT infrastructure in hospitals improve the hospital service quality?

RQ2: What is the role of supply chain information sharing in hospitals?

RQ3: How do distinct types of hospitals (public vs. private) vary in terms of IT infrastructure and service quality?

RQ4: What are the best practices to improve the outcome quality and supply chain agility in hospitals?

In line with the goal, the following are the major objectives of the study.

RO1: To assess the impact of IT governance on outcome quality and supply chain agility.

RO2: To examine the role of information sharing capability as a mediator between IT governance and outcome quality.

RO3: To examine the role of information sharing capability as a mediator between IT governance and supply chain agility.

RO4: To suggest best practices to improve outcome quality and achieve supply chain agility in hospitals.

Outcome quality is an important attribute of a healthcare system, and it comprises patient waiting time, patient satisfaction, and patient loyalty; however, the extant literature on healthcare does not consider outcome quality as a predicted variable. There is a need for a comprehensive framework that studies the antecedents and outcome variables of the hospital ecosystem. To this end, this study examines the effect of information technology governance on outcome quality and supply chain agility with the mediating role of information-sharing capability. The novelty of this research lies in developing a framework that tests the relationships between the variables that play a pivotal role in the hospital's strategy for delivering high service quality. The study's main contributions are the framework it suggests, its subsequent testing, and its contextual applicability. The findings will enable the managers and policymakers to underscore the importance of IT governance and information-sharing capability in improving a healthcare supply chain's outcome quality and agility.

1.3 Thesis Format

In this study conducted, the following path has been undertaken to conduct the research as illustrated in Figure **1.2**

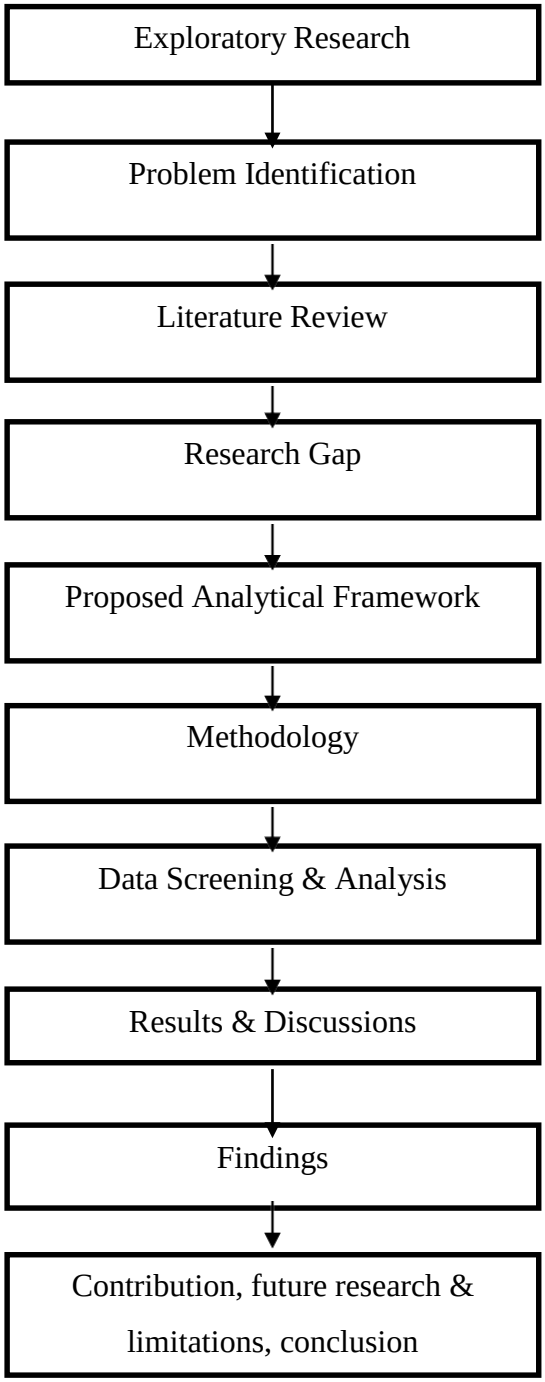

Figure 1.2 Format of Thesis

In the first chapter of the paper, the topic is introduced, its background is covered, as well as any gaps in the body of literature and contributions, in the first chapter of the paper. The industry backdrop is briefly discussed in Chapter 2 while taking the literary review into account. A thorough overview of the literature, the study's assumptions, and its suggested theoretical framework are presented in Chapter 3. The study's methodology is presented in Chapter 4, which includes the research concept and design, sample design, data collecting, analytic tool, and procedures for preliminary data analysis. The findings portion will be in Chapter 5, while the discussion sections, the study's limitations, and suggestions for further research will be in Chapter 6.

Chapter 2 INDUSTRY BACKGROUND

2.1 Global Healthcare Industry

The healthcare sector is one of the most imperative and critical sectors of an economy and hospitals are the most important units where the margin for error is small as they must work round the clock with flexibility. In the world of today, the prime focus of hospitals is towards new innovative machinery, technology, and patient demands (Attaran, 2020). Totals spent in the healthcare sector have continued to increase over the years to increase the human lifespan and for a better and healthy living standard for developing countries. Management of the supply chain and value chain is not only limited to manufacturing firms but is equally important in the services industry, as management is of core importance in hospitals (Rungsrisawat & Jermsittiparsert, 2019).

Healthcare is among the most important sectors of a country operating in an environment that is filled with uncertainty and unpredictability of what the future holds coupled with inadequate resources possessed in this sector (Wang et al., 2016). Hospitals and other healthcare Institutions around the globe face great challenges to fulfill health-related needs. The main objective of hospitals is in developing and sustaining an organizational environment which results in superb quality, hygiene and is patient centric (Bharathi et al., 2020). The Pandemic of 2020 proved that hospital supply chains are not resilient enough to respond to the catastrophe caused to human life on a large scale, for which development of a rapid delivery network has become the topmost priority. It has set forth greater challenges for healthcare supply chains to be taken into consideration and revamp them with flexibility and responsiveness to fulfill the patient's needs (Ivanov, 2020).

The healthcare industry is under loads of strain because of growing costs, tighter government restrictions, increased competition, and customer demands for greater quality services. The healthcare sector as a commercial activity must seek for value addition throughout the supply chain to improve SC performance (Habib et al., 2022). The hospital SC is made up of the collection of design activities, planning, procurement, manufacture (goods and services), delivery, and return management from the supplier to the recipient (patients), considering all patient dynamics in the hospital. Without product flows, money flows – which are powered by information sharing among the numerous supply chain partners – would not be possible. The objective is to offer the most

dependable and secure patient care service available (Tamir et al., 2017). Long-term challenges for supply chain management in the healthcare industry include cost and risk.

In the healthcare industry, SCM must be considered. The ultimate objective is to ensure the patients' and diverse supply chain stakeholders' happiness (Habib et al., 2022). The expense of acquiring new clients is five times higher than the cost of holding the ones you already have. Therefore, it can be argued that service providers are not only preventing continuous improvement, which is crucial for business survival, but also losing clients and profits to rivals by refusing to solicit feedback from current clients (patients) on how to improve or redesign value creation processes in hospitals (Han & Hyun, 2015).

2.2 Healthcare Industry of Pakistan

Pakistan is a nation striving to achieve the Millennium Development Goals that have been set for the developing nations of the world. Pakistan has come a long way since its inception and has made progress in the social, economic, and agricultural sectors, and is continuing to improve further in the agricultural sector in recent times (Raza et al., 2020) Pakistan has been able to emerge with a positive real GDP (Gross Domestic Product) growth rate throughout time. Despite all of this, the improvement in the healthcare sector cannot be ignored, which holds huge significance and requires major attention from stakeholders. The country is working towards development in the healthcare sector with improved service and delivery mechanisms, structural reforms, health policies, Millennium Development Goal Programs, and the introduction of Public Private Partnerships.

Table 2.1 Pakistan Public Sector Health Expenditure

Year	Total Health Expenditure (Rs million)	Health Expenditure as % of GDP
2016 – 17	267,953	0.8
2017 – 18	328,962	0.9
2018 – 19	416,467	1.1
2019 – 20	421,778	1.0
2020 – 21	505,411	1.1
2021 – 22	657,185	1.2

Source: (Pakistan Economic Survey, 2022)

Table 2.1 represents a nation's importance to public health and the amount of money Pakistan devotes to providing its citizens with healthcare services. A higher proportion denotes more significant government investment in public health, whereas a smaller number denotes less investment. A comparatively low level of investment in public health may be reflected by the 1.2% public health spending to GDP ratio, which may have an impact on the population of Pakistan having access to quality healthcare facilities and services. This could potentially affect the general health and well-being of the population.

2.2.1 Structure of the Healthcare Industry

As per the constitution of Pakistan, health provisions are the responsibility of provincial governments except for the federally administered areas. The political elite's support is necessary for the health strategy to be executed. The Federal Government of Pakistan has complete responsibility over all significant health-related decisions within the country's centralized healthcare system. This concentration limits the provincial government's ability to implement programs outside of its own provinces. In the creation of health policies and health planning, stakeholder, community, and individual group participation is nonexistent. This results in an imbalance in communication between the federal, provincial, and district levels. In addition, there are numerous projects that have no outcomes and there is resource duplication. Even though the government acknowledges in the National Health Policy 2025 that good governance is a necessary component of providing quality healthcare, it does not provide opportunities for good governance. Unsustainable projects have an unbalanced power structure as a result, which causes the populace to lose faith in the system (Javed & Ilyas, 2018). The healthcare system is split between the public and private sector. 70% of the population is in the private sector, while 30% is in the public sector. Both formal and informal healthcare systems are developed in the private sector. Today, 99% of people living in cities and 92% of people living in rural areas have access to healthcare.

Developing countries like Pakistan have had to deal with profound difficulty in coping up with the crisis caused globally due to Covid-19 (Walker et al., 2020). As Pakistan is a developing nation, it is working towards improving its healthcare system. Due to inadequate healthcare services provided by public hospitals, most individuals are forced to choose private hospitals. To receive better medical care, save their lives, and gain more time, patients must pay more money. People

have higher expectations of the services offered by hospitals in this situation, and they evaluate such services considering those expectations. Research on healthcare services, especially in Pakistan, shows that public hospitals fall short of private hospitals in terms of quality of care, and that this may have an impact on patient satisfaction and loyalty intentions (Shabbir et al., 2016). In terms of the physical environment, fair admission procedures, staff behavior, and the caliber of doctors and nurses, private hospitals offer greater service quality.

In the private sector, formal and informal healthcare setups are established and are regularly upgraded for instant information receiving and sharing. The availability of medico-staff, essential surgical instruments and machinery has elevated the standard of the private sector in Pakistan. In contrast, the public sector healthcare is faced with the problem of resource and staff deficiency (Zaidi et al., 2019). Given the resource constraints, the improvements in efficiency and effectiveness are nothing short of a big challenge.

2.2.2 Healthcare Industry in Pakistan

Researchers and academics throughout the world are focusing increasingly on the concerns of patient satisfaction and service quality due to the expanding population (and healthcare difficulties) and a growing emphasis on improvement in each sector of the economy to achieve competitiveness in national economies. Developed nations are pushing healthcare tourism in addition to enhancing their healthcare systems to better serve their populations (Lee & Fernando, 2015). By providing high-quality healthcare at reasonable prices, developing nations can also benefit from these advantages (De Arellano, 2007). Yet, this can be a difficult undertaking in countries like Pakistan where healthcare is not a top priority and where academics or researchers pay more attention to problems like patient happiness and service quality than policy makers or practitioners. In the service industry, displaying good client relationship management and market value creation has always depended heavily on the quality of customer service provided. However, in underdeveloped nations, healthcare practitioners often pay little heed to the opinions of treatment recipients, and they disregard their impressions and expectations (Lee & Fernando, 2015).

There has not been much research done on ITG, ISC, SCA, and OQ in hospitals despite the dire state of healthcare in Pakistan, where quality initiatives are more visible in the manufacturing,

education, and agricultural sectors than in the healthcare sector. A study on both private and public hospitals in Pakistan was carried out to determine the connection between patient loyalty, happiness, and opinions of service quality. According to the research, patients at private hospitals were happier than those at public hospitals. Another research that employed the SERVQUAL scale discovered that patients in private hospitals are happier than those in public hospitals (Irfan & Ijaz, 2011). Another case study focused on Pakistani public and private hospitals in the context of the growing concern regarding healthcare spending in developing countries like Pakistan, which spends a sizable portion of its GDP on the defense industry and debt repayment while using the remaining funds to finance bureaucracy and administrative mismanagements (Nasim & Yousaf, 2014). They discovered that, in contrast to other research, patients in public hospitals tend to be happier than those in private hospitals.

Chapter 3 LITERATURE REVIEW

3.1 Hospital Supply Chain Management

To achieve Total Quality Management (TQM) in healthcare services through the most effective use of resources, Hospital Supply Chain Management (HSCM) is a set of strategies to effectively integrate suppliers or vendors, transport, and hospital services like an outpatient emergency, in-patient, laboratory, radiology, stores and purchase, food, laundry, medicines, equipment, etc. (Kazemzadeh et al., 2012). Suppliers provide medical products to buyers after making them, including surgical supplies, medical gadgets, and medications. Buyers keep inventories to facilitate product delivery to health professionals. A health professional in the healthcare industry stands for individuals who provide care for patients (Habib et al., 2022). There is also cash flow from the patients to the hospital administration and from the administration to the suppliers (Tamir et al., 2017).

Healthcare is among the most critical sectors of a country operating in an environment filled with uncertainty and unpredictability, and hospitals are the most basic units as they must work round the clock with flexibility (Wang et al., 2016). Today's prime focus of hospitals is on new innovative machinery, technology, and patient demands. Totals spent in the healthcare sector have continued to increase over the years to increase the human lifespan and for a better and healthy living standard for developing countries. Management of the supply chain and value chain is not only limited to manufacturing firms but is equally essential in the services industry, as management is of core importance in hospitals (Rungsrisawat & Jermsittiparsert, 2019). The information interchange between the supply chain partners fuels the operations of SC in hospitals. The ultimate objective is to satisfy various supply chain stakeholders (Habib et al., 2022).

Hospitals and other healthcare institutions around the globe face significant challenges in fulfilling health-related needs. The main objective of hospitals is to develop and sustain an organizational environment that results in improved quality and hygiene and is patient centric (Bharathi et al., 2020). The COVID-19 pandemic proved that hospital supply chains are not resilient enough to respond to the catastrophe caused to human life on a large scale, for which the development of a rapid delivery network has become the top priority. The healthcare industry is under strain because

of growing costs, tighter government restrictions, increased competition, and patient demands for more incredible quality services. As a commercial activity, the healthcare sector must seek value addition throughout the SC to improve SC performance (Habib et al., 2022).

3.2 Outcome Quality

High service quality is essential to meet or surpass client expectations, establish trust and confidence, and forge strong emotional connections with customers (Uzir et al., 2021). The quality of service a hospital provides to its patients is unavoidable for its growth. Physicians and clinicians are morally obliged to care for patients and listen to their essential concerns (Mitropoulos et al., 2018). The code of conduct ensures that ethical approaches are followed for patients seeking medical consultation. Different patients differently view the quality of the hospital. The outcome quality of a hospital comprises three things: patient waiting time, patient satisfaction, and patient loyalty (Chahal & Kumari, 2010).

According to the literature on healthcare, one of the most critical indicators of outcome quality is patient satisfaction. Patient satisfaction improves directly with the hospital's enhanced quality of service. After using a service or product, a client's attitude, or preference toward it is known as customer satisfaction (Yi et al., 2021). When a product or service performs better than expected, the outcome is increased consumer satisfaction (Raggiotto et al., 2023). The critical components of patient satisfaction are efficiency, accessibility, and technical competence of health service providers (Meesala & Paul, 2018). Patient satisfaction makes clinical outcomes, patient compliance, and loyalty to the hospital possible (Ng & Luk, 2019).

Hospital service level and patients' health depend on the wait time (Küçük et al., 2021). When waiting time for appointments and treatments is reduced, it improves patient health and satisfaction (Tlapa et al., 2020). An online rating of physicians showed that those patients who approached a physician quickly, rated high for the doctor (Lin et al., 2020). The less wait time opens the door for early medical treatment and reduces the chances of health deteriorating. Longer wait times negatively impact the patient's willingness to seek medical care. Additionally, patient satisfaction maintains an inverse relation with waiting time. The empirical evidence supports that the reduced wait time of a patient results in higher patient satisfaction (Godley & Jenkins, 2019).

Improving patient loyalty in healthcare settings depends heavily on the patient's experience. Customers are more likely to feel satisfied, interested, and devoted to a brand when they have a pleasant experience (Meyer Waarden et al., 2023). Customer loyalty is one of the most intriguing elements for the financial sustainability of a business (Gao & Huang, 2021). Patients are vulnerable to neglect by physicians and hospital staff. Once neglected, they tend to separate themselves from the hospital and discontinue acquiring its service. Patient satisfaction and loyalty are the two strategic structures that must be checked and maintained at a higher pedestal for success to be sustained over time (Meesala & Paul, 2018). Both wait time and patient satisfaction are inseparable variables when it comes to the measurement of outcome quality. Once these two parameters are ensured, patient loyalty is likely to emerge.

3.3 Supply Chain Agility

Supply chain agility has emerged as one of the critical components of supply chain management. A critical factor in assuring patient recovery and subsequent satisfaction is the speed of healthcare delivery (Vähätalo & Kallio, 2015). SCA, linked to quick perception and reaction times, has become crucial in response to the expanding demands of the global market for business competitiveness (Gligor et al., 2013). Organizations that do not have agile supply chains eventually suffer losses in revenue and market share. Due to the variety of complex operations involved in a hospital setting, it is necessary to have an agile approach at the forefront to meet the desired targets. Managers require redesigning their processes to overcome challenges caused by humans and nature (Alzoubi & Yanamandra, 2020).

Academics and business professionals have offered numerous meanings of agility. The capacity to quickly adapt to a new state is known as (Haq & Boddu, 2017). A company's capacity for swiftly reshaping plans and adapting activities inside SC is known as SCA (Gligor et al., 2013). It refers to the capability of successfully implementing a wide variety of cost-efficient and quality-centric products with reduced lead times in diverse groups of quantity that provide more excellent value to consumers through customization (Malviya, 2021). SCA in the services industry holds much more importance than production facilities, as the extent of customized services that can be delivered determines the competitive edge. Hospitals in this regard must be agile in their operations and supply chain to match the unprecedented demand, reduce costs and save time.

The ability of the entities in a SC to identify changes, opportunities, and threats is referred to as alertness. The ability to retrieve pertinent data is referred to as accessibility. The ability to make judgments with certainty is called decisiveness, which has been highlighted as another crucial aspect of SCA. After deciding on the type of reaction that would best accommodate the changes, it is necessary to act swiftly to put that decision into action (Yusuf et al., 2014). The fourth characteristic of agility, swiftness, is the capacity for speedy decision-making and action. The fifth component, flexibility, deals with adapting operations and goals to changing market conditions to acquire a competitive edge (Gligor et al., 2013).

3.4 Information Technology Governance

Over the past ten years, academia and businesses have begun examining several emerging fields, including IT Governance. There is a strong consensus in the literature that information technology governance affects the value realized from investments in information technology (Kizito, 2019). The Institute Board Briefing has summarized ITG as carrying out IT functions in a manner that is aligned with the organization's objectives and generates the target value, making most of the opportunities by maximizing benefits, responsible use of resources, and risk management regarding IT to be dealt appropriately (Wautelet, 2019). ITG also focuses on relationship structures, process development, and controlling IT resources to reach the company's goals with value addition. The literature proposes three modes of ITG: centralized, decentralized, and federal. In a centralized mode, the complete control is with corporate IT management to make decisions. In a decentralized mode, middle management controls the decision-making process and change requests. In federal mode, the control and decision-making authority is divided between top management and line managers (Negash et al., 2018).

ITG is a method that companies use to coordinate their IT initiatives with their performance objectives and designate responsibility for both the outcomes and execution of the actions. Policies, plans, and procedures are the backbone of hospital IT governance. It works as a bridge between the management and clinical approaches to ensure the quality of the service. If the system of hospital governance is well-equipped, the staff is well-trained and competent, and the policy and planning are bound to yield desirable results. Industrialization has fueled automation in every part of global networking, with no exception in hospitals. It is monumental to speed up the

integration of information technology in hospitals, from patient entry to diagnosis and treatment of major acute diseases (Housley et al., 2018). Automation supports clinical decision-making and record-keeping and eases hospital management, medical personnel, and patients (Ruiz & Duffy, 2021).

Good governance addresses creating sustainable value, which aids in achieving the firm's goals while balancing social and economic benefits (Teremetskyi et al., 2020). The basis for providing patients with better and more efficient medical treatment is health information systems (Alipour et al., 2023). The hospital information system can be utilized for quick patient response and, when necessary, as a teaching tool to assist patients in making the right decisions at the proper time. To enable systematic data gathering and analysis, every patient-oriented information system must be structured around patients (Jebraeily et al., 2019). Information technologies have a crucial role in improving productivity, the quality of healthcare, and effective communication. Healthcare businesses are compelled by robust IT governance mechanisms to successfully implement an information-sharing strategy and maximize the value of IT infrastructure that benefits both the staff and the patients. Considering this, we develop the following hypothesis.

H1a: *IT governance has a significantly positive effect on outcome quality.*

Sharing information with partners at all levels of the supply chain is another aspect of IT integration that enables them to collaborate and create coordinated replenishment strategies (Kim & Chai, 2017). The proper stakeholders can receive effective, timely, and transparent business information thanks to IT integration, which reduces the time required for knowledge and information sharing (Joshi et al., 2022). The ability of employees to implement the organization's response to market changes is reflected in their competency, but top management's role and vision ensure the importance of supply chain agility for generating organizational competitive advantages. What potential determinants or factors might improve the supply chain agility in a hospital? The effective IT governance system at a hospital holds the key to the solution.

It is a new concept to use information technology to improve supply chain management. IT integration is the degree to which information systems are connected among SC partners and organizational members (Kabra & Ramesh, 2016). Improving the Supply Chain Management

System (SCMS) is aided by using IT. Businesses can better manage their environments' unpredictability with an agile SC, improving overall business performance (Regin, 2023). What can potentially improve the SCA in a hospital? An effective IT governance mechanism holds the key to the solution. IT governance ensures that the supply chain's IT systems are standardized and optimized, operations are streamlined, complexity is decreased, and efficiency is improved, all of which increases SCA. Moreover, data collection, storage, and analysis are all aspects of effective data management that may be implemented with the help of IT governance. This enables organizations to monitor KPIs and quickly make informed decisions by gaining real-time visibility into their supply chain processes. We, therefore, derive the following hypothesis.

H1b: *IT governance has a significantly positive effect on supply chain agility.*

The effectiveness of information sharing depends on the way it is used (Chen, 2003). This means the due practice of information sharing is important for desirable outcomes in hospitals. In the private sector, formal and informal healthcare setups are established and are regularly upgraded for instant information receiving and sharing. The availability of medico-staff, essential surgical instruments and machinery has elevated the standard of the private hospitals in developing countries. In contrast, the public sector healthcare is faced with the problem of resource and staff deficiency (Zaidi et al., 2019). Robust governance mechanisms for IT enable supply chain members to share real-time information that streamlines SC operations. It ensures that information regarding the policies, procedures, processes, and responsibilities is transparently shared with the personnel (Mengcheng & Tuure, 2022).

Without the most advanced IT systems, it is challenging to organize communication between the many different partners in SC (Regin, 2023). Sharing information with partners at all levels of the supply chain is another aspect of IT integration (Winter et al., 2023). It enables them to collaborate and create coordinated replenishment strategies, monitor lead times, optimize the supply base, reduce transit times, etc. With IT systems in place, their governance is mandatory to ensure that data is protected, the staff is well equipped with the information systems, backups are in place, and Enterprise Resource Planning (ERP) systems and software are used to their maximum potential. Thus, having information technology at the core, along with its governance, paves the way for

sharing information among hospital supply chain entities. We, therefore, derive the following hypothesis.

H2: *IT governance has a significantly positive effect on information sharing capability.*

3.5 Information Sharing Capability

Organizations currently are observing competition from across the globe, changing market requirements, dynamic customer needs, and continuously innovating and evolving technologies. The firm's ability to promptly assess and react to changing market conditions results in a competitive advantage (Neirotti & Raguseo, 2017). The benefits of real-time information sharing, collaboration, and coordination can be obtained through IT, demonstrating agility in response to market demands (Almansoori et al., 2021). It enhances the firm's capacity to share large sets of internal and external data to improve the overall SC efficacy. Efficient communication and sharing of updated information allow the firms to acquire competitiveness and flourish in capacity to achieve sustainability (Fawcett et al., 2007). In addition, timely information sharing allows firms to respond quickly to SC disruptions, resulting in demand uncertainty (Mustafid et al., 2018). The ability of a firm to react with alertness to the changing demands of the market becomes a reliable and smooth way of working based on a robust and well-structured flow of information sharing.

It has become a dire for the hospitals to quickly adopt creative and innovative strategies through the usage of IT applications. IT can be used to improve patient satisfaction as all the ‘information parameters’ of patients can be integrated into the hospital's information system in a way that will enable the hospital to treat different patients differently, resulting in increased patient satisfaction (Zabada et al., 2001). Authors have suggested that efficient communication and sharing of updated information allows the firms to acquire competitiveness and flourish capacity to achieve sustainability (Fawcett et al., 2007) The role of information technologies is particularly important for efficient communication, increasing productivity, increasing the health-care quality.

There is a lack of accessibility to real time data in hospitals among the various stakeholders for informed decision making (Dias & Escoval, 2012). Information sharing between SC participants is an essential element for improving the overall service quality of the hospital, which results in reduced wait times, increased patient satisfaction, and increased patient loyalty. Most findings

suggest a positive correlation between coordination mechanisms and service quality (Musenze & Mayende, 2021; Robinson, 2010). Availability of essential medical supplies on time, such as prescription drugs, medical equipment, and consumables, in hospitals can be made possible with practical and real-time information sharing between SC members, reducing delays in patient care, and boosting patient satisfaction. Additionally, accuracy in order fulfillment can be achieved by the real-time availability of SC information. This reduces order mistakes, backorders, and delays, which benefits patient care and satisfaction. Therefore, we derive the following hypothesis for this study.

H3a: *Information sharing capability has a significantly positive effect on outcome quality.*

New advancements in information technology have diverted the practice of individualism towards collaboration among business partners. Information sharing allows the companies to collect, analyze and disseminate the information among members of SC. Information technologies enable businesses to gather, examine, and share information among SC participants to enhance decision-making. Improved connectivity can alter competitive capacities in hospitals as the lead periods for order fulfillment and new product development are getting shorter. As information is power, people are reluctant to share it (Karamat et al., 2019). The likelihood that employees will use information systems in hospitals is influenced by how they perceive the convenience and advantages of using those information systems (Rochmah et al., 2020).

Organizations that do not have agile supply chains eventually suffer losses in revenue and market share. In an SC setting involving hospitals, a principal element is sharing and availability of real-time data that consists of a patient database, staff database, room check-in, room check-out, operation theatres schedules, inventory levels, lead times, procurement activities, supplier selection, etc. The desire to exchange information in the SC establishes a link between innovation capability and connectivity between buyers and suppliers. Sharing information can also help with logistics integration and ensure a quick and efficient flow of supplies and inventory throughout the SC (Prajogo & Olhager, 2012). Hospitals encounter a considerable influx of information, for which collaboration and integration are required internally and externally to homogenize the workflow across the entire supply chain. An effective way to maximize the enormous influx of data is by

integrating the supply chain entities and real-time information sharing, which helps increase agility (Yu et al., 2021). Therefore, we derive the following hypothesis for this study.

H3b: *Information sharing capability has a significantly positive effect on supply chain agility.*

It is difficult to overstate the significance of IT integration for enhancing supply chain information exchange in the healthcare sector. Hospitals, both public and private, deal with a wide range of issues, from human resources and patient information to medical equipment and pharmaceutical supply. Effective resource management, made possible by IT integration, directly contributes to increased patient satisfaction (Ruiz & Duffy, 2021). Furthermore, IT integration encourages enhanced supplier communication as hospitals can respond quickly to shifts in demand or supply shortages, preserving continuity in patient care, thanks to real-time order tracking and open lines of contact with suppliers (Kim & Chai, 2017).

Information sharing capability has been used as a mediator in literature in very few studies related to the outcome quality of hospitals. Some studies have focused on sharing information by doctors and physicians with patients and maintaining e-health records to improve quality of healthcare services (Ayaad et al., 2019; De Rosis & Barsanti, 2016) but not on how information sharing among supply chain entities helps improve outcome quality. Sharing and availability of supplies and demand information throughout the supply chain will result in the availability of all essential supplies without disruptions and help hospitals meet patients' demands promptly. To have this streamlined flow of information, it is necessary to have information technology governance in place. There is very little literature that addresses this idea. Thus, this paper proposes the following hypothesis.

H4a: *Information sharing capability mediates the relationship between IT governance and outcome quality.*

In hospitals, agility in supply chain is crucial, especially during periods of abrupt shifts in demand or unanticipated disruptions in supply. ERP systems allow for the real-time tracking of supplies, effective inventory management, and quick adjustment to demand changes by integrating many areas of a hospital's operations (Ye & Wang, 2013). The end result is a supply chain that is easily adaptable to changing demands without interfering with the provision of services. Real-time

contact with suppliers is made possible by IT technologies, which also provide information on inventory levels and order statuses. Through more collaboration and openness with suppliers, hospitals may be able to shorten lead times and better prepare for supply shortages.

ISC has been used as a mediator in literature in very few studies related to SCA. A study analyses the mediating effect of information sharing in determining the relationship between supplier innovativeness and SCA (Kim & Chai, 2017). Other authors also studied the role of information sharing in forming a relationship between supplier innovativeness and SCA (Jermsittiparsert & Rungsrisawat, 2019). However, ISC as a mediator in manufacturing supply chains has been studied extensively; ISC as a mediator in the context of supply chains of the services industry is underexplored. Accurate time information sharing between supply chain entities increases visibility throughout the chain and makes supply chains agile. Information technology governance tends to enhance information-sharing capability among supply chain participants, which improves supply chain agility in hospitals. This claim is explored less in literature. Thus, this paper proposes the following hypothesis.

H4b*: Information sharing capability mediates the relationship between IT governance and supply chain agility.*

3.6 Research Gap

Outcome Quality (OQ) in literature has not been studied as a predicted variable. Instead, it has been studied separately in parts such as patient satisfaction, patient loyalty, and patient waiting time (Dhakate & Joshi, 2023; Newman-Casey et al., 2020; Yang & Chen, 2018). Limited studies have been conducted on supply chain agility in the services industry and hospitals where operations vary from manufacturing supply chains (Al Humdan et al., 2020; Siahkal Mahalleh et al., 2022). Moreover, the relationship between IT governance and supply chain agility is underexplored (Regin, 2023). Additionally, there have been few studies on information-sharing capability as a mediator in the services industry (Alzoubi & Yanamandra, 2020). Thus, there is a need for a comprehensive framework that studies the antecedents and outcome variables of the hospital ecosystem, which this study aims to address in the literature.

Table 3.1 Typology of relevant studies and contribution of proposed study

Paper	ITG	OQ	SCA	ISC	Context
(Chahal & Kumari, 2010)		✓			Hospitals
(Fayezi & Zomorrodi, 2015)			✓	✓	Manufacturing
(Kabra & Ramesh, 2016)	✓		✓		Humanitarian SC
(Kim & Chai, 2017)			✓	✓	Manufacturing
(Dehgani & Jafari Navimipour, 2019)	✓		✓		Manufacturing
(Jermsittiparsert & Rungsrisawat, 2019)			✓	✓	Manufacturing
(Alzoubi & Yanamandra, 2020)			✓	✓	Manufacturing
(Joshi et al., 2022)	✓				Manufacturing and services
(Oliveira-Dias et al., 2022)			✓	✓	Industry 4.0
(Makudza et al., 2023)			✓		E-procurement
(Winter et al., 2023)				✓	Industry 4.0
This paper	✓	✓	✓	✓	*Hospitals*

There are studies in literature that have focused on the aspects of information technology and how it helps to improve patient satisfaction (Nash et al., 2010; Zabada et al., 2001), but not on how the salient aspects of information technology governance improve the outcome quality of hospitals which includes patient loyalty and patient waiting time along with patient satisfaction. There are also studies which show that information technology helps in making the supply chains become agile (Kabra & Ramesh, 2016), but there is not much research conducted on governance of information technology in helping supply chains become agile, specifically in services industry. In addition, studies mostly have been conducted on manufacturing firms that have focused on aligning IT functions and collaborative governance to help improve information sharing those result in better supply chain performance (Dehgani & Jafari Navimipour, 2019).

As evidenced in literature, studies have focused on the effectiveness of the service delivery process that results in patient satisfaction, which is highly dependent on the real-time exchange of information and readily available data for making informed decisions (De Rosis & Barsanti, 2016;

Liu et al., 2013). However, these studies were about increased patient satisfaction through recording and maintaining electronic health records and how the exchange of information between doctors and patients helps improve patient satisfaction. These studies did not focus on how real-time supply chain information exchange can help improve outcome quality. In addition, several studies reveal that information-sharing capability among the members of SC helps in achieving supply chain agility, but these studies have been conducted on medium-large sized manufacturing firms and not much on services industry

3.7 The Proposed Framework

The role of ITG in achieving SCA and improving the OQ of hospitals is yet to be addressed. Similarly, the role of ISC in improving the OQ of hospitals is yet to be addressed. Furthermore, the impact of ISC is underexplored in a mediating role in the services industry. To understand these constructs in the context of hospitals, a new framework must be developed to enable hospital SC to become agile and improve outcome quality.

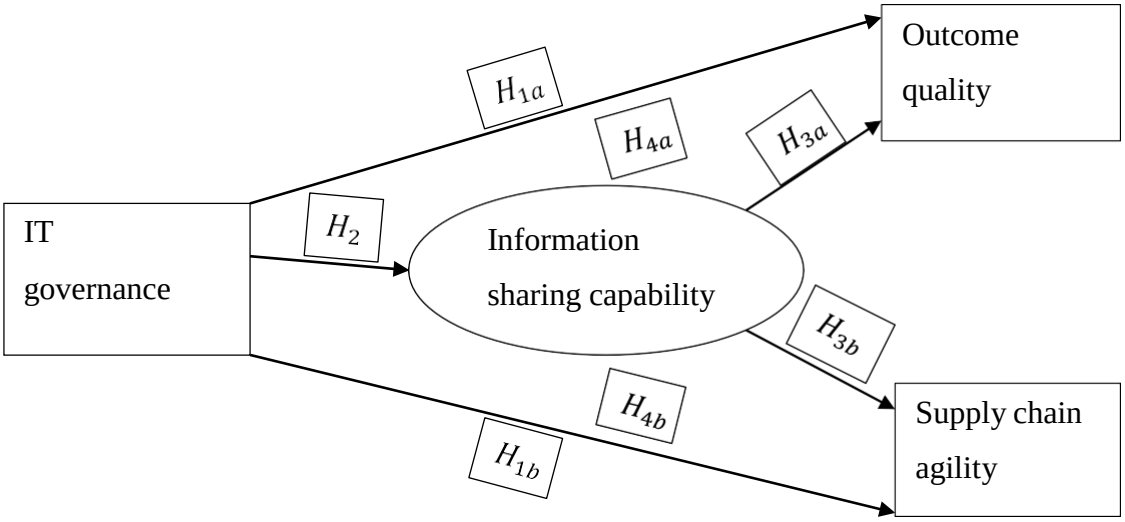

Figure 3.1 Proposed Analytical Framework

Therefore, our study suggests the framework shown in Figure 3.1 to address the aforementioned research gap by testing the seven hypotheses. The aim is to examine the impact of IT governance and information-sharing capability on healthcare's outcome quality (H1a and H3a) and supply chain agility (H1b and H3b). In addition, we consider the mediating role of information sharing

capability between IT governance (H4a) and outcome quality and IT governance and supply chain agility (H4b). Lastly, we examine the relationship between IT governance and information-sharing capability (H2). The framework and findings will provide insights into a healthcare system regarding the importance of IT governance and information-sharing capabilities and how hospital managers and policymakers can leverage them to enhance the outcome quality and supply chain agility.

The existing literature, nonetheless, provides an in-depth understanding of the constructs measured in this study. Furthermore, it also helps build an understanding on how to fulfil the objectives of the research, in the form existing scales of the construct variables, and the statistical tools used to analyze the models. Researchers have used various statistical frameworks and models to examine the roles of these variables in different contexts. The next section of this study provides an in-depth understanding of the statistical model used, specifically in context of hospitals.

Chapter 4 METHODOLOGY

The aim of this research design is to form a link between the hypothesis developed and the complete methods used for collection of data, reviewing of data and its understanding. The research design allows the researcher to specify the research decisions according to the nature and scope of the subject matter. The structure of our research is developed to gain answers to our research questions. Moreover, it allows us to develop, alter, and govern the complete research.

4.1 Research Design and Philosophy

The structure of the research questions, the several topics being studied, the level of behavioral control required, and the researcher's philosophical perspective are all to be considered when choosing an appropriate research methodology. The positivist research philosophy, often known as realism, is used in this work. This school of thought adheres to objectivism, which contends that there is only one reality or one truth. The quantitative design strategy is used in this work in accordance with the philosophy. This method offers advantages to the researchers in terms of the objectivity and correctness of the findings, the simplicity of the research process, and the study's affordability. It is because objectivism maintains that reality is reality regardless of the perception of anyone, including the investigator (Diesing, 1966). Inferential procedures are used to analyze the hypotheses.

4.1.1 Level of Reasoning

There are two levels of reasoning: inductive and deductive. The former refers to the logic from specific to general, while the latter inclines toward general to clear conclusions (Park et al., 2020). There is a consistency in that inductive reasoning leads to new propositions and research hypotheses; however, deductive reasoning is applied to test, refine, extend, or measure the research hypothesis. Given this research design's priorities, the study was framed under deductive reasoning. Especially deductive reasoning is deeply embedded into the philosophy of objectivism; both go side by side. As the top-down approach, this study surveyed a large population to collect the observations required to draw a valid conclusion and generalize the reasoning.

4.1.2 Research Strategy

There are several strategies for undertaking a research study, including survey, experimental, action research, case study, ethnography, and grounded theory. This was a survey research strategy to collect data from the larger population on a subject area. The information is collected from the sampled individuals according to the subject requirements and considerations. Online platforms like LinkedIn and Outlook were adopted for most responses while on-site visits were also conducted in some cases.

4.1.3 Time Horizon

In the time horizons, two research techniques are available for a researcher's choice. One is cross-sectional, and the other is longitudinal research. The cross-sectional study only collects data from the respondents at one point. In contrast, longitudinal research is the name of repeated data collection from the respondents at different time intervals in a study (Moorman et al., 2008). This study was based on single-time data collection.

4.1.4 Sampling Design

The population of the study is employees of hospitals in Pakistan. The sampling unit is individuals i.e., supply chain professionals working in hospitals (Alzoubi et al., 2022; Chen et al., 2013). The non-probability sampling approach is used in the investigation since a sample frame is not available. Non-probability samples refer to those in which the probability of a subject becoming part of the sample is unknown, leading to selection bias, however, there are several ways to control the bias. Among the types of non-probability sampling methods, this study adopts a purposive sampling approach. Purposive sampling, also called subjective, judgmental, or selective sampling, is a technique in which the sample selection is based on the researcher's judgement. Certain criteria are set by researchers based on which it is determined which units are to be selected for the sample. Among the diverse types of purposive sampling, this study adopts the homogenous sampling method. This technique enables the researcher to select units based on similar characteristics that are of particular interest in the study (Rai & Thapa, 2015).

The selection criteria used in this study to select hospitals is that it must have a supply chain information sharing system implemented which provides the basis of information sharing and IT

governance. The second characteristic is that the hospital must have at least one hundred beds, referred to as medium-sized hospitals. This provides an understanding that the supply chain operations being executed are of considerable level. One of the major benefits of purposive sampling is that it provides the researcher with appropriate justification to make logical, analytical, or theoretical generalizations from the selected sample (Rai & Thapa, 2015). Several authors have applied inferential analysis techniques like Process macro and Structural Equational Modeling, on purposive samples (Mashele & Chuchu, 2018; Mubarak et al., 2021). Furthermore, the sample size for this study, n=185, is drawn based on sampling recommendation by researchers who have conducted studies of the same context (Alzoubi et al., 2022; Chen et al., 2013).

To ensure an adequate sample size for a study, it is recommended to have a minimum of five times as many observations as the number of variables to be analyzed. However, it is considered more favorable to have a sample size with a ratio of 10 observations per variable. This guideline ensures a more robust and reliable analysis by providing sufficient data points for each variable being studied (Hair et al., 2010). (Burmeister & Aitken, 2012) proposed an alternative approach for determining sample size in multiple regression. According to their method, the sample size (N) should be greater than 50 plus 8 times the number of predictors (p), $N > 50 + 8p$. (Sekaran & Bougie, 2016) propose the following rules of thumb for determining sample size:

1) Sample sizes larger than 30 and less than 500 are appropriate for most research.
2) Where samples are to be broken into sub-samples (male/females, juniors/seniors, etc.), a minimum sample size of 30 for each category is necessary.
3) In multivariate research (including multiple regression analyses), the sample size should be several times (preferably 10 times or more) as large as the number of variables in the study.
4) For simple experimental research with tight experimental controls (matched pairs, etc.), successful research is possible with samples as small as 10 to 20 in size.

4.1.5 Data Collection

An empirical respondent-filled questionnaire survey that includes items to assess the research variables is used to gather the data (See Appendix). The items are constructed on 5-point Likert scales, where 1 = strongly disagree and 5 = strongly agree. The common goals of a questionnaire

survey are the collection of data from a representative sample of the target population, so the findings can be generalized within random error limits (Singh, Ajay & Masuku, 2014). The questionnaire survey method is an inexpensive data collection method, which offer fast results. Moreover, it offers scalability as information can be gathered from a large audience. As this is a quantitative study, questionnaire is an appropriate and viable data collection instrument since the data can be easily quantified and analysed. To further grasp the idea behind the study, a pilot study that included interviews and surveys was done. After reviewing the pilot study's findings, improvements were made to the questionnaire's items so that respondents would have a better comprehension of them when they filled out the form. A total of 404 online questionnaires were sent to supply chain professionals in hospitals (Alzoubi et al., 2022), out of which 193 responses were attained, yielding a response rate of 48% (Swafford et al., 2006). Out of those 193 responses, 185 responses were usable for further analysis. The supply chain professionals are suitable to provide responses in the questionnaire based on the nature of our study, as authors previously have also conducted research on supply chains and customer satisfaction by collecting data from similar professionals and not from customers (Asha et al., 2023; Omoruyi & Mafini, 2016; Yu et al., 2013).

4.2 Mediation Analysis

Mediation refers to the addition of a third variable M in the relationship between two variables X and Y (MacKinnon et al., 2007). This represents an indirect relationship between X and Y, through the mediation of M, i.e., X causes M and M causes Y. This implies that variable X has an indirect influence on variable Y (Van Kollenburg & Croon, 2022). So, the relationship between X and Y exists if the effect of M is significant. Any causal system where at least one causal antecedent X variable is postulated to influence an outcome Y through a single intervening variable M is considered to have a simple mediation model. Two pathways exist in this model for how X can affect Y. Finding these routes involves following the routes that one can take to travel from X to Y. It is to be noted that in these relationships, X must cause M and in turn M causes Y, else the effect of X carried to Y through will not be considered significant (Preacher & Hayes, 2008). It is vital to keep in mind that mediation is a causal explanation when determining whether a theory or notion you are examining could be conceptualised as a mediation process. It is presumable that the

connections within the system are causal, and that M is situated causally between X and Y. If not proven empirically, it must be inferred that X causes M, which therefore causes Y. If M is not situated causally between X and Y, then M cannot potentially carry the influence of X on Y (Hayes, 2017).

Mediation analysis emphasizes on ‘how’ an effect function. A significant feature of this model is that it allows a direct effect, an indirect effect (most common), or both to depend on one or more mediators (Hayes, 2017). When examining a causal process through an experiment that includes a mediation component, the estimation, interpretation, and inferential testing of the direct and indirect effects are particularly crucial. In modern mediation research, the constituent parts of the indirect effect—which include the effects of X on M and M on Y—must be estimated to derive these effects. Numerous scholars also typically determine the total impact of X on Y (Preacher & Hayes, 2008). This phenomenon is also referred to as simple mediation model (Hayes, 2017). In this study, the mediator M, which is ISC, is hypothesised to mediate the relationships between the dependent variables SCA & OQ and the independent variable ITG. The Hayes PROCESS macro is used to carry out the analysis in SPSS. It is a well-established tool and is widely used in literature to analyse mediation models (Mensah, 2021). The analysis is conducted by applying Hayes Process model number 4.

The statistical model of Hayes process macro model number 4 is presented in Figure **4.1**

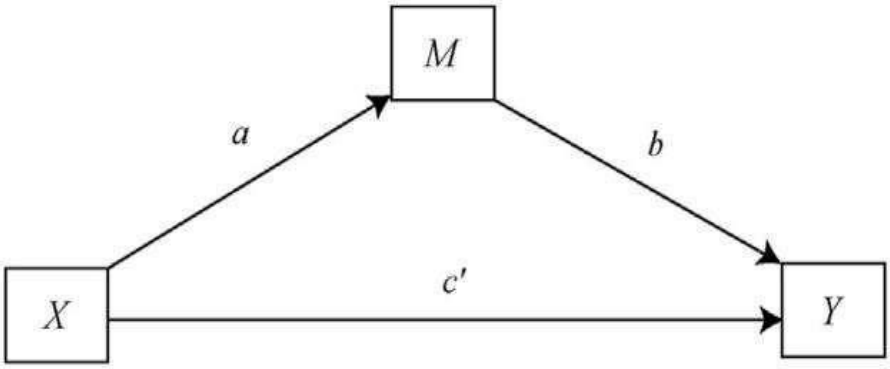

Figure 4.1 Statistical framework

In this model, the coefficients for X in a model that predicts M from X are 'a', 'b', and 'c′,' respectively, and the coefficients for Y in a model that predicts Y from M and X are 'c' and 'd′,'

respectively. The product of "a" and "b" quantifies the indirect impact of X on Y through M, whereas "c‴" quantifies the direct effect of X in the language of path analysis.

Direct effect of X on Y = $\acute{c}$

The parameters of the direct effect of X on Y can be typically estimated with *Equation 1*.

$$Y = \alpha_y + cX \qquad \textit{Equation 1}$$

Where α_y is the intercept and c is the slope of the direct effect.

The effect of X on M is represented by *Equation 2*.

$$Y = \alpha_M + aX \qquad \textit{Equation 2}$$

The effect of M on Y is represented in *Equation 3.*

$$Y = \alpha_y + bM \qquad \textit{Equation 3}$$

The mediation effect is represented in *Equation 4*

$$\hat{Y} = \alpha_y + c'X + bM \qquad \textit{Equation 4}$$

Research studies have provided evidence that authors are sometimes interested in determining the direct, indirect, and total effect of some causal antecedent on multiple dependent variables (Broeren et al., 2011; Webster & Saucier, 2013). A close examination of this model shows that it is just a simple mediation model with a common X and M variable. The direct, indirect and total effect on multiple Y variables in such a case can be determined using PROCESS macro models by substituting one Y variable for another Y variable at each run respectively and seeding the random number generator with a common seed for bootstrap sampling at each run i.e. if bootstrap intervals were set to 5000 for first Y variable, then bootstrap intervals are to be set at 5000 for the second Y variable (Hayes, 2013).

4.3 Preliminary Data Analysis

4.3.1 Reliability

Reliability refers to the measurement instrument's consistency level. It can be measured objectively using Cronbach's alpha, the most widely accepted empirical measure of reliability. The acceptable range of alpha values has been reported to be 0.70 to 0.95 (Bland & Altman, 1997).

4.3.2 Assumptions of Regression Analysis

(Hayes, 2017) illustrate the following assumptions of ordinary least squares regression analysis.

i) The first assumption is normality. Normality refers to a statistical distribution called normal distribution or Gaussian distribution. The phenomenon relates to the shape of the independent variable and the predictor variables' distribution. We evaluate the normality of data using Skewness and Kurtosis test (Hopkins & Weeks, 1990).

ii) An important assumption in regression is the linearity of variables. This assumes a straight-line relationship between two variables. The analysis will yield incorrect predictions if non-linear data is fitted to a linear model. A standard tool to test for linearity in the data set is Pearson's Correlation (Pak & Oh, 2010).

iii) Homoscedasticity, which refers to the occurrence where the standard deviations of a predicted variable that are monitored across multiple values of the predictor variable remain constant, is another crucial tenet of regression. The homoscedasticity assumption is broken by heteroscedasticity. Tests for heteroscedasticity are frequently conducted using scatter plots and the White's test (White, 1980). To address the issue of heteroscedasticity, researchers advise the inclusion of standard errors that are compatible with heteroscedasticity (Hayes & Cai, 2007).

iv) Regression coefficients can occasionally be overestimated or underestimated. The nature and scope of non-independent situations determine this. This causes the autocorrelation issue, which yields false findings. An important presumption in regression is the lack of autocorrelation. The most effective and straightforward method for evaluating first-order autocorrelation is thought to be the Durbin-Watson test. D-W statistics values between 1.5 and 2.5 are regarded as typical (Field, 2013).

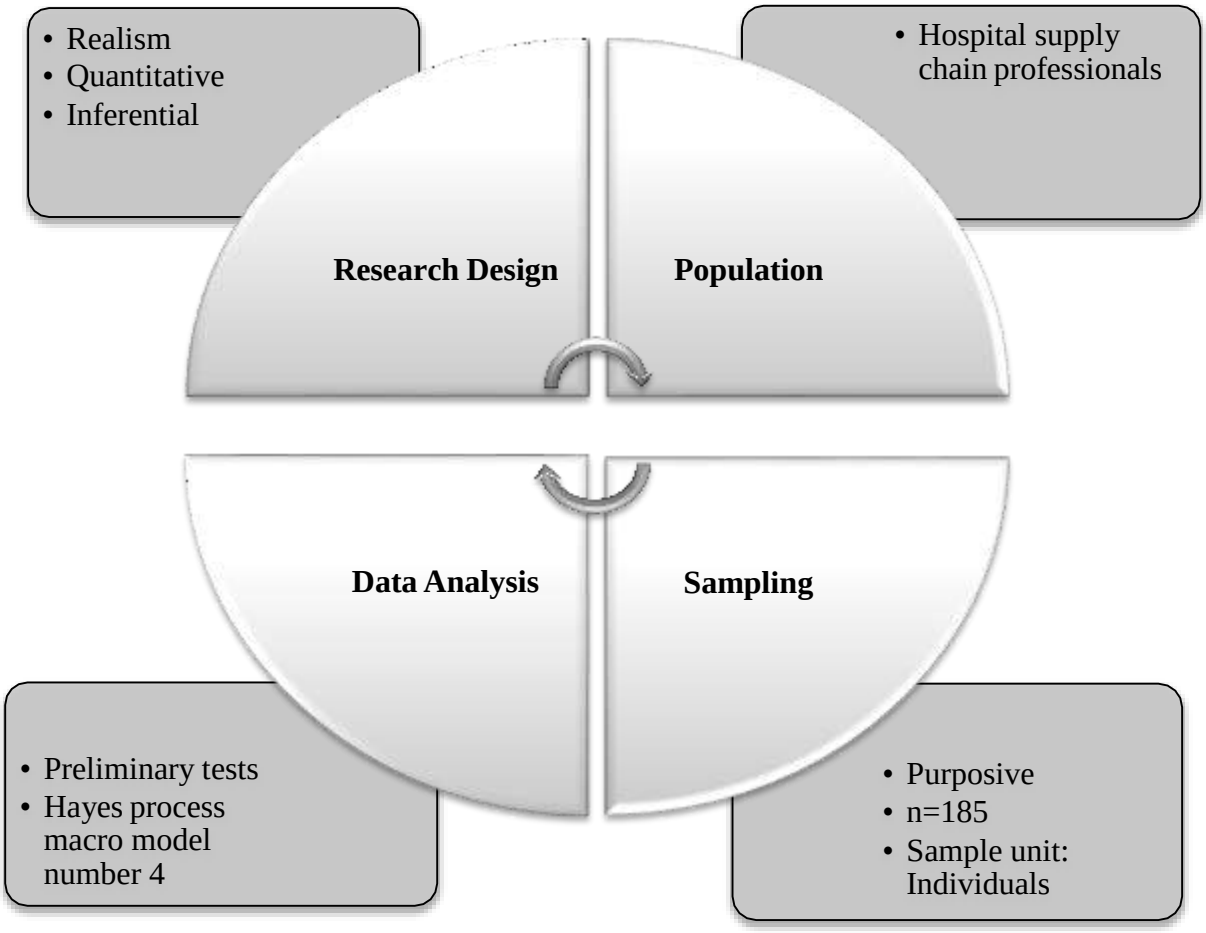

Figure 4.2 Summary diagram of methodology

Chapter 5 RESULTS AND DISCUSSION

This chapter discusses the results of the statistical analysis conducted on SPSS. The section is divided into four sub-sections. The first subsection, 'Data,' discusses the results of the preliminary analysis which include the demographics analysis, missing value analysis and tests of normality, linearity, heteroscedasticity, and autocorrelation. The next subsection delivers an in-depth understanding of the results of the mediation analysis and discusses its implications. The last subsection of the chapter discusses the results of the analysis in detail, with support from literature.

5.1 Data

Eight of the 193 replies obtained through an online survey were disregarded because they failed to fulfil the requirements for sample selection i.e., the number of beds were less than one hundred, so 185 responses were used for further analysis. Responses amounting to 185 were collected from fifty-one hospitals. The maximum number of responses from one hospital were seven and minimum were two. The designations of the respondents are listed in Table 5.1

Table 5.1 Designation of respondents

Designation	Count	Designation	Count
Assistant Director Supply Chain	1	Manager Supply Chain	12
Assistant Manager Procurement	11	Procurement Executive	26
Assistant Manager Supply Chain	8	Procurement Manager	16
Assistant Manager Warehouse	3	Procurement Officer	42
Deputy Manager Procurement	7	Supply Chain Executive	21
Deputy Manager Supply Chain	4	Supply Chain Officer	21
Director Supply Chain	4	Warehouse Executive	9

Total Responses	**185**

Figure **5.1** illustrates that 26% individuals have overall work experience between (1 – 5 years), 37% individuals have between (6 – 10 years) and likewise 37% individuals have work experience of above 10 years.

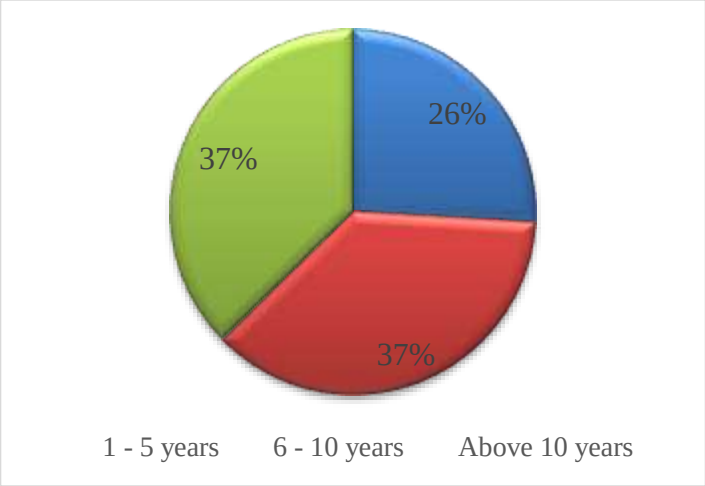

Figure 5.1 Professional experience of respondents

Table 5.2 illustrates the breakdown and characteristics of the hospitals under study from different provinces of Pakistan.

Table 5.2 Hospital Characteristics

Province breakdown	
Baluchistan	1
Federal	8
KPK (Khyber Pakhtunkhwa)	8
Punjab	23
Sindh	11
Hospital Characteristics	
Number of beds	**Count of hospitals**
100 - 499	28
500 - 999	17

Above 1000	6

5.1.1 Reliability

The reliability of the scales was assessed using Cronbach's alpha reliability analysis. The acceptable range of alpha values have been reported to be 0.70 to 0.95 (Bland & Altman, 1997). The analysis generated good Cronbach alpha values for each scale, ensuring reliability of the questionnaire. The values for Cronbach's alpha for each variable scale are given in Table 5.3.

Table 5.3 Reliability of scales

Construct	**Cronbach's alpha**
ITG	0.92
ISC	0.79
OQ	0.95
SCA	0.94

5.1.2 Normality

Process macro takes into consideration the normality assumptions, even though there are several tests to determine if the data has a normal distribution. Nonetheless, we assessed the normality of data using Skewness and Kurtosis in SPSS. The acceptable range of values falls between -1 and +1. All variables' Skewness and Kurtosis values are within the normal reference range. The results are presented in Table 5.4.

Table 5.4 Normality of data

Constructs	**Skewness**	**Kurtosis**
ITG	-0.859	-.150
ISC	-0.356	-.566
OQ	-0.672	-.211
SCA	-0.817	.065

5.1.3 Linearity

Linearity of the variables is assessed with Pearson's correlation. The analysis's findings demonstrate that, with a 95% confidence interval of p 0.05, the Pearson Correlation for all variables is statistically significant. Consequently, the linearity assumption is upheld (See Table 5.5).

Table 5.5 Pearson's correlation

Correlations					
		ITG	ISC	OQ	SCA
ITG	Pearson Correlation	1	.710**	.765**	.790**
	Sig. (2-tailed)		.000	.000	.000
ISC	Pearson Correlation	.710**	1	.634**	.726**
	Sig. (2-tailed)	.000		.000	.000
OQ	Pearson Correlation	.765**	.634**	1	.820**
	Sig. (2-tailed)	.000	.000		.000
SCA	Pearson Correlation	.790**	.726**	.820**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	185	185	185	185
**. Correlation is significant at the 0.05 level (2-tailed).					

5.1.4 Heteroscedasticity

Although there are multiple approaches to the measurement of homoscedasticity or heteroscedasticity in literature, to lessen the impact of heteroscedasticity on the inference, Hayes recommends using a Heteroscedasticity-Consistent Standard Error Estimator (Hayes & Cai, 2007). However, this does not negate the requirement for a reliable heteroscedasticity measuring test. Therefore, we first tested heteroscedasticity using White test (White, 1980). The results are depicted in Table 5.6.

Table 5.6 Heteroscedasticity analysis

Independent variable	Dependent variable	Chi-Square	df	Sig.
ITG	ISC	0.312	2	.085

ITG	OQ	3.706	2	.157
ITG	SCA	2.457	2	.293
ISC	OQ	2.570	2	.277
ISC	SCA	8.046	2	.018

A different method for estimating standard error is employed to get around the heteroscedasticity issue, and it does not make use of the homoscedasticity assumption (Hayes & Cai, 2007). A very alluring strategy for minimising the impact of heteroscedasticity on inference is the deployment of a heteroscedasticity-consistent standard error (HCSE) (White, 1980). The functional form in which heteroscedasticity exists in the model is not necessary for this method. It doesn't need sophisticated computer simulations or transformation techniques (Hayes & Cai, 2007). Four distinct HSCE kinds have been created by researchers. The chosen estimator, the HC4, is used in this model (Cribari-Neto, 2004).

5.1.5 Autocorrelation

The results of the Durbin-Watson test for the relationships reveal that the D-W statistic values lie between 1.5 and 2.5, indicating the absence of autocorrelation (See Table 5.7).

Table 5.7 Autocorrelation Analysis

Independent variable	Dependent variable	R	Durbin-Watson
ITG	ISC	.710	1.802
ITG	OQ	.765	1.737
ITG	SCA	.790	1.886
ISC	OQ	.634	1.571
ISC	SCA	.726	2.029

The results of the preliminary analysis reveal that the assumptions of linearity, normality and autocorrelation are not violated. To deal with heteroscedasticity, PROCESS employs heteroscedasticity-consistent standard errors. Therefore, we proceed with the descriptive analysis and the OLS regression analysis.

5.1.6 Descriptive Statistics

The results of the descriptive analysis reveal that the respondents have rated ITG, OQ and SCA on the higher level with means equal to 4.01, 3.93 and 3.94, respectively. ISC has been rated on the lower level with a mean of 3.56 (See Table 5.8)

Table 5.8 Descriptive Statistics

Descriptive Statistics				
Variables	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
ITG	1.33	5.00	4.01	0.87
ISC	1.40	5.00	3.76	0.76
OQ	1.53	5.00	3.93	0.77
SCA	1.50	5.00	3.94	0.79
Valid N	185	185	185	185

5.2 Public and Private Hospitals

The results of the comparison between public and private hospitals of Pakistan are displayed in Table 5.9. The Welch test is used to analyze the difference between two groups based on the assumptions of unequal number of samples and heterogeneity of variances between two groups (Ruxton, 2006). The t-statistics value and P-values indicate that the two groups are significantly different from each other for the variables under study.

Table 5.9 Comparison of public and private hospitals

Constructs	t-statistics	P-values	Public hospitals	Private hospitals
ITG	19.671	0.000	3.60	4.24
ISC	16.229	0.000	3.42	3.95
OQ	26.626	0.000	3.53	4.14

SCA	21.790	0.000	3.55	4.13

The mean values are based on data for the constructs from 64 supply chain professionals working in government hospitals and 121 supply chain professionals working in private hospitals, from different cities of Pakistan. Based on the data collected of different constructs, we can identify that private hospitals have higher mean scores for Information technology governance, information sharing capability, outcome quality and supply chain agility. In government hospitals, the governance of information technology is lower compared to the private hospitals in the country, which results in low level of information sharing between supply chain members in government hospitals as compared to private hospitals. As a result, we can see that outcome quality and supply chain agility are rated lower in government hospitals as compared to private hospitals.

5.2.1 IT Governance in Private and Public Hospitals

When it comes to IT governance, private and public hospitals in Pakistan present distinctly different outcomes. One can see a more effective IT governance architecture in private hospitals. Their activities are supported by innovative technologies and a modernized infrastructure that allows for effective patient care, accurate record-keeping, and expedited processes. This well-implemented IT integration reflects visionary leadership that recognizes the significance of technology in the delivery of healthcare services. In these hospitals, IT governance is more than simply embracing technology; it is about strategically integrating it into every facet of hospital administration. The delivery of healthcare services has been dramatically expedited by this seamless integration of technology, improving patient experience.

On the other hand, public hospitals fall behind in putting in place a strong IT governance structure. Budgetary constraints, bureaucratic red tape, and a lack of knowledge about the advantages of digitalization are just a few of the problems. This frequently leads to less effective processes, record systems that rely heavily on paper, and a more significant workload for healthcare personnel. To close this gap, it will need a concentrated effort to focus on resource allocation, policy reforms, and a culture shift toward embracing digital transformation. Public hospitals can significantly improve their operational efficiency and the standard of patient care by making a

deliberate effort to digitize their operations and by laying a strong emphasis on IT management and governance.

5.2.2 Information Sharing Capability in Private and Public Hospitals

Supply chain information sharing in private hospitals in Pakistan has seen significant strides in recent years, specifically post COVID-19 era as hospitals embarked on a journey of creating a robust network of transparency and efficiency. Private hospitals leverage advanced IT systems for real-time tracking of medical supplies, maintaining optimal inventory levels, and streamlining the procurement process. The ripple effects of this digital transformation are affecting all facets of supply chain operations, and not just logistics. This open communication between suppliers, hospital management, and healthcare professionals ensures that resources are readily available, reducing delays and enhancing patient care.

In contrast, public hospitals face challenges in achieving this level of supply chain transparency. The reasons span from budget constraints to bureaucratic hurdles, limiting their ability to invest in sophisticated IT systems. As a result, supply chain processes in public hospitals often rely on manual documentation and face the risk of errors, delays, stock outs, over stocking, inefficiencies, and reduced patient care. Efforts are necessary to overcome these barriers and foster an environment where information sharing is valued as a crucial step towards improved healthcare services. Public sector hospitals must quickly embrace digital transformation if they are to reap the rewards of increased supply chain information sharing and better patient outcomes.

5.2.3 Outcome Quality in Private and Public Hospitals

Prominent levels of satisfaction are typically associated with private hospitals in Pakistan. Modern technology and well-designed services are increased in these facilities, which place a high priority on patient-centered care. In addition to other factors, effective appointment systems, lower wait times, and timely care increase patient satisfaction. The hospital staff's friendliness and responsiveness, together with their training to handle a wide range of situations, further enhance the patient's experience. Additionally, patients are more satisfied in private hospitals because of the pristine surroundings. Modern medical technology investments promote the high caliber of healthcare services.

In contrast, there are several issues in Pakistan's public hospitals that have an impact on patient satisfaction and service quality. Underfunding and constant overpopulation lead to lengthy wait times and rushed appointments. Despite their best efforts, medical staff regularly must manage high patient demands, which can increase stress levels and compromise patient care. Due to the challenging scheduling process, patients may have long waits for diagnostic procedures. These problems are made worse by a lack of access to the most advanced medical technologies, which may limit the effectiveness of the therapy provided. Public hospitals are still essential, serving as lifelines for people who cannot afford to pay for private healthcare.

5.2.4 Supply Chain Agility in Private and Public Hospitals

Private hospitals in Pakistan provide a representation of how supply chain agility can improve healthcare services. These hospitals' advanced inventory management systems and effective procurement processes enable them to react quickly to changes in demand. They react quickly to changes in the number of patients, making sure that basic supplies are constantly available. This agility includes rapid changes to medical technology and equipment in addition to the acquisition of medications and consumables. Private hospitals frequently have solid working relationships with a variety of vendors, ensuring they can find replacements quickly when needed. Due to the substantial reduction in supply chain delays caused by this agile strategy, patient care quality has increased while efficiency has increased.

In contrast, Pakistan's public hospitals frequently suffer with supply chain agility. Their capacity to adjust to rapid changes in demand is frequently constrained by bureaucratic red tape and financial restrictions. Traditional, manual inventory management techniques may cause waste and may jeopardize patient care by causing overstocks and stock outs. When faced with shortages, having few supplier contacts can limit their capacity to find alternate suppliers. These difficulties highlight the requirement for extensive supply chain management improvements in public hospitals. Public hospitals may increase the agility of their supply chains, enhancing operational effectiveness and patient care, by adopting digital transformation and fortifying their supplier networks.

5.2.5 Use of IT Tools for Improving the Hospital Ecosystem

Hospitals may improve patient care and optimize their operations by using IT governance solutions. Service delivery can be improved by implementing technologies like Electronic Health Record (EHR) systems, telemedicine, and data analytics. With robust IT governance structures and the most recent technologies, private hospitals frequently set the standard in this area. On the other hand, public hospitals frequently fall behind due to administrative red tape and budgetary restrictions. Adopting comparable equipment and procedures, however, can benefit them and assist in increasing productivity, decrease errors, and improving patient care.

Tools that enable supply chain information sharing are essential in the age of digital transformation. Hospitals may benefit from having a full perspective of their operations, including supply chain management, thanks to enterprise resource planning (ERP) systems like SAP, MS Dynamics 365 as well as Warehouse Management Systems and Transportation Management Systems. Some advantages of these systems include effective inventory management and real-time tracking of medical supplies. Private hospitals frequently excel at exchanging information about the supply chain due to their sophisticated IT infrastructure. In contrast, public hospitals may suffer with limited funding and inadequate technological expertise. They may, however, overcome many of their supply chain issues by incorporating such systems.

5.3 Mediation Analysis

To calculate the effects of mediation, we used the PROCESS macro syntax in SPSS using Hayes PROCESS model number 4. To eliminate bias in the obtained confidence intervals, or CI = 95%, the statistical significance of the direct and indirect effect was examined using 10,000 bootstrap samples and heteroscedasticity-consistent SEs in the form of HC4. On the items for each construct, mean composite scores were also used. The OQ and SCA were input as dependent variables at each run, with ITG set as the independent variable and ISC as the mediator.

Table 5.10 Direct effects of independent variables on dependent variables

Direct Relationships	Unstandardized Coefficients	P-values	t-statistics
ITG → OQ	0.561	0.000	6.837

ITG → SCA	0.502	0.000	6.805
ITG → ISC	0.619	0.000	13.486
ISC → OQ	0.182	0.017	2.401
ISC → SCA	0.348	0.000	4.800

Table 5.10 illustrates the direct effects. The results provide evidence for a significant direct effect of ITG on OQ (Effect = 0.561, $p < 0.05$). This reveals that with the governance of information technology, the outcome quality of the hospitals will improve, thereby accepting H_1. The results provide evidence for a significant direct effect of ITG on SCA (Effect = 0.502, $p < 0.05$). This reveals that with the governance of information technology, supply chains become agile, thereby accepting H_2. The model summary for ISC as the resultant variable revealed a P-value < 0.05 and $R^2 = 0.504$. The governance of information technology improved the information sharing capability among supply chain entities (Effect = 0.61, $p < 0.05$), thereby providing support for H_3. The model summary for OQ as the resultant variable revealed a P-value < 0.05 and $R^2 = 0.601$. Information sharing capability among supply chain members improves the outcome quality of the hospital (Effect = 0.182, $p < 0.05$), thereby providing support for H_4. The model summary for SCA as the resultant variable revealed a P-value < 0.05 and $R^2 = 0.678$. Information sharing capability among supply chain members helps improve supply chain agility (Effect = 0.348, $p < 0.05$), thereby providing support for H_5.

Table 5.11 Indirect effects of independent variables on dependent variables

Indirect Relationships	Indirect Effect	LLCI	ULCI
ITG → ISC → OQ	0.129	0.056	0.211
ITG → ISC → SCA	0.215	0.127	0.304

Table 5.11 illustrates the indirect effects. The results provide evidence for a significant indirect effect of ITG on OQ (Effect = 0.129, $p < 0.05$). This reveals that with the governance of information technology, the outcome quality of the hospitals will improve through information

sharing capability of supply chain entities. Although the indirect effect is weak, the results suggest that the ISC significantly mediates the relationship between ITG and OQ. The results provide evidence for a significant indirect effect of ITG on SCA (Effect = 0.215, $p < 0.05$). This reveals that with the governance of information technology, supply chains become agile through information sharing capability between supply chain members. Although the indirect effect is weak, the results suggest that the ISC significantly mediates the relationship between ITG and SCA.

Table 5.12 Total effect of independent variables on dependent variables

Independent variable	Dependent variable	Total Effect	P-value	t-statistic
ITG	OQ	0.676	< 0.05	12.841
ITG	SCA	0.718	< 0.05	14.64

Table 5.12 represents the total effects. The total effect of ITG on OQ is the sum of direct and indirect effects. This represents the overall impact of ITG on OQ (Effect = 0.676, $p < 0.05$). The total effect of ITG on SCA is the sum of direct and indirect effects. This represents the overall impact of ITG on SCA (Effect = 0.718, $p < 0.05$).

5.4 Discussion

The results of this study reveal that if information technology is governed in hospitals, the outcome quality will improve. These findings are consistent with those in the literature (Nash et al., 2010; Zabada et al., 2001). Although these authors have focused on the aspects of information technology and how it helps to improve patient satisfaction, our study focuses on the salient aspect of information technology governance in improving the outcome quality of hospitals. Also, the results show that if information technology is governed in hospitals, the supply chains will become agile. These findings are consistent with those in the literature (Swafford et al., 2008). The study's author studied how IT integration and flexibility help achieve agility. Our study focuses on the salient aspects of IT governance in achieving supply chain agility.

The results of this study also reveal that IT that is governed tends to improve information-sharing capability among supply chain members of the hospital. Moreover, collaboration among parties

and coordinated processes in an organization are byproducts of information sharing. These findings are consistent with those in the literature (Ye & Wang, 2013). The authors of this study had focused on aligning IT functions and collaborative governance to help improve information sharing those results in better supply chain performance. Our study focuses on the salient aspect of information technology governance in improving information-sharing capability among SC members.

The results of this study also reveal that information-sharing capability helps improve outcome quality. The reason for this, as evidenced in the literature, is that the effectiveness of the service delivery process that results in patient satisfaction, is highly dependent on the real-time exchange of information and readily available data for making informed decisions (De Rosis & Barsanti, 2016; Liu et al., 2013). However, these studies were about increased patient satisfaction through recording and maintaining electronic health records and how the exchange of information between doctors and patients helps improve patient satisfaction. Our study focuses on how real-time supply chain information exchange can help improve outcome quality. Another study suggested that good service quality requires coordination among business units that results in improved outcomes for the business. (Lavikka et al., 2009).

The results of this study also reveal that information-sharing capability among the members of SC helps the hospitals in achieving supply chain agility. The reason for this, as evidenced in the literature, is that information sharing allows organizations to develop knowledge and understanding of the market they are operating in real-time. Frequent information sharing within the supply chain translates into adjusting for changes in supply side, making quick decisions, and responding to market changes swiftly. These findings are consistent with the literature (Alzoubi & Yanamandra, 2020). Although these authors have studied this relationship in medium-sized manufacturing firms, our study focuses on this relationship in hospitals.

Lastly, the mediation model is significant, which illustrates the significance of the impact of information technology governance on outcome quality and supply chain agility through the mediating effect of information sharing capability. The acceptance and rejection of the hypotheses, based on the findings of the study, is mentioned in

Table ***5.13***.

Table 5.13 Hypothesis findings

Hypotheses	**Conclusion**
H_1	Accepted
H_2	Accepted
H_3	Accepted
H_4	Accepted
H_5	Accepted
H_6	Accepted
H_7	Accepted

The analysis of the study provides evidence to accept H_1, which demonstrates the positive impact of information technology governance on outcome quality. We also accept H_2, which illustrates the positive effect of information technology governance on supply chain agility. Further, we accept H_3, which illustrates the positive relationship between information technology governance and information sharing capability. Additionally, we also accept H_4 and H_5, which illustrate the positive impact of information sharing capability on outcome quality and supply chain agility, respectively. The results also lead to the acceptance of H_6 and H_7 which demonstrate the mediation effect of information sharing capability on the relationship between information technology governance and outcome quality and the relationship between information technology governance and supply chain agility, respectively.

Chapter 6 CONCLUSION

ITG is the most essential element required for hospitals to operate and the significance it holds in increased patient satisfaction, increased patient loyalty and reduced patient wait times is astronomical. It can help improve communication and coordination between various stakeholders for e.g., implementation of electronic health portal which can guarantee ease for patients to schedule appointments, communicate with health service providers at various stages and reduce overall process time and hurdles. It can help automate administrative tasks that can help spare more time for the staff to provide patient care. ITG can help hospitals engage better with the patients by providing them educational materials, health trackers and personalized treatment plans. It can also help leverage analytics by collecting and analysing data on wait times, satisfaction scores to identify areas of improvement and make data driven decisions. Additionally, ITG holds great significance in enabling real time information sharing among supply chain members that helps improve outcome quality of the hospitals. Hospitals require to have real time information of the location and availability of goods and medicines so they are provided to the patients in a timely manner which will result in their satisfaction. When information is shared in a SC, it helps streamline operations and reduce delays in the provision of health services to the patients. It will help hospitals keep track of the availability of supplies, accurate inventory management, efficient transportation, reduced lead & transit times, improved product quality that meets lofty standards and reduces risk of complications, and reduced costs which will be translated into less financial burden onto the patients. In addition, hospitals can also be able to identify the usage of medication by identifying trends over a period, to develop effective medication and treatment plans for patients. Collaboration between various SC participants, such as suppliers, distributors, and internal departments, can be facilitated through ITG. Hospitals may be able to adapt to changes in demand more rapidly and effectively because of better communication and cooperation. Hospitals can automate important SC procedures including ordering, inventory control, and order fulfilment with the use of ITG. By doing so, the time and resources needed to manage the supply chain can be decreased. Hospitals may enhance their data management skills, including data analysis and reporting, with the aid of IT governance and information sharing.

ITG and information sharing among SC entities is also extremely important in hospitals as these can help in improved visibility throughout the SC by integrating tools and technologies that enable for real-time tracking and monitoring of inventory levels, demand, and supply. This can increase hospitals' overall supply chain agility. Hospitals may be able to improve their supply chain agility by using this information to obtain insights into their operations and pinpoint areas for development. Hospitals can manage supply chain risks, such as delays, shortages, or quality problems, more effectively by implementing IT governance. Overall, supply chain agility can assist hospitals in lowering transportation and procurement costs by streamlining procurement procedures, enhancing resource allocation, obtaining better transportation rates with carriers, limiting disruptions, and optimising delivery routes. Hospitals may proactively spot cost-saving possibilities and maximise the efficiency of their supply chain operations by using real-time data and automating processes.

6.1 Contribution of the Study

This study addressed the importance of hospital IT governance and supply chain information sharing. It proposed an analytical framework that addressed the direct relationship between information technology governance (ITG) and outcome quality (OQ) and their indirect relationship through the mediation of information sharing capability (ISC). The framework also addressed the direct relationship between information technology governance (ITG) and supply chain agility (SCA) and their indirect relationship through the mediation of information sharing capability (ISC). Data were collected from supply chain professionals via survey and analyzed using the Hayes mediation technique. The results revealed significantly positive direct relationships between ITG and OQ, ITG and SCA, ITG and ISC, ISC and OQ, and ISC and SCA. Lastly, the mediation model was found to be significant, which illustrates the impact of ITG on OQ and SCA through the mediating effects of ISC.

6.2 Managerial Implications

Managers and policymakers at hospitals can utilize the findings of this study to strengthen the IT governance and information-sharing capabilities of healthcare as they impact the patient satisfaction, loyalty, waiting time, agility, and flexibility of a healthcare supply chain, safeguard

the healthcare from vulnerabilities and aligns the practices in accordance with the Sustainable Development Goals (SDGs). In the following subsections, we discuss the prospects of IT governance for a healthcare system by outlining the patient-related benefits, supply chain-related benefits and information-sharing-related benefits. In addition, we underscore the importance of IT governance for achieving SDGs and working in an uncertain environment such as the COVID-19 pandemic.

6.2.1 Prospects of IT Governance for a Healthcare System

The road to IT-governed healthcare is extended; however, several small steps in the right direction can help conceive a well-governed IT system. Figure 6.1 summarizes the tasks required to enable an IT Governance system in healthcare and its associated prospects. Managers need to conduct feasibility studies for investments in IT infrastructure to evaluate the strategic benefit that would be gained from such investments in the long term. For effective use of technological tools and to utilize their maximum potential, hospital personnel should be regularly trained by conducting periodic training programs and providing other training materials for assistance. Managers need to keep track of KPIs and monitor patient satisfaction levels (by collecting and analysing data, real-time information exchange and visibility in the supply chain) to pinpoint areas for improvement. This could entail interviewing patients or holding focus group discussions to get opinions on the standard of treatment provided and identifying areas that could be improved. Given the strong relation to IT infrastructure and information sharing, managers must prioritize achieving supply chain agility. To better align supply chain processes with the agility objective, managers must review and redesign the supply chain network by streamlining procurement processes, investing in process coordination, and fostering a data and information-sharing culture. Most importantly, managerial decision-making must be based on factual data from the coordinated processes established using IT tools and procedures by leveraging data analytics to track and examine the effectiveness of the supply chain, patient satisfaction, and other essential metrics. The following sub-sections discuss the patient-related benefits, supply chain-related system and information-sharing-related benefits of a well-governed IT system in healthcare.

6.2.2 Patient-related Benefits

Information Technology Governance (ITG) is the essential element required for hospitals to operate, and its significance in increased patient satisfaction, increased patient loyalty and reduced patient wait time. It can help improve communication and coordination among stakeholders, e.g., the implementation of an electronic health portal, which can guarantee ease for patients to schedule appointments, communicate with health service providers at various stages, and reduce overall process time and hurdles. ITG can help hospitals engage better with patients by providing them with educational materials, health trackers, and personalized treatment plans. In addition, hospitals can also identify medication usage by identifying trends over a period to develop effective medication and treatment plans for patients. Hospitals can automate essential SC procedures, including ordering, inventory control, and order fulfilment, using ITG. By doing so, patients can be provided effective treatment and medication in a timely manner. To summarize, a well-positioned ITG system ensures patient satisfaction, loyalty, improved communication, engagement, and the development of efficient patient treatment plans.

6.2.3 Supply Chain-related Benefits

Hospital management must recognize the importance of implementing ITG mechanisms. They must invest in internal and external process coordination (i.e., Transportation Management Systems, Warehouse Management Systems, and ERPs (Enterprise Resource Planning)) for effective information sharing between supply chain entities. ITG and information sharing among SC entities are extremely important in hospitals as these can help improve visibility throughout the SC by integrating tools and technologies that enable real-time tracking and monitoring of inventory levels, demand, and supply. Collaboration between various SC participants, such as suppliers, distributors, and internal departments, can be facilitated through ITG.

ITG helps hospitals keep track of the availability of supplies, accurate inventory management, efficient transportation, reduced lead & transit times, improved product quality that meets the required standards, reduced risk of compliance and complications, and reduced costs, which will translate into less financial burden onto the patients. This can increase hospitals' overall supply chain agility. Hospitals may improve their supply chain agility by using this information to obtain insights into their operations and pinpoint areas for development. Hospitals can become more agile

and effectively manage supply chain risks, such as delays, shortages, or quality problems, by implementing ITG. Once agility is embedded in the supply chain, it can assist hospitals in lowering transportation and procurement costs by streamlining procurement procedures, enhancing resource allocation, obtaining better transportation rates with carriers, limiting disruptions, and optimizing delivery routes. Hospitals may proactively spot cost-saving possibilities and maximize the efficiency of their supply chain operations by using real-time data and automating processes.

6.2.4 Information Sharing-related Benefits

Hospitals must have real-time information on the location and availability of goods and medicines, so they are provided to the patients on time, resulting in their satisfaction. ITG holds excellent significance in enabling real-time information sharing among supply chain members that help improve the outcome quality of the hospitals. It can help to automate administrative tasks that can help spare more time for the staff to provide patient care. It can also help leverage analytics by collecting and analysing data on wait times and satisfaction scores to identify areas of improvement and make data-driven decisions. Hospitals may enhance their data management skills through IT governance and information sharing, including data analysis and reporting.

Management must create communication protocols, foster a culture of data sharing, and encourage cooperation throughout the supply chain to ensure patients receive the best possible care and treatment on time. When information is shared in an SC, it helps streamline operations and reduce delays in providing health services to patients. Hospitals can adapt to changes in demand more rapidly and effectively because of better communication and cooperation through a well-governed IT system.

6.2.5 Relevance of IT Governance with SDGs and Pandemic Diseases

There has been an increased focus on designing healthcare and its supply chain in accordance with the guidelines of Sustainable Development Goals (SDGs). There is a lack of information technology integration, inadequate information sharing and communication between partners and stakeholders among the key hindrances in achieving the SDGs. Thus, a well-governed IT system in healthcare cannot only meet the outcome quality and agility requirements, but it also warrants a sustainable supply chain to meet the guidelines of SDGs. A well-designed governance system

for IT can ensure visibility and transparency within healthcare and its entire supply chain. Such governance systems can be further improved by integrating them with the supply chain digital twin to transform healthcare and its supply chain to effectively deal with vulnerabilities and uncertainties.

There was an increase in data security threats and healthcare cyber-attacks during the COVID-19 era. A robust and well-intact IT-governed system can prevent such attacks; however, data and advanced analytical skills are required to practice in an IT-governed hospital. The top management can be responsible for inculcating a culture where data is shared, skills are acquired, and transparency is ensured. Agile and IT-governed healthcare can respond well to uncertainties in the face of disruptions through virtual clinics to warrant patient satisfaction and improved quality. However, telemedicine cannot replace physical examination, and the accessibility of the Internet and technology-related knowledge remains problematic.

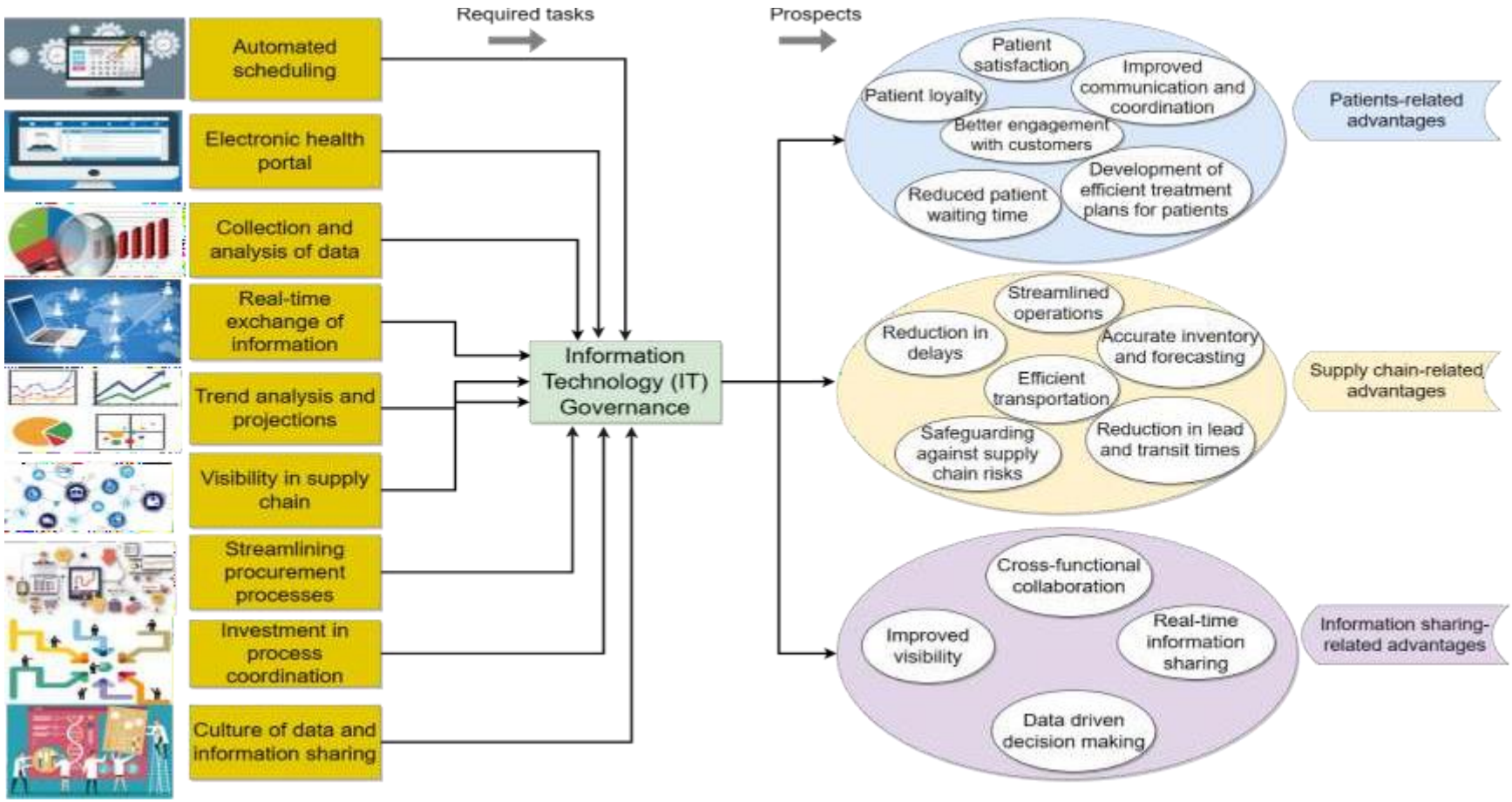

Figure 6.1 Required tasks and prospects of IT Governance for patients, supply chain and information sharing in healthcare.

6.3 Limitations and Future Recommendations

Like every research, this study also has its limitations. The first limitation is the use of non-probability sampling due to unavailability of a sampling frame. Although the non-probability sampling technique i.e., purposive sampling, used in this study accounts for better generalizability compared to other non-probability sampling methods, nonetheless, probability samples would increase the generalizability to a great extent. Another limitation is using cross-sectional data for this study due to time and cost constraints.

Improving governance, investing in IT systems, and building capabilities are time-consuming phenomena, and it is not easy to ascertain their impact in a cross-sectional study setting. Thus, future researchers may conduct longitudinal studies to understand the unfolding of governance and capabilities at various times. This will further enhance the robustness and applicability of the framework and its findings. It is suggested that future researchers should replicate the proposed framework in other supply chains, such as tourism, hotels, and the logistics industry. The proposed framework can be further enriched by studying the impact of moderating variables such as risk management, supply chain resilience, and supply chain complexity in the relationship between IT governance and supply chain agility. IT and agility are essential facets of Society 5.0 and Industry 5.0. Thus, future research may extend and replicate the proposed framework in the context of Industry 5.0 and Society 5.0 practices. The proposed framework was applied to a developing country context, and we understand that the IT governance and information-sharing capabilities and the outcome quality may vary across developed and developing countries. Thus, the comparative assessment of the proposed framework between developing and developed countries may further enhance its generalizability and robustness.

References

Abu Khadra, H., Zuriekat, M., & Alramhi, N. (2009). An empirical examination of maturity model as measurement of information technology governance implementation. International Arab Journal of Information Technology, 6(3), 310–319.

Adelaja, I., Sayma, M., Walton, H., McLachlan, G., de Boisanger, J., Bartlett-Pestell, S., ... & Sara, H. (2020). A comprehensive hospital agile preparedness (CHAPs) tool for pandemic preparedness, based on the COVID-19 experience. Future Healthcare Journal, 7(2), 165.

Al Humdan, E., Shi, Y., & Behnia, M. (2020). Supply chain agility: a systematic review of definitions, enablers and performance implications. International Journal of Physical Distribution and Logistics Management, 50(2), 287–312. https://doi.org/10.1108/IJPDLM-06-2019-0192

Alipour, J., Mehdipour, Y., Karimi, A., Khorashadizadeh, M., & Akbarpour, M. (2023). Security, confidentiality, privacy and patient safety in the hospital information systems from the users' perspective: A cross-sectional study. International Journal of Medical Informatics, 175(7), 105066. https://doi.org/10.1016/j.ijmedinf.2023.105066

Almansoori, A., AlShamsi, M., Salloum, S. A., & Shaalan, K. (2021). Critical Review of Knowledge Management in Healthcare. Studies in Systems, Decision and Control, 295, 99–119. https://doi.org/10.1007/978-3-030-47411-9_6

Alzoubi, H. M., Elrehail, H., Hanaysha, J. R., Al-Gasaymeh, A., & Al-Adaileh, R. (2022). The Role of Supply Chain Integration and Agile Practices in Improving Lead Time During the COVID-19 Crisis. International Journal of Service Science, Management, Engineering, and Technology, 13(1), 1–11. https://doi.org/10.4018/IJSSMET.290348

Alzoubi, H. M., & Yanamandra, R. (2020). Investigating the mediating role of information sharing strategy on agile supply chain. Uncertain Supply Chain Management, 8(2), 273–284. https://doi.org/10.5267/j.uscm.2019.12.004

Asha, A. A., Dulal, M., & Habib, D. A. (2023). The influence of sustainable supply chain management, technology orientation, and organizational culture on the delivery product quality-customer satisfaction nexus. Cleaner Logistics and Supply Chain, 7(4), 100107. https://doi.org/10.1016/j.clscn.2023.100107

Attaran, M. (2020). Blockchain technology in healthcare: Challenges and opportunities, International Journal of Healthcare Management, 15(1), 70–83. https://doi.org/10.1080/20479700.2020.1843887

Ayaad, O., Alloubani, A., ALhajaa, E. A., Farhan, M., Abuseif, S. (2019). The role of electronic medical records in improving the quality of health care services: Comparative study. International Journal of Medical Informatics, 127(4), 63–67. https://doi.org/10.1016/j.ijmedinf.2019.04.014

Bharathi, R., Abirami, T., Dhanasekaran, S., Gupta, D., Khanna, A., Elhoseny, M., & Shankar, K. (2020). Energy efficient clustering with disease diagnosis model for IoT based sustainable healthcare systems. Sustainable Computing: Informatics and Systems, 28(12), 100453. https://doi.org/10.1016/J.suscom.2020.100453

Bland, J. M., & Altman, D. G. (1997). Statistics notes: Cronbach's alpha. Bmj, 314(7080), 572. https://doi.org/10.1136/bmj.314.7080.572

Blondiau, A. (2015). Challenges for inter-departmental cooperation in hospitals: Results from cross-case analysis. Health Policy and Technology, 4(1), 4–13. https://doi.org/10.1016/j.hlpt.2014.10.012

Broeren, S., Muris, P., Bouwmeester, S., van der Heijden, K. B., & Abee, A. (2011). The Role of Repetitive Negative Thoughts in the Vulnerability for Emotional Problems in Non-Clinical Children. Journal of Child and Family Studies, 20(2), 135–148. https://doi.org/10.1007/s10826-010-9380-9

Burmeister, E., & Aitken, L. M. (2012). Sample size: How many is enough? Australian Critical Care, 25(4), 271–274. https://doi.org/10.1016/j.aucc.2012.07.002

Cambra-Fierro, J., Gao, L. (Xuehui), Melero-Polo, I., & Trifu, A. (2021). How do firms handle variability in customer experience? A dynamic approach to better understanding customer retention. Journal of Retailing and Consumer Services, 61(7), 102578. https://doi.org/10.1016/j.jretconser.2021.102578

Carvalho, R., Lobo, M., Oliveira, M., Oliveira, A. R., Lopes (2021). Analysis of root causes of problems affecting the quality of hospital administrative data: A systematic review and Ishikawa diagram. International Journal of Medical Informatics, 156(12), 104584. https://doi.org/10.1016/j.ijmedinf.2021.104584

Chahal, H., & Kumari, N. (2010). Development of multidimensional scale for healthcare service quality (HCSQ) in Indian context. Journal of Indian Business Research, 2(4), 230–255. https://doi.org/10.1108/17554191011084157

Chen, D. Q., Preston, D. S., & Xia, W. (2013). Enhancing hospital supply chain performance: A relational view and empirical test. Journal of Operations Management, 31(6), 391–408. https://doi.org/10.1016/j.jom.2013.07.012

Cribari-Neto, F. (2004). Asymptotic inference under heteroskedasticity of unknown form. Computational Statistics & Data Analysis, 45(2), 215–233. https://doi.org/10.1016/S0167-9473(02)00366-3

De Arellano, A. B. R. (2007). Patients without borders: the emergence of medical tourism. International Journal of Health Services, 37(1), 193–198. https://doi.org/10.2190/4857-468G-2325-47UU

De Rosis, S., & Barsanti, S. (2016). Patient satisfaction, e-health and the evolution of the patient–general practitioner relationship: Evidence from an Italian survey. Health Policy, 120(11), 1279–1292. https://doi.org/10.1016/j.healthpol.2016.09.012

Dehgani, R., & Jafari Navimipour, N. (2019). The impact of information technology and communication systems on the agility of supply chain management systems. Kybernetes, 48(10), 2217–2236. https://doi.org/10.1108/K-10-2018-0532

Dhahri, A. A., Iqbal, M. R., & Pardoe, H. (2020). Agile application of video telemedicine during the COVID-19 pandemic. Cureus, 12(11).

Dhakate, N., & Joshi, R. (2023). Classification of reviews of e-healthcare services to improve patient satisfaction: Insights from an emerging economy. Journal of Business Research, 164(3), 114015. https://doi.org/10.1016/j.jbusres.2023.114015

Dias, C., & Escoval, A. (2012). The open nature of innovation in the hospital sector : The role of external collaboration networks. Health Policy and Technology, 1(4), 181–186. https://doi.org/10.1016/j.hlpt.2012.10.002

Diesing, P. (1966). Objectivism vs. subjectivism in the social sciences. Philosophy of Science, 33(1/2), 124–133. https://doi.org/10.1086/288081

Fawcett, S. E., Osterhaus, P., Magnan, G. M., Brau, J. C., & McCarter, M. W. (2007). Information sharing and supply chain performance: The role of connectivity and willingness. Supply Chain Management, 12(5), 358–368. https://doi.org/10.1108/13598540710776935

Fayezi, S., & Zomorrodi, M. (2015). The role of relationship integration in supply chain agility and flexibility development: An Australian perspective. Journal of Manufacturing Technology Management, 26(8), 1126–1157. https://doi.org/10.1108/JMTM-11-2014-0123

Field, A. (2013). Discovering statistics using IBM SPSS statistics. sage.

Gao, M., & Huang, L. (2021). Quality of channel integration and customer loyalty in omnichannel retailing: The mediating role of customer engagement and relationship program

receptiveness. Journal of Retailing and Consumer Services, 63(11), 102688. https://doi.org/10.1016/j.jretconser.2021.102688

Getele, G. K., Li, T., & Arrive, J. T. (2019). Risk Management in the Service Supply Chain: Evidence from the Healthcare Sector. IEEE Engineering Management Review, 47(4), 143–152. https://doi.org/10.1109/EMR.2019.2933512

Gligor, David M., Holcomb, M. C., & Stank, T. P. (2013). A multidisciplinary approach to supply chain agility: Conceptualization and scale development. Journal of Business Logistics, 34(2), 94–108. https://doi.org/10.1111/jbl.12012

Godley, M., & Jenkins, J. B. (2019). Decreasing wait times and increasing patient satisfaction: A lean six sigma approach. Journal of Nursing Care Quality, 34(1), 61–65. https://doi.org/10.1097/NCQ.0000000000000332

Govindan, K., Mina, H., & Alavi, B. (2020). A decision support system for demand management in healthcare supply chains considering the epidemic outbreaks: A case study of coronavirus disease 2019 (COVID-19). Transportation Research Part E: Logistics and Transportation Review, 138(6), 101967. https://doi.org/10.1016/j.tre.2020.101967

Guillemette, M. G., Raymond, L., & Paré, G. (2022). Assessing the maturity and performance of the IT function in acute-care hospitals: a configurational view. Health Systems, 0, 1–13. https://doi.org/10.1080/20476965.2022.2075797

Habib, M. M., Chowdhury, F., Sabah, S., & Debnath, D. (2022). A Study on Hospital Supply Chain Management. American Journal of Industrial and Business Management, 12(5), 806–823. https://doi.org/10.4236/ajibm.2022.125042

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). Multivariate Data Analysis, 7th edn, Harlow, England. United Kingdom, Pearson.

Han, H., & Hyun, S. S. (2015). Customer retention in the medical tourism industry: Impact of quality, satisfaction, trust, and price reasonableness. Tourism Management, 46, 20–29. https://doi.org/10.1016/j.tourman.2014.06.003

Haq, A. N., & Boddu, V. (2017). Analysis of enablers for the implementation of leagile supply chain management using an integrated fuzzy QFD approach. Journal of Intelligent Manufacturing, 28(1), 1-12, https://doi.org/10.1007/s10845-014-0957-9

Hayes, A. F. (2013). Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach. 2nd Edn. New York: Guilford Publications, 1, 20.

Hayes, A. F. (2017). Introduction to mediation, moderation and conditional process analysis-Appendices A & B (V3). Methodology in the Social Sciences, 53, 527.

Hayes, A. F., & Cai, L. (2007). Using heteroskedasticity-consistent standard error estimators in OLS regression: An introduction and software implementation. Behavior Research Methods, 39(4), 709–722. https://doi.org/10.3758/BF03192961

Hopkins, K. D., & Weeks, D. L. (1990). Tests for normality and measures of skewness and kurtosis: Their place in research reporting. Educational and Psychological Measurement, 50(4), 717–729. https://doi.org/10.1177/0013164490504001

Housley, G., Lewis, S., Usman, A., Gordon, A. L., & Shaw, D. E. (2018). Accurate identification of hospital admissions from care homes; development and validation of an automated algorithm. Age and Ageing, 47(3), 387–391. https://doi.org/10.1093/AGEING/AFX182

Irfan, S. M., & Ijaz, A. (2011). Comparison of service quality between private and public hospitals: Empirical evidences from Pakistan. Journal of Quality and Technology Management, 7(1), 1–22.

Ivanov, D., & Dolgui, A. (2020). Viability of intertwined supply networks: extending the supply chain resilience angles towards survivability. A position paper motivated by COVID-19 outbreak. International Journal of Production Research, 58(10), 2904–2915. https://doi.org/10.1080/00207543.2020.1750727

Javed, S. A., & Ilyas, F. (2018). Service quality and satisfaction in healthcare sector of Pakistan : the patients' expectations. International Journal of Health Care Quality Assurance, 31(6), 489–501. https://doi.org/10.1108/IJHCQA-08-2016-0110

Jebraeily, M., Rahimi, B., Fazlollahi, Z. Z., & Afshar, H. L. (2019). Using SERVQUAL model to assess hospital information system service quality. Hormozgan Medical Journal, 23(1), 1–6. https://doi.org/10.5812/hmj.86977

Jermsittiparsert, K., & Rungsrisawat, S. (2019). Impact strategic sourcing, supplier innovativeness, and information sharing on supply chain agility. International Journal of Innovation, Creativity and Change, 5(2), 397–415. https://doi.org/10.18510/hssr.2019.7418

Joshi, A., Benitez, J., Huygh, T., Ruiz, L., & De Haes, S. (2022). Impact of IT governance process capability on business performance: Theory and empirical evidence. Decision Support Systems, 153(2), 113668. https://doi.org/10.1016/j.dss.2021.113668

Kabra, G., & Ramesh, A. (2016). Information Technology, Mutual Trust, Flexibility, Agility, Adaptability: Understanding Their Linkages and Impact on Humanitarian Supply Chain

Management Performance. Risk, Hazards and Crisis in Public Policy, 7(2), 79–103. https://doi.org/10.1002/rhc3.12096

Karamat, J., Shurong, T., Ahmad, N., Afridi, S., Khan, S., & Mahmood, K. (2019). Promoting healthcare sustainability in developing countries: Analysis of knowledge management drivers in public and private hospitals of Pakistan. International Journal of Environmental Research and Public Health, 16(3), 1–24. https://doi.org/10.3390/ijerph16030508

Kazemzadeh, R. B., Sepehri, M. M., & Jahantigh, F. F. (2012). Design and analysis of a health care supply chain management. Advanced Materials Research, 433, 2128–2134. https://doi.org/10.4028/www.scientific.net/AMR.433-440.2128

Keesara, S., Jonas, A., & Schulman, K. (2020). Covid-19 and health care's digital revolution. New England Journal of Medicine, 382(23), e82.

Kim, M., & Chai, S. (2017). The impact of supplier innovativeness, information sharing and strategic sourcing on improving supply chain agility: Global supply chain perspective. International Journal of Production Economics, 187(2), 42–52. https://doi.org/10.1016/j.ijpe.2017.02.007

Kizito, M. (2019). An inquiry into IT governance in healthcare organizations in Uganda. IFIP Advances in Information and Communication Technology, 551(5), 39–50. https://doi.org/10.1007/978-3-030-18400-1_4

Küçük, A., Demirci, M., Kerman, G., & Soner Özsoy, V. (2021). Evaluating of hospital appointment systems in Turkey: Challenges and opportunities. Health Policy and Technology, 10(1), 69–74. https://doi.org/10.1016/j.hlpt.2020.11.008

Lavikka, R., Smeds, R., & Jaatinen, M. (2009). Coordinating the service process of two business units towards a joint customer. Production Planning & Control, 20(2), 135-146. https://doi.org/10.1080/09537280802707555

Lee, H. K., & Fernando, Y. (2015). The antecedents and outcomes of the medical tourism supply chain. Tourism Management, 46, 148–157. https://doi.org/10.1016/j.tourman.2014.06.014

Lin Y, Hong YA, Henson BS, Stevenson RD, Hong S, Lyu T, Liang C Assessing Patient Experience and Healthcare Quality of Dental Care Using Patient Online Reviews in the United States: Mixed Methods Study. J Med Internet Res 2020;22(7):e18652. doi: 10.2196/18652

Liu, J., Luo, L., Zhang, R., & Huang, T. (2013). Patient satisfaction with electronic medical/health record: A systematic review. Scandinavian Journal of Caring Sciences, 27(4), 785–791.

https://doi.org/10.1111/scs.12015

Luther, L., Benkenstein, M., & Rummelhagen, K. (2016). Enhancing patients' hospital satisfaction by taking advantage of interpersonal similarity. Journal of Retailing and Consumer Services, 30(5), 50–58. https://doi.org/10.1016/j.jretconser.2015.12.002

MacKinnon, D. P., Fairchild, A. J., & Fritz, M. S. (2007). Mediation analysis. Annual Review of Psychology, 58, 593–614. https://doi.org/10.1146/annurev.psych.58.110405.085542

Makudza, F., Jaravaza, D. C., Govha, T., Mukucha, P., & Saruchera, F. (2023). Enhancing supply chain agility through e-procurement in a volatile frontier market. Journal of Transport and Supply Chain Management, 17(1), 1–12. https://doi.org/10.4102/jtscm.v17i0.847

Malviya, R. (2021). Agile manufacturing. Lean Tools in Apparel Manufacturing: A Volume in The Textile Institute Book Series, 14, 399–421. https://doi.org/10.1016/B978-0-12-819426-3.00011-4

Mashele, F., & Chuchu, T. (2018). An Empirical Investigation into the Relationship between Sustainability and Supply Chain Compliance within the South African public and the private sector. Journal of Business and Retail Management Research, 12(2), 121-132.

Meesala, A., & Paul, J. (2018). Service quality, consumer satisfaction and loyalty in hospitals: Thinking for the future. Journal of Retailing and Consumer Services, 40(1), 261–269. https://doi.org/10.1016/j.jretconser.2016.10.011

Mengcheng, L., & Tuure, T. (2022). Information Technology–Supported value Co-Creation and Co-Destruction via social interaction and resource integration in service systems. Journal of Strategic Information Systems, 31(2), 101719. https://doi.org/10.1016/j.jsis.2022.101719

Mensah, A. (2021). Job stress and mental well-being among working men and women in Europe: The mediating role of social support. International Journal of Environmental Research and Public Health, 18(5), 2494. https://doi.org/10.3390/ijerph18052494

Meyer-Waarden, L., Bruwer, J., & Galan, J. P. (2023). Loyalty programs, loyalty engagement and customer engagement with the company brand: Consumer-centric behavioral psychology insights from three industries. Journal of Retailing and Consumer Services, 71(3), 103212. https://doi.org/10.1016/j.jretconser.2022.103212

Mitropoulos, P., Vasileiou, K., & Mitropoulos, I. (2018). Understanding quality and satisfaction in public hospital services: A nationwide inpatient survey in Greece. Journal of Retailing and Consumer Services, 40(1), 270–275. https://doi.org/10.1016/j.jretconser.2017.03.004

Moorman, C., Rindfleisch, A., Malter, A. J., & Ganesan, S. (2008). Cross-sectional versus longitudinal survey research: Concepts, findings, and guidelines. Journal of Marketing Research, 45(3), 261–279. https://doi.org/10.1509/jmkr.45.3.261

Mubarak, N., Khan, J., Yasmin, R. and Osmadi, A. (2021), The impact of a proactive personality on innovative work behavior: the role of work engagement and transformational leadership, Leadership & Organization Development Journal, 42(7), 989-1003. https://doi.org/10.1108/LODJ-11-2020-0518.

Musenze, I. A., & Mayende, T. S. (2021). Coordination and Quality Service Delivery in Service Organizations: Qualitative Investigation. Journal of African Business, 22(2), 190–208. https://doi.org/10.1080/15228916.2019.1699758

Mustafid, Karimariza, S. A., & Jie, F. (2018). Supply chain agility information systems with key factors for fashion industry competitiveness. International Journal of Agile Systems and Management, 11(1), 1–22. https://doi.org/10.1504/ijasm.2018.091352

Nash, M., Pestrue, J., Geier, P., Sharp, K., Helder, A., & McAlearney, A. S. (2010). Leveraging information technology to drive improvement in patient satisfaction. Journal for Healthcare Quality, 32(5), 30-40. https://doi.org/10.1111/j.1945-1474.2010.00110.x

Nasim, K., & Yousaf, S. (2014). Service quality perceptions and patients ' satisfaction : A comparative case study of a public and a private sector hospital in Pakistan. International Journal for Quality Research, 8(3), 447-460.

Negash, S., Musa, P., Vogel, D., & Sahay, S. (2018). Healthcare information technology for development: improvements in people's lives through innovations in the uses of technologies, 24(2), 189–197. https://doi.org/10.1080/02681102.2018.1422477

Neirotti, P., & Raguseo, E. (2017). On the contingent value of IT-based capabilities for the competitive advantage of SMEs: Mechanisms and empirical evidence. Information and Management, 54(2), 139–153. https://doi.org/10.1016/j.im.2016.05.004

Newman-Casey, P. A., Musser, J., Niziol, L. M., Shedden, K., Burke, D., & Cohn, A. (2020). Designing and validating a low-cost real time locating system to continuously assess patient wait times. Journal of Biomedical Informatics, 106(10), 103428. https://doi.org/10.1016/j.jbi.2020.103428

Ng, J. H. Y., & Luk, B. H. K. (2019). Patient satisfaction: Concept analysis in the healthcare context. Patient Education and Counseling, 102(4), 790–796. https://doi.org/10.1016/J.PEC.2018.11.013

Oliveira-Dias, D., Maqueira-Marín, J. M., & Moyano-Fuentes, J. (2022). The link between information and digital technologies of industry 4.0 and agile supply chain: Mapping current research and establishing new research avenues. Computers and Industrial Engineering, 167(5), 108000. https://doi.org/10.1016/j.cie.2022.108000

Omoruyi, O., & Mafini, C. (2016). Supply Chain Management and Customer Satisfaction in Small to Medium Enterprises. Studia Universitatis Babe-Bolyai Oeconomica, 61(3), 43–58. https://doi.org/10.1515/subboec-2016-0004

Pak, S. Il, & Oh, T. H. (2010). Correlation and simple linear regression. Journal of Veterinary Clinics, 27(4), 427–434. https://doi.org/10.1007/978-3-319-89993-0_6

Park, Y. S., Konge, L., & Artino, A. R. (2020). The Positivism Paradigm of Research. Academic Medicine, 95(5), 690–694. https://doi.org/10.1097/ACM.0000000000003093

Pekovic, S., & Rolland, S. (2020). Recipes for achieving customer loyalty: A qualitative comparative analysis of the dimensions of customer experience. Journal of Retailing and Consumer Services, 58(1), 102270. https://doi.org/10.1016/j.jretconser.2020.102170

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, 135(1), 514–522. https://doi.org/10.1016/j.ijpe.2011.09.001

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behavior Research Methods, 40(3), 879–891. https://doi.org/10.3758/BRM.40.3.879.

Raggiotto, F., Compagno, C., & Scarpi, D. (2023). Care management to improve retail customers' and employees' satisfaction. Journal of Retailing and Consumer Services, 72(5), 103280. https://doi.org/10.1016/j.jretconser.2023.103280

Rai, N., & Thapa, B. (2015). A study on purposive sampling method in research. Kathmandu: Kathmandu School of Law, 5.

Raza, M. Y., Wasim, M., & Sarwar, M. S. (2020). Development of Renewable Energy Technologies in rural areas of Pakistan. Recovery, Utilization and Environmental Effects, 42(6), 740–760. https://doi.org/10.1080/15567036.2019.1588428

Regin, R. (2023). Information Technology Factor Affecting Firm Performance through Supply Chain Agility. Central Asian Journal of Theoretical and Applied Science, 4(1), 148-168. https://doi.org/10.17605/OSF.IO/VYSR7.

Robinson, K. M. (2010). Care coordination: A priority for health reform. Policy, Politics, and Nursing Practice, 11(4), 266–274. https://doi.org/10.1177/1527154410396572

Rochmah, T. N., Fakhruzzaman, M. N., & Yustiawan, T. (2020). Hospital staff acceptance towards management information systems in Indonesia. Health Policy and Technology, 9(3), 268–270. https://doi.org/10.1016/j.hlpt.2020.07.004

Ruiz, R. L., & Duffy, V. G. (2021). Automation in Healthcare Systematic Review. Lecture Notes in Computer Science, 13097, 111–124. https://doi.org/10.1007/978-3-030-90966-6_9

Rungsrisawat, S., & Jermsittiparsert, K. (2019). Does human capital improve health care agility through health care supply chain performance? Moderating role of technical orientation. International Journal of Supply Chain Management, 8(5), 792–803.

Ruxton, G. D. (2006). The unequal variance t-test is an underused alternative to Student's t-test and the Mann-Whitney U test. Behavioral Ecology, 17(4), 688–690. https://doi.org/10.1093/beheco/ark016

Scala, B., & Lindsay, C. F. (2021). Supply chain resilience during pandemic disruption: evidence from healthcare. Supply Chain Management, 26(6), 672–688. https://doi.org/10.1108/SCM-09-2020-0434

Sekaran, U., & Bougie, R. (2016). Research methods for business: A skill building approach (7 ed.). West Sussex: Wiley. S

Shabbir, A., Malik, S. A., & Malik, S. A. (2016). Measuring patients' healthcare service quality perceptions, satisfaction, and loyalty in public and private sector hospitals in Pakistan. International Journal of Quality and Reliability Management, 33(5), 538–557. https://doi.org/10.1108/IJQRM-06-2014-0074

Siahkal Mahalleh, A. H., Mehregan, M. R., & Yousefzadeh, S. (2022). Prioritize the Dimensions of Agile Hospital Supply Chain with Combination of Interpretive Structural Modeling and Analytic Network Process. Caspian Journal of Health Research, 7(3), 137–150. https://doi.org/10.32598/cjhr.7.3.416.1

Swafford, P. M., Ghosh, S., & Murthy, N. (2008). Achieving supply chain agility through IT integration and flexibility. International Journal of Production Economics, 116(2), 288–297. https://doi.org/10.1016/j.ijpe.2008.09.002

Tamir, M., Ouzayd, F., & Chiheb, R. (2017). Literature review and classification of performance analysis methods: Hospital supply chain. Proceedings of the International Conference on Industrial Engineering and Operations Management, 1947–1958.

Teremetskyi, V., Duliba, Y., Kroitor, V., Korchak, N., & Makarenko, O. (2020). Corruption and strengthening anti-corruption efforts in healthcare during the pandemic of Covid-19, 89(1), 25–28. https://doi.org/10.1177/0025817220971925

Tlapa, D., Zepeda-Lugo, C. A., Tortorella, G. L., Baez-Lopez, Y. A., Limon-Romero, J., Alvarado-Iniesta, A., & Rodriguez-Borbon, M. I. (2020). Effects of Lean Healthcare on Patient Flow: A Systematic Review. Value in Health, 23(2), 260–273. https://doi.org/10.1016/J.JVAL.2019.11.002

Uzir, M. U. H., Al Halbusi, H., Thurasamy, R., Thiam Hock, R. L., Aljaberi, M. A., Hasan, N., & Hamid, M. (2021). The effects of service quality, perceived value and trust in home delivery service personnel on customer satisfaction: Evidence from a developing country. Journal of Retailing and Consumer Services, 63(4), 102721. https://doi.org/10.1016/j.jretconser.2021.102721

Vähätalo, M. and Kallio, T.J. (2015), Organising health services through modularity. International Journal of Operations & Production Management, 35(6), 925-945. https://doi.org/10.1108/IJOPM-12-2013-0523

Van Kollenburg, G. H., & Croon, M. A. (2022). How to Define and Test an Indirect Moderation Model: The Missing Link in Regression-Based Path Models. Statistics Methodology, 18(3), 164–184.

Walker, P. G. T., Whittaker, C., Watson, O. J., Baguelin, M., Winskill, P., Hamlet, A. (2020). The impact of COVID-19 and strategies for mitigation and suppression in low and middle income countries. Science, 347(6220), 413–422. https://doi.org/ 10.1126/science.1260419

Wang, G., Gunasekaran, A., Ngai, E. W. T., & Papadopoulos, T. (2016). Big data analytics in logistics and supply chain management: Certain investigations for research and applications. International Journal of Production Economics, 176(6), 98–110. https://doi.org/10.1016/j.ijpe.2016.03.014

Wautelet, Y. (2019). A model-driven IT governance process based on the strategic impact evaluation of services. Journal of Systems and Software, 149(3), 462–475. https://doi.org/10.1016/J.JSS.2018.12.024

Webster, R. J., & Saucier, D. A. (2013). Angels and Demons Are Among Us: Assessing Individual Differences in Belief in Pure Evil and Belief in Pure Good. Personality and Social Psychology Bulletin, 39(11), 1455–1470. https://doi.org/10.1177/0146167213496282

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. Econometrica: Journal of the Econometric Society, 48(4), 817–838.

https://doi.org/10.2307/1912934

Winter, M., Dopler, S., Müller, J. M., & Zeisler, A. (2023). Information sharing and multi-tier supply chain management of SMEs in the context of Industry 4.0. Procedia Computer Science, 217(2023), 1378–1385. https://doi.org/10.1016/j.procs.2022.12.336

Yang, Q.-X., & Chen, J. (2018). Patients' trust in physicians and its influence on patients' loyalty to hospitals in Guangzhou, China: a cross sectional study. The Lancet, 392, S16. https://doi.org/10.1016/s0140-6736(18)32645-x

Ye, F., & Wang, Z. (2013). Effects of information technology alignment and information sharing on supply chain operational performance. Computers and Industrial Engineering, 65(3), 370–377. https://doi.org/10.1016/j.cie.2013.03.012

Yi, H. T., Yeo, C. K., Amenuvor, F. E., & Boateng, H. (2021). Examining the relationship between customer bonding, customer participation, and customer satisfaction. Journal of Retailing and Consumer Services, 62(9), 102598. https://doi.org/10.1016/j.jretconser.2021.102598

Yu, W., Zhao, G., Liu, Q., & Song, Y. (2021). Role of big data analytics capability in developing integrated hospital supply chains and operational flexibility: An organizational information processing theory perspective. Technological Forecasting and Social Change, 163 (2), 120417. https://doi.org/10.1016/j.techfore.2020.120417

Yu, W., Jacobs, M. A., Salisbury, W. D., & Enns, H. (2013). The effects of supply chain integration on customer satisfaction and financial performance: An organizational learning perspective. International Journal of Production Economics, 146(1), 346–358. https://doi.org/10.1016/j.ijpe.2013.07.023

Yurtsever, N., & Angin, D. E. (2022). Examining the Mediating Role of Altruism in the Relationship between Empathic Tendencies, the Nature Relatedness, and Environmental Consciousness. Center for Educational Policy Studies Journal, 12(1), 217–239. https://doi.org/10.26529/cepsj.1032

Yusuf, Y. Y., Gunasekaran, A., Musa, A., Dauda, M., El-Berishy, N. M., & Cang, S. (2014). A relational study of supply chain agility, competitiveness and business performance in the oil and gas industry. International Journal of Production Economics, 147(PART B), 531–543. https://doi.org/10.1016/j.ijpe.2012.10.009

Zabada, C., Singh, S., & Munchus, G. (2001). The role of information technology in enhancing patient satisfaction. British Journal of Clinical Governance, 6(1), 9–16. https://doi.org/10.1108/14664100110384948

Zaidi, S. A., Bigdeli, M., Langlois, E. V., Riaz, A & Bump, J. B. (2019). Health systems changes after decentralisation: Progress, challenges and dynamics in Pakistan. BMJ Global Health, 4(1), 1–8. https://doi.org/10.1136/bmjgh-2018-001013

Appendix

Questionnaire

It is essential for hospitals to fulfill diverse patient needs in a timely manner as it is related to the life of individuals. Timely sharing of information along with governance of information technology can help hospital supply chains become agile. I am an MS student at NUST (National University of Sciences and Technology), studying logistics and supply chain management. Research thesis is an important milestone in my degree. I am conducting research on 'Information Sharing in Agile Hospital Supply Chains.' The information collected under this study is protected under NUST Code of Research Ethics. It is ensured that all responses will be kept strictly confidential and used for academic purposes only.

Question	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1. **Information Sharing Capability**					
Our hospital's information sharing system is integrated with our suppliers.					
Our hospital's processes are internally integrated.					
Our hospital's processes are externally integrated with our suppliers to exchange adequate information					
Our hospital's suppliers are willing to share necessary information with us.					
We frequently and regularly communicate with our suppliers.					
2. **Outcome Quality**					
The waiting time to see the doctors is acceptable to our patients.					
The waiting time to receive treatments is acceptable to our patients.					
The waiting time to be registered is acceptable to our patients.					
The admission process is simple.					
Proper queue management is followed.					
Nursing staff are available throughout their duty time.					
Emergency patients do not have to wait long for treatment.					

Our patients are satisfied with our indoor services.					
Hospitals are fully conscious of patient problems.					
Hospitals have a system in place to receive complaints/suggestions from patients.					
Our patients are satisfied with the availability of doctors during their duty time.					
Our patients are satisfied with the price set for our services.					
Our patients are satisfied with the up-to-date level of health care facilities.					
Our patients are satisfied with the variety of service our hospital offers.					
Emergency patients are satisfied with the medical care provided in this hospital.					
Patients trust the services of our hospital.					
Patients would like to come to our hospital again.					
Patients will recommend our hospital to their friends and relatives.					
The price effectiveness makes patients want to visit the hospital again.					
3. **Supply Chain Agility**					
We have a proper mechanism to forecast the number of patients.					
We can effectively identify and assess the demand side risks.					
We can successfully mitigate the demand side risks.					
We have a proper mechanism in place to identify changes in supply side.					
We can effectively identify and assess the supply side risks.					
We can successfully mitigate the supply risks.					
Our supply chain manager is empowered to make resolute decisions to deal with changes in supply and demand.					
We can quickly respond to changes in supply and demand.					
When required, we can adjust our supply chain operations to the extent necessary to execute our decisions.					
We can adjust the specification of our services as required by our patients.					

4. **IT Governance**					
Our hospital's senior management views IT on a strategic level.					
Our hospital's senior management endorses IT investments.					
The IT system of our hospital can detect unauthorized changes in real time.					
Database Management System ensures data privacy and defines authorized users.					
All reports are generated through an automated system.					
Our employees have adequate access to the information necessary for their decision making.					

In addition to the above information, the following demographic information is also important to the study.

Designation? _____

Overall Professional Experience.

- 1 – 5 years
- 6 – 10 years
- Above 10 years

Experience working in this hospital.

- 1 – 5 years
- 6 – 10 years
- Above 10 years

Name of hospital? _____

Number of employees? _____

Number of beds? _____

Have you or any of your family, friends, and relatives received treatment at respective hospital? _____

Would you like to receive a report of the findings once concluded? If yes, please provide the following information.

Email: _____