

Impact of the Critical Success Factors of Supplier Selection on Supply Chain Performance: A Study of the Healthcare Industry of Pakistan

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Abstract

The study aimed to identify and prioritize critical success factors (CSFs) for improving supply chain performance in the context of healthcare industry of Pakistan. Five factors of supplier selection were identified from the literature and the relative importance of each was evaluated in determining the supply chain performance of the healthcare providers. 83 valid questionnaires were used to measure the factors with the results showing quality, cost and service as pivotal among other CSFs of Supplier Selection for SCP. Supplier quality was the most significant factor positively influencing improvements in supply chain performance of the buying hospital. Cost associated with purchasing from suppliers as well as supplier services also had an impact, but supplier profile and risk showed no significant effect. Overall, the research results highlighted the significant correlation between the multi-criteria decision factors of supplier selection and supply chain performance in the healthcare sector.

Keywords: Critical success factors of supplier selection, Supply chain performance, Multi-criteria supplier selection, Healthcare procurement

1 Introduction

Suppliers are crucial to overall supply chain viability and effectiveness in today's challenging business environment. Businesses go through a formal process of supplier selection to identify, evaluate and even contract with suppliers (Kenyatta, 2017). This requires organizations to employ a methodical approach to evaluate and select the right supplier depending on their standards which involves multi-criteria decision-making (MCDM) techniques (Gonzal et al., 2023).

A thorough assessment of both qualitative and quantitative factors such as quality, cost, delivery etc. is required for appropriate supplier selection (Aggarwal et al., 2018). Thus, supplier selection is a multi-criteria decision-making problem (Moheb-Alizadeh & Handfield, 2019; Tirkolaee et al., 2021) that entails identifying the suppliers, evaluating them on the basis of different criteria and assessment of

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their performance to choose a right supplier (Chai & Ngai, 2020). The effectiveness and success of choosing the right suppliers require significant contributions of the key elements regarded as critical success factors (CSFs) of supplier selection that ensure supplier's ability to meet an organization's requirement for cost, quality, performance and sustainability (Ho et al., 2010).

Supplier selection methods can be a source of competitive advantages for companies, while simultaneously; poor selection of the suppliers might result in the business failure (Naqvi & Amin, 2021). Three key areas in supplier selection include selection criteria, purchasing situation and environment complexity, and decision-making models (De Boer et al., 2001). In this paper, only supplier selection criteria will be discussed with a focus to determine their relation with supply chain performance in the healthcare sector.

Supplier selection problems in healthcare supply chains (HSCs) are critical due to their impact on human health and mortality, either directly or indirectly (Mathur et al., 2018). Despite the severe cost reduction pressures on healthcare industry, cost is not the driving force in supplier selection decisions; instead, multiple criteria are considered (D. Lambert et al., 1997). MCDM methods have thus become significant and straightforward tools for supplier selection decisions by healthcare managers (Pamucar et al., 2022). Few researchers have examined the effectiveness of multiple criteria for choosing suppliers in determining the supply chain performance of hospitals where flexible operations, reliable schedules and quick response are crucial to ensure patient safety and satisfaction as well as financial sustainability of the hospital. This lack of empirical understanding highlights the need for further investigation into which criteria of supplier selection significantly contribute towards enhancing the supply chain performance of healthcare organizations.

The healthcare sector in Pakistan is comprised of two parallel systems, public and private. The share of private sector constitutes around 65% of the total health expenditure, the share of public sector is 15% and the share of others is 20% (Wasay et al., 2019). Other types of healthcare institutions include a growing number of trusts, NGOs and social welfare organizations that operate primarily on donations and grants including Zakat and offer support health facilities to a very large section of the population, mainly the rural population. Private healthcare organizations in Pakistan usually rely on a few suppliers, mostly between two to five suppliers, seeking to maintain consistent supplier relations to meet their requirements (*Health and Social Work Private Sector Hospitals*, 2011). Thus, the focus of managers in healthcare organizations is to maintain long-term supplier relationships which make supplier selection and evaluation a critical process.

Individually, supplier selection and supply chain performance have been studied vastly in the literature. Comprehensive dimensions to examine supplier selection criteria and metrics to measure supply chain performance have been developed and tested by numerous researchers previously. However, the literature

on investigating the impact of CSFs of Supplier selection on supply chain performance of an organization is scarce. Also, studies in the healthcare sector that examine this relationship are insufficient. To fill this gap, this study critically examines the existing literature on supplier selection to identify the consistently reviewed criteria, recognized as Critical Success Factors (CSFs) of Supplier Selection and investigate their relationship with supply chain performance in terms of delivery reliability and responsiveness within the context of healthcare sector in a developing country like Pakistan.

Although multi-criteria decision-making methods are widely employed for supplier selection in the healthcare sector, their impact on supply chain performance remains unclear. This study examines how different supplier selection criteria influence supply chain performance in a dynamic healthcare environment, specifically hospitals and medical centers in Pakistan. From a practical view, the study determines the valid CSFs and makes recommendations to the healthcare decision makers. These findings could inspire them to identify and prioritize their CSFs for selecting the right suppliers to ensure a high-performing supply chain. From a theoretical standpoint, the study considers the healthcare context and develops a research model by identifying the critical success factors (CSFs) of supplier selection based on a literature review that can influence the performance of supply chain.

The paper is organized as follows: part 2 presents an overview of the previous research work on critical success factors (CSFs) of supplier selection and supply chain performance (SCP) and the development of hypotheses. Part 3 illustrates the methodology, which includes quantitative methods of data collection and analysis. The results are given in Part 4, followed by discussion and recommendations in Part 5, and the conclusions in Part 6.

2 Literature Review & Hypothesis Development

2.1 Supplier Selection

Numerous studies have posited that supplier evaluation and selection process begin with recognizing the related criteria to effectively choose the right suppliers. Pal et al. (2013) conducted a thorough literature review to identify typically utilized supplier selection criteria and methods. The study findings highlighted the growing importance of a multitude of nonprice criteria of supplier selection. It was proposed to harmonize and develop the right combination of qualitative and quantitative criteria and methods to select the best supplier. Kar (2014) highlighted that supplier selection decision models require an identification of the set of criteria which include traditional performance-based criteria, such as quality, delivery, price, service, as well as nontraditional, evolving ones. His study purported that the growing focus among today's businesses is to achieve excellence which will require them to continuously change supplier selection criteria and place more emphasis on non-price factors in making supplier selection decisions.

Mukherjee (2016) identified the importance of proactive supplier selection as organizational systems become increasingly complex and advanced. Proactive supplier selection focuses on using multiple criteria, emphasizing on multiple suppliers and considering sourcing as a strategic process. Taherdoost and Brard (2019) maintained that selection of adequate criteria for supplier selection depends on the buying situation, purchaser needs and global market changes. Like Pal et al., (2013), they suggested employing new hybrid methods including both qualitative and quantitative attributes for making supplier selection and evaluation decisions Ikram et al., (2019) studied supplier selection criteria in Pakistani companies and identified that more emphasis has been placed on economic criteria including quality, performance, delivery, net prices and technical capabilities. Hu et al., (2025) investigated supplier selection criteria in online retail environment and ranked them according to their relative importance. This study also highlighted how different supplier selection criteria are adjusted according to order sizes and product features.

2.2 Supplier Selection in the Healthcare Sector

One of the important studies to develop a MCDM model was conducted by Göncü and Çetin (2022) which serves as a decision support system for supplier selection in public healthcare sector. In addition to price, a holistic set of sub-criteria categorized under the main supplier selection criteria including quality, logistics (delivery time), technical values, occupational health and safety and sustainability were selected from literature and weighted using ANP and DEMATEL methods. Based on the ranking of the primary criteria, price and quality emerged as the most important criteria in the healthcare organizations. The model presented in this study offered profound insights into the public healthcare procurement practices that have started to consider non-cost criteria along with the cost criterion while making supplier selection decisions.

Stević et al., (2020) proposed a decision-making model for supplier selection in the private healthcare organizations. The study results highlighted quality, price, reliability, on-time delivery, and supplier reputation as significant among 21 criteria of supplier selection. Stephen et al., (2016) focused on investigating and developing a decision support model for evaluating and selecting suppliers in the healthcare institutions using analytical hierarchy process (AHP) and artificial neural network (ANN). The study highlighted quality of products supplied and services offered by the supplier as the significant factors of supplier selection followed by delivery, cost and risk.

Akcan and Güldeş (2019) used Hybrid Multi-criteria Decision Making (HMCDM) approach to choose and evaluate suppliers for a public hospital in Turkey by identifying the important criteria and sub criteria. In their study, logistics was found to be the most important criterion which entails meeting customer expectations at the right time in the right quantities. It was followed by cost and quality that supplier offers as the important factors for selecting the best supplier

for the hospital. Venkatesh et al., (2015) used MCDM approach to identify five priority criteria including quality, delivery, financial status, cost and good management principles (GMP) and their 15 sub-criteria to rank and assess the blood bag suppliers of a healthcare organization. Manivel and Ranganathan (2019) investigated the significance of supplier selection process in hospital pharmacy. Cost, delivery, service, flexibility and relationship were the five criteria of supplier selection identified from literature to evaluate the pharmacy suppliers and select the appropriate one.

Miah et al., (2014) conducted one of the pioneering studies and proposed a Decision Support Solution (DSS) approach for multi-criteria supplier selection in health purchasing. The study results showed quality as the most important criterion and cost as the second most important criterion of healthcare supplier selection followed by customer service. It was recommended to determine a supplier selection criterion specific to the industry instead of using a generic method. Bahadori et al., (2020) conducted a descriptive study in a military hospital aimed to develop a model for selecting the best supplier using a combination of Artificial Neural Network (ANN) and fuzzy VIKOR. The study results showed that the most important factor influencing supplier selection was quality. The other effective factors of supplier selection included price, delivery, the supplier's background and payment terms. Given the significant impact of quality, it was recommended that hospitals should develop quality assessment protocols to continuously evaluate the quality of equipment and medical supplies to ensure proper functioning and performance.

Table 1: Supplier Selection Criteria in the Healthcare Sector Consistently Studied in Literature (2016 Onwards)

Criteria	Studied by
Cost, Service, Risk, Quality, Delivery	(Stephen et al., 2016)
On-time delivery, Price, Pollution control, Quality, Service performance, Flexibility, Technology capacity, Job security, Green supply chain, Resource consumption, Hazardous substance management, Waste management	(Uçal Sarı et al., 2017)
Cost, Quality, Services, Delivery, Supplier Profile	(Forghani et al., 2018)
Price–Cost, Quality, Supplier Profile, Delivery, Flexibility	(Badi & Ballem, 2018)
Green competence, Social competences, Economic goals, Production competence and technological capabilities, Quality, Delivery time, Health, Customer service, Risk	(Moradi & Jolai, 2018)
Logistics, Quality, Cost, Flexibility, Reliability	(Akcan & Güldeş, 2019)

Cost, Delivery, Service, Flexibility, Relationship	(Ranganathan & Palanisamy, 2019)
Quality, Price–Cost, Distance, Past performance, Technology, Flexibility, Compliance with delivery date, and Repair–Maintenance services	(Özgüner, 2020)
Cost, Quality, Reputation, On-time delivery, Flexibility, Technology capability, Service and after sales service	(Khalili Nasr et al., 2021)
Cost, Quality, Delivery time, Flexibility, Robustness, Reliability, Payment strictness, Transportation quality	(Pamucar et al., 2022)

After conducting a thorough literature survey and discussions with academic experts, five criteria of supplier selection were identified to assess their impact on Supply Chain.

Performance (SCP) of healthcare organizations. These criteria included Cost, Quality, Service, Supplier Profile and Risk. Factors related to economic sustainability are primarily considered by Healthcare Supply chain HSC Professionals while selecting medical material suppliers (Nsikan et al., 2022). Given the significant importance of economically sustainable supplier selection criteria determined in previous studies, the model developed in this study for evaluating the influence on SCP of hospitals mainly included economic factors of supplier selection.

2.3 Supplier selection and business performance

Supplier selection in relation with business performance has been perused widely in literature. Rezaei et al., (2020) pointed out that supplier selection is a strategic process in organizations that play a critical role in the success of their business performance. Naibor et al., (2018) revealed that supplier selection criteria have a positive and significant influence on performance of manufacturing firms in Kenya. Famiyeh and Kwarteng (2018) studied the impact of supplier selection criteria on firm's operational competitive capability as well as on overall performance in Ghanaian business environment. The findings indicated that in order to achieve operational capabilities and improving the overall business performance, it is important to source from suppliers with sound track record of quality, service and common strategic/management fit.

(Milošević et al., 2021; Petrović et al., 2019) argued that supply chain efficiency or inefficiency is fundamentally dependent on supplier performance. Quartey-Papafio et al., (2021) maintained that high performing supplier selection is crucial to maximize supply chain surplus in the healthcare sector. Nyaberi et al., (2018) identified that supplier selection affects organizational performance mainly through quality products from supplier, decrease in costs and suppliers' good market reputation. Abuzaid et al., (2024) examined comprehensive supplier selection

criteria including traditional ones such as quality, flexibility, price, delivery, and those related to green practices. The study results indicated the significant effect of suppliers' capability to meet each criterion requirement on buying firms' performance.

Several authors have mentioned the importance of supplier selection decisions by emphasizing their impact on the entire supply chain, from procurement of raw materials to delivery of finished products to end users. Maureen and Aila (2023) concluded that improvements in supplier selection practices lead to the improved performance of supply chains of public sugar firms in Kenya. According to Rohmanna et al., (2022), the proper supplier selection contributes to decreasing production cost and improving supply chain performance in manufacturing industries. OWICH et al., (2023) presented the significant impact of supplier selection practices on supply chain performance of county referral Hospitals in Kenya. Although the significant impact of supplier selection criteria on buying firm's business and supply chain performance has been vastly identified in literature, the results of some studies remained ambiguous. Emon et al., (2024), Shi and Zhang (2023) maintained that the significance of supplier selection practices in determining the overall performance of an organization varies across industries allowing for further investigation of this relationship in the healthcare industry.

2.4 Improvement of Supply Chain Performance

The existing literature highlights the significance of measuring supply chain performance. In the last few decades, there has been a shift from traditional financial performance measures towards a balanced approach for quantifying the supply chain performance.

Sarode and Khodke (2009) proposed a multi-attribute decision making technique to evaluate the performance in supply chain. (Galankashi & Rafiei, 2022; Hahn et al., 2021; Saleheen & Habib, 2024) evaluated supply chain performance in terms of financial metrics such as cost efficiency, profit and sales growth and return on investment (ROI). The development of frameworks like the Supply Chain Operations Reference (SCOR) model provided a multifaceted view of supply chain performance measurement encompassing metrics ranging from operational efficiency and effectiveness to adaptability and responsiveness. The results of a study conducted by Lemghari et al., (2018) underscored SCOR model as a strategic resource and an integrated construct to measure supply chain performance.

Various other researchers started incorporating non-financial metrics alongside the financial ones to capture a comprehensive and multi-dimensional view of supply chain performance (Israel et al., 2023). Alahmad, (2021) defined supply chain performance as a supply chain's ability to meet customer demands by ensuring product availability in a profitable manner. They identified factors including timely delivery, delivery reliability, forecasting accuracy, cost control, and responsiveness to varying requirements to quantify supply chain excellence.

Bhagwat and Sharma (2007) asserted that performance metrics at the strategic level including rate of return on investment, flexibility to meet particular customer needs, delivery lead time responsiveness and buyer-supplier partnership level are very important when measuring the supply chain performance. Lanka et al., (2016) highlighted the significance of measuring supply chain performance in terms of operational efficiency and effectiveness including metrics related to on-time delivery, delivery reliability, and inventory turnover and order fulfillment lead time. These metrics are vital to measure the flexibility and resilience of supply chains to manage risk and uncertainty (Paul & Saha, 2025).

According to (Avittathur & Jayaram 2016; Galankashi & Helmi, 2016), an organization's supply chain performance is heavily determined by its lean and agile practices. Due to the growing attention towards resilient supply chains, Karl et al., (2018; Singh et al., 2019) studied the metrics related to responsiveness to measure supply chain performance in terms of agility, delivery reliability, flexibility and visibility. These parameters evaluate the ability of a supply chain to respond to the variability and functional disruptions. Some researchers also put emphasis on measuring supply chain performance from quality management perspective. The success of an organization's supply chain performance is strongly related to its quality management practices (Waseem & Yusoff, 2025). Machado et al., (2019) identified quality metrics to ensure compliance to the quality standards focusing on performance measures related to continuous improvement, sustainability, stakeholder engagement, absence of defects and supplier quality management.

Bhagwat and Sharma (2007) in their earlier study integrated customer management with supply chain management by including customer-centric metrics to measure supply chain effectiveness to meet or exceed customer expectations. Healthcare procurement usually includes medical supplies such as; medications, surgical instruments, disposables, medical equipment and devices, non-medical supplies and other support services such as maintenance and IT support that are directly associated with human life (Adebayo et al., 2024).

As per the standards established in guidelines on minimum standards for establishment of hospital pharmacies in Pakistan, after selecting the suppliers, their performance in terms of quality, safety and efficacy of supplied products, and contribution towards attainment of buying organization's goals should be assessed through an ongoing mechanism. This necessitates the rational identification of the performance metrics to continuously appraise the supply chain performance of the hospitals so the performance shortfalls are pointed out and dealt with timely and accurately.

Rashidi et al., (2020) placed more emphasis on managerial KPIs by highlighting their ability to recognize the process loopholes and offer remedies to ensure the smooth functioning of hospital supply chain. Another study by Langarizadeh et al., (2024) conducted a thorough systematic literature review on key performance indicators (KPIs) to measure supply chain performance of

hospitals. Their study identified 64 KPIs and grouped them into three key categories: financial, clinical, and managerial. Amos et al., (2020) studied performance measurement in public hospitals in Ghana which highlighted that the quality of service delivery, learning and growth and operational effectiveness have an equal effect on the performance of healthcare delivery.

A systematic study of healthcare supply chain KPIs by Senna et al., (2023) indicated that healthcare supply chain delivery reliability and responsiveness are the antecedents to the quality of healthcare supply chains. A profound analysis on the performance indicators of supply chain performance underscores the significance of performance measures related to operational reliability and agility. Hence, this study emphasizes particularly on determining the impact of the critical success factors of supplier selection on the hospital supply chain performance from the managerial perspective by using delivery reliability and responsiveness as the key performance metrics.

2.5 Hypotheses

2.5.1 Cost

Traditionally, cost has been considered an important factor in supplier selection. Cost criterion has evolved from focusing merely on the unit price (Weber et al., 1991), discounts and payment terms (Dickson, 1966) to a broader concept that not only includes logistics and quality expenses (Karpak et al., 2001), but also the total cost of ownership (Khurruam & Bhutta, 2003)

In literature, cost has been a widely studied factor of supplier selection along with other criteria across different sectors. Suppliers are generally assessed on the cost-related dimensions during the initial screening stages (Jharkharia et al., 2007). Cost includes the purchase price, transportation and carrying costs as well as the payment terms (Yu et al., 2008). Cost criterion involves determining the purchase price, transportation cost, handling cost, and transaction processing costs associated with purchasing from a supplier (Alkahtani et al., 2019). Despite the inclusion of non-price criteria in supplier selection decisions, cost remains one of the primary factors that are considered, especially in less complex purchase decisions (Cheraghi et al., 2011). Ekiyor et al., (2019) found a statistically significant relationship between supplier selection criteria including cost, quality and timely delivery and operational performance of pharmacies. Kannan & Tan (2002) maintained that cost has historically been the core economic criterion of supplier selection but its impact on firm performance must be determined alongside other criteria. A recent study conducted by Abuzaid et al., (2024) highlighted that cost alongside the bundle of criteria to evaluate suppliers explains a significant difference in purchasing firm's performance. However, the study emphasized that the direct effect of cost/price on firm performance is dependent on the context and thus should be explored across various contexts or industries. This study therefore hypothesized:

H1: *Cost as a factor of supplier selection significantly relates with supply chain performance of the buying hospital.*

2.5.2 Quality

Quality is the consistently adopted factor across multi-criteria decision-making models for supplier selection outpacing cost that has been a largely applied factor traditionally (Ho et al., 2010). In the studies conducted during the mid-20th century by (Dickson 1966; Wind et al., 1968), quality gained importance as a dominant criterion of supplier selection outdoing delivery, performance history and cost. D. M. Lambert et al., (1997) claimed quality, delivery, and service as more critical criteria of supplier selection than cost in influencing the company performance. Another early study by Vonderembse and Tracey (1999) identified a link between quality and manufacturing performance.

Quality, as defined by Holjevac (2008), is an integral part of a product or service that determines its ability to consistently meet or exceed the customer expectations. A significant amount of literature is devoted to identify the factors or methods to evaluate quality. Quality as a factor of supplier selection can be critically assessed by dividing into the qualitative and quantitative methods (Abdolshah, 2013). Continuous improvement programs, certifications such as ISO 9000, capability of handling abnormal quality, rate of rejects, quality of customer and support services and ease of repair are the commonly employed factors for assessing suppliers in terms of quality (Tektaş & A Aytakin, 2011; Teng et al., 2005). Numerous studies in healthcare procurement highlighted supplier quality as a strong predictor of hospital performance (Bahadori et al., 2020; Miah et al., 2014). Therefore, it is hypothesized:

H2: *Quality as a factor of supplier selection significantly relates with supply chain performance of the buying hospital.*

2.5.3 Service

Service is consistently recognized as one of the key criteria of supplier selection besides cost, quality and delivery (Naqvi & Amin, 2021). Despite being ranked slightly below quality, service is a critical criterion of supplier selection (Wilson, 1994). According to Donaldson (1994), service comprises all those activities that seller offers to enhance or augment the product that holds value for the buyer. The study specifies service as a value-added competitive dimension and important in maintaining buyer-seller relationships. Different researchers have established measures to evaluate service as a criterion of supplier selection. Reliability of delivery service, after-sales service or technical support, warranty, responsiveness, information sharing and transparent communications are among the commonly identified dimensions to evaluate supplier service capability (Konys, 2019; Suraraksa et al., 2019).

Ho et al., (2010) related supplier service capability to long-term competitive advantage and sustained performance of the company. Several studies

in healthcare settings signified a link between services offered by supplier and organizational performance (Bahariniya, 2024; Manivel & Ranganathan, 2019). Thus, this study hypothesized:

H3: *Service as a factor of supplier selection significantly relates with supply chain performance of the buying hospital.*

2.5.4 Supplier Profile

Supplier's profile is a complementary criterion that allows for the detailed scrutiny of the potential suppliers, especially to manage risk or pursue strategic partnerships with suppliers (Taherdoost & Brard, 2019).

According to Mwikali and Kavale (2012), Supplier profile entails the performance history of the supplier that facilitates the decision-making for selecting suppliers. Their study further identified financial health, customer base as well as past performance of supplier related to production schedules, response to market, and its ability to make commercial relations and business references. Another study conducted by Forghani et al., (2018) highlighted financial status, management and organization, supplier facilities and capacity, past record documentation, good manufacturing practice, environmental regulation compliance, occupational health and safety management practices as the key components of supplier profile. Similar dimensions have also been discussed by Reid-Regier and Snage (2022). Financial credibility of supplier and past performance are considered as the key attributes of supplier profile necessary for preliminary evaluation of supplier (Halizahari et al., 2020; Maina, 2013).

Two studies conducted in Kenya indicated that supplier profile alongside quality, service levels, and cost are among the key criteria that significantly influence procurement performance (Akinyi Odhiambo, 2015; Chemjor, 2015). Studies relating supplier selection and business performance show that careful evaluation of selection criteria including profile attributes such as financial stability, capacity and performance history leads to better organizational outcomes and competitive advantage (Ittner et al., 1999). The findings of Naibor et al., (2018) revealed the positive and significant relationship between financial status evaluation and the performance of manufacturing firms. Therefore, this study hypothesized:

H4: *Supplier profile as a factor of supplier selection significantly relates with supply chain performance of the buying hospital.*

2.5.5 Risk

Risk is an inevitable phenomenon in supplier networks that, without proper management techniques not only causes disruptions in the system but also requires significant time to recover (Hallikas et al., 2004). Risk has become a key criterion in supplier selection theory and practices which captures both the probability of the occurrence of supplier-related risks and their consequences on the buying firm performance (Wagner & Bode, 2008; Zsidisin, 2003).

Chopra and Sodhi (2004) maintained that risk in supply chains can be caused by supplier, company's internal processes or customers, classifying them into six interruptions: delays, disruptions, system breakdowns, and information processing problems, intellectual property breaches or procurement failures. Their findings served to establish a link between exposure to such risks and firm performance encouraging risk wary supplier selection. Kleindorfer and Saad (2005) showed that companies with explicit supplier risk management procedures tend to maintain better performance. Greater supply chain risks result in poor performance metrics affecting inventory costs, lead-time, flexibility and responsiveness (Bhatnagar & Technovation, 2005).

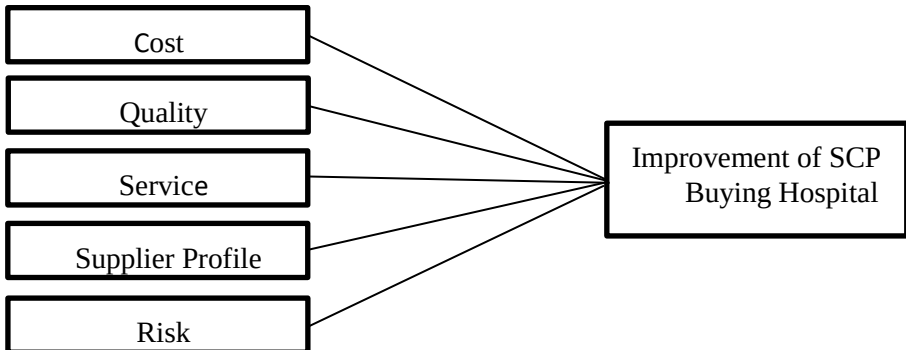
Mwikali and Kavale (2012) discussed that global supplier selection decisions are strongly influenced by perceived risks while emphasizing mainly on the geographical location and political stability of the suppliers' home country as the components to evaluate potential suppliers. (Viswanadham et al., 2013) highlighted the significant relationship between performance and risk criterion along with cost and quality. Another study maintained that identifying the risk factors that affect the supply chain performance is important Avelar-Sosa et al., (2014). It is therefore hypothesized:

H5: *Risk as a factor of supplier selection significantly relates with supply chain performance of the buying hospital.*

3. Methodology

In general, this research is a correlational study that uses quantitative analysis to describe the relationship between critical success factors of Supplier Selection and supply chain performance in the healthcare sector. Primary data was collected through questionnaire surveys and data was analyzed with the help of SPSS software. The proposed conceptual framework is shown in Figure 1.

Figure: *Conceptual Framework*



3.1 Questionnaire Design

Both paper-based and web-based questionnaires designed in English were provided. The content included structured statements related to the five independent variables proposed as CSFs of supplier selection for improving SCP in the healthcare organizations primarily hospitals. Research scales from previous studies with slight modifications were used to match the study context. Supplier selection criteria were measured by adapting items from previous studies to ensure validity. In order to operationalize cost, 5-item scale was adapted from (Göncü & Çetin, 2022; Hinrichs-Krapels et al., 2022; Visani et al., 2016). 5-item scale for measuring quality was taken from studies by (Chai et al., 2013; Ho et al., 2010; Kannan & Tan, 2002), 6 item scale for service was adapted from (Dickson, 1966; Donaldson, 1994; Forghani et al., 2018; Ghodsypour & O'Brien, 1998; Hsu & Lee, 2023), supplier profile was measured by taking the 4 item scale from (Kannan & Tan, 2002; Verma & Pullman, 1998), risk was measured using a 3 item scale from (Wagner & Bode, 2008; Zsidisin, 2003).

Questionnaires were formed using Simple attitude scales to reflect responses from 'strongly disagree' to 'strongly agree' based on the scores from 1 to 5. The data were collected using the scores for each measurement item in the valid questionnaires. The questionnaire was comprised of two parts; one part was designed to gain information about the variables and the other sought basic information about the respondents. The questions for each variable and the corresponding item indices used in the questionnaire are listed in Appendix B.

In order to identify the SCP of the healthcare organizations, statements regarding delivery reliability and responsiveness adapted from (Hedin et al., 2006; Kannan & Tan, 2002; Ravula, 2023; Tong et al., 2019) and (Beamon, 1999; B Sezen, 2008; Gunasekaran et al., 2001) respectively were added in the questionnaire to gather respondents' answers on a Likert scale from 1 to 5 for 'strongly disagree' to 'strongly agree'.

3.2 Research model

Data from the 90 questionnaires was analyzed using SPSS 23.0. A regression model was developed with one dependent variable (DV) and five independent variables (IV):

$$Y = \beta_0 + \beta_1 C_i + \beta_2 Q_i + \beta_3 S_i + \beta_4 SP_i + \beta_5 R_i \quad (1)$$

C_i = Cost, Q_i = Quality, S_i = Service, SP_i = Supplier Profile, R_i = Risk, β_0 = differential impacts on factors other than cost, quality, service, supplier profile and risk, β_1 = differential impacts on cost, β_2 = differential impacts on quality, β_3 = differential impacts on service, β_4 = differential impacts on supplier profile, and β_5 = differential impacts on risk. The overall importance of the regression model was tested by developing a hypothesis:

$$H_0: \beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 = 0$$

H1: At least one coefficient is non-zero.

4. Results

4.1 Respondent Profile

Both paper-based and web-based questionnaires were distributed to the managers of hospitals and medical facilities. In total, 150 questionnaires were distributed and 112 were collected from the respondents, with 83 suitable for analysis. The respondents' demographic information is summarized in Table 2 Study respondents' demographic information.

Table 2: Study Respondents' Demographic Information.

Background	Details	Frequency	Percent
Facility type	Public Hospital	9	10.8
	Private Hospital	70	84.3
	Others	4	4.8
Position	Supply Chain manager	25	30.1
	Procurement manager	20	24.1
	Others	38	45.8
Experience	Less than 5 years	21	25.3
	5 – 10 years	45	54.2
	More than 10 years	17	20.5

4.2 Correlation analysis

The relationships between five independent variables and one dependent variable are identified using correlation coefficients (see Table 3). Based on correlation alone, all hypotheses are supported as individually, cost, quality, service and supplier profile are significantly associated while risk is moderately associated with improved SCP.

Table 3: Correlation Analysis.

Supply Chain Performance			Cost	Quality	Service	Supplier Profile	Risk
Supply Chain Performance	Pearson	1	0.783**	0.810**	0.819**	0.760**	0.488**
	Correlation						
	Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000
	N	83	83	83	83	83	83

**Correlation is significant at the 0.01 level (2-tailed).

Table 4: *Summary of Model Fitting and Regression Analysis.*

Model	R	R-square	Adjusted Rsquare	Std. error of the estimate	Durbin- Watson
1	0.896 ^a	0.802	0.789	0.32743	2.023

a. Predictors: (constant), cost, quality, service, supplier profile, risk.

b. Dependent variable: SCP.

In the regression analysis, the F-test of the regression model shows that the value of F-statistic is 62.473 (Table 5) and the significant factor is 0.000 (<0.05), which shows that the regression model is statistically significant.

Table 5: *ANOVA Analysis of the Proposed Model.*

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	33.488	5	6.698	62.473	0.000 ^b
	Residual	8.255	77	0.107		
	Total	41.743	82			

Predictors: (Constant), cost, quality, service, supplier profile, risk. Dependent variable: SCP.

4.3 Regression Analysis

Table 4 shows the importance of criteria selected in this study in making supplier selection decisions ($R = 0.896$), which illustrates that 89.6% of variance in the supply chain performance of hospitals is a result of critical success factors of supplier selection (Cost, Quality, Service, Supplier Profile and Risk). The degree of model-fitting was good ($R\text{-square} = 0.802$) and these five determinants explained 80.2% of the variance. The Durbin–Watson Statistic of 2 suggests no serial correlation (Turner 2019). The value of the Durbin–Watson statistic in this study was 2.023, which is very close to 2, showing that there was no autocorrelation among residuals. Regression analysis was used to test the hypotheses, as shown in Table 6. When p-value is <0.05, there exists a significant relationship between the independent and dependent variables. If not, the independent variable is not considered to be significantly influencing the dependent variable.

These results strongly support H2, and suggest that supplier quality significantly relates to the improvement of SCP of the buying healthcare organization. Similarly, H1 and H3 were also strongly supported, suggesting that cost and services offered will also affect SCP. However, supplier profile and risk did not significantly contribute towards improvement of SCP of the healthcare organizations. The regression coefficients were 0.156 and 0.045 and the significance levels were 0.074 and 0.460 (>0.05) respectively. The model below

investigates how these five variables affect improvements in SCP: $I = 0.768 + 0.184C + 0.253Q + 0.184S + 0.127SP + 0.039R$

Table 6: *Coefficients of Supply Chain Performance*

Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	0.768	0.172		4.476	0.000
	Cost	0.184	0.063	0.257	2.935	0.004
	Quality	0.253	0.073	0.317	3.460	0.001
	Service	0.184	0.073	0.249	2.524	0.014
	Supplier Profile	0.127	0.070	0.156	1.810	0.074
	Risk	0.039	0.052	0.045	0.742	0.460

Dependent variable: SCP.

5. Discussion

The study contributes to and extends the existing research stream by empirically investigating the significance of CSFs of Supplier selection in determining the firm's supply chain performance. Specifically, the relationship between supplier selection criteria and supply chain performance is assessed in the context of healthcare industry of Pakistan. Based on the previous literature, five key supplier selection criteria in the healthcare sector are identified and the significant link between each criterion and the improvement of supply chain performance is determined (Badi & Ballem, 2018; Forghani et al., 2018; Stephen et al., 2016). The results present the Cost, Quality and Service among others as the highly rated factors significantly associating with the delivery reliability and responsiveness of the buying hospital. While cost has long remained a chief criterion for prioritizing suppliers, rising competition and the dynamic environment demands the institutions operating in the healthcare industry to make their processes more flexible and increase responsiveness towards diverse customer needs (Lambert et al., 1997). It has clearly been reflected in the results of this study that healthcare providers are also emphasizing non-cost-related CSFs in making supplier selection decisions to improve their overall supply chain performance, which allows them to increase their patient satisfaction and overall financial rewards.

The study findings offer profound implications to the managers in the healthcare sector for making supplier selection as well as evaluation decisions, particularly with the intent to improve the overall Supply Chain Performance. According to data analysis, quality is strongly associated with the improvement of supply chain performance of the hospital and it is the most significant factor because healthcare industry deals with the patients whose life and health depend on the reliability and quality of the supplied materials and products. The results show that managers perceive "Quality" to be the most important supplier attribute, followed

by “On Time Delivery” and “Unit Cost of Parts” (Verma & Pullman, 1998). A study conducted by Miah et al., (2014) also identified quality as an important factor in supplier selection decisions in healthcare supply chain management. Another recent study conducted by Beltran-Salomon et al., (2025) confirms the importance of supplier quality for the performance of supply chain in medical industry.

Cost is another key determinant of supply chain performance. The findings align with the study conducted in pharmaceutical supply which showed that cost is the most important criterion, followed by quality and company profile (Badi & Ballem, 2018). In addition, services offered by the suppliers also have a significant relation to the improvement of supply chain performance of the hospitals. Unlike the hypotheses, supplier profile and risk do not significantly relate to the supply chain performance of buying hospitals. The reduction in the importance of these two factors in supplier selection decisions occurs due to the growth of the buyer-supplier relationship in subsequent purchases and the use of IT systems that enable transparency and open communication between parties. The empirical results and the theoretical arguments presented in this study suggest that hospitals in Pakistan should realize supplier selection as a primary and critical function by elevating it to a significant level towards improving their overall supply chain performance.

The study has offered some recommendations to managers in the healthcare industry to develop supplier selection and management practices in order to optimize the performance of the dynamic healthcare supply chains.

- I. Closely coordinate with suppliers to design and implement cost-management practices. A supplier’s ability to reduce costs, improve quality, develop new processes, products, and services before their competitors significantly influences the profitability of a business (Famiyeh & Kwarteng, 2018). While cost is considered a strategic supply chain planning initiative, organizations can gain competitive advantage by controlling supply chain costs through redesigning and reconfiguring their supply base continually to reduce the impact on the overall supply chain (Sarode & Khodke, 2009). The research results indicate cost as an important criterion in modern supplier selection practices aside from quality and services. Thus, managers in the healthcare providing organizations should collaborate with their suppliers to design product development and delivery processes with the focus on value-added cost-reduction.
- II. Foster supplier quality management by initiating quality management programs that ascertain supplier quality standards and decentralize the purchasing and evaluation processes. Supplier evaluation programs allow the company to choose competent suppliers having good reputation and performance in terms of quality. The relationship between suppliers and the company should not remain restricted to purchasing but also include collaboratively managing and making quality products (Chau et al., 2021).

The study results have highlighted the importance of quality in supplier selection and ultimately on the overall supply chain performance of the healthcare organizations. This necessitates obtaining the quality commitment from suppliers by working closely with them.

- III. Establish an IT-based integrated network that not only connects healthcare service providers with their suppliers but also to the patients. A better IT system allows timely and accurate insights into various aspects across the whole supply chain including cost and quality and end-to-end business processes. It leads to better communication and cooperation among supply chain members which also improves overall performance of the company (Li et al., 2025). This would enhance collaboration among all the parties involved in healthcare service provision and allow the suppliers to define a holistic set of services that cater to the unique and ever-changing requirements of their customers in terms of delivery schedules, demand flexibility, response time and after-sale services.

In view of the results from previous literature and discussions with academicians and managers, effective supplier relationship management and the integration of IT systems bring about positive outcomes for managing cost, quality and service as well as mitigating the risk. This avers that engendering long-term, strategic and cooperative relationships with a limited number of dedicated suppliers, and maintaining transparency and continuous knowledge exchange between the hospital and its suppliers lead towards improvement in supply chain performance.

6. Conclusions and further research

This study identified CSFs of supplier selection and tested their impact on supply chain performance in the context of the healthcare industry primarily hospitals and medical centers in Pakistan. The results reveal that multi-criteria supplier selection decisions have an effect on supply chain responsiveness and delivery reliability of the healthcare providers. Supplier quality is identified as the strongest positive factor of supplier selection in determining the improvement of supply chain performance of the buying healthcare institutions. Total costs associated with purchasing from a particular supplier also significantly relate to the supply chain performance improvement. Similarly, study results highlighted that services offered by the suppliers influence the hospital's ability to manage flexible processes and become highly responsive to unique patient needs which, in turn determine their supply chain performance and affects their patient satisfaction level and profitability. Thus, it is evinced that despite the stringent cost reduction pressures, hospitals and medical centers take into account multiple criteria while making supplier selection and evaluation decisions rather than emphasizing solely on the price.

Few limitations were faced while conducting this study, for instance, despite the good response rate the sample size was still small. It is due to the fact

that supply chain, though implemented, has not been fully recognized as a separate functional area with designated personnel responsible to strategically perform sourcing and supplier selection practices. It is especially the case within small and medium sized institutions in healthcare industry in Pakistan where traditional methods of supplier selection are still in practice. This is the reason that this study primarily targeted large hospitals and medical centers for data collection.

Future studies should explore other potential CSFs of supplier selection not perused in this study and identify the reason why the two factors including supplier profile and risk, previously considered significant were not significant in this study. CSFs of supplier selection and the supply chain performance improvement should also be examined in other industries or countries so as to cater to the limitations encountered in the conduct of this study. This would contribute to identify a conclusive picture and explore the consistency of the results of this study in other contexts.

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