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Impact of lean supply chain practices on competitive advantage in the private hospital sector in Sri Lanka

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A B S T R A C T

Lean Practices have been implemented by private hospitals to get counterproductive solutions for reducing costs and gaining a competitive advantage. This research aims to examine the significance of lean practices on competitive advantage in the Sri Lankan private hospital sector to fill the knowledge gap. This research used a quantitative approach in which primary data was collected through a questionnaire-based survey and an analysis was conducted using structural equation modeling using the SmartPLS software. The research reveals the level of impact of lean practices, 5S, Kaizen, Kanban, and Just in Time in achieving a competitive advantage in the private hospital sector. Studies have demonstrated a significant impact of adopting the Just in Time approach in comparison to other established lean practices within the Sri Lankan private hospital sector, highlighting its unique and valuable contribution for health services. Researchers demonstrated when comparing Just in Time with other chosen lean practices for the study from the perspective of supply chain professionals, Just in Time contributes significantly to the competitive advantage of the Sri Lankan private hospital sector.

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1. Introduction

Business entities in industries are using different types of strategies to get effective solutions to avoid the inefficiencies and deficiencies caused by the daily processes and lean practices are a unique method that can be applied efficiently to solve these problems. Identified studies encompass the contribution of lean practices to improve operational performance in the Sri Lankan private hospital sector and the industry is experiencing significant changes as a result of the economic and social instability. The healthcare industry in Sri Lanka is segmented into private sector-owned hospitals and government-owned hospitals (Wijewardana & Rupasinghe, 2013; Ilangakoon et al.,2021). Sri Lanka's private healthcare sector is a significantly expanding industry. The main causes of the challenges faced by the private healthcare sector are government regulations, inflation, and problems with imports and exports. All of these factors have an direct or indirect effect on consumers, either directly or indirectly. The private sector must execute strategies to enable the business to supply services to customers in a methodical manner and at a reasonable price. In Sri Lanka, there are more than a hundred private hospitals, although only a small percentage has the finest facilities. Through this study, the present health issues in Sri Lanka's private sector hospitals were taken into consideration together with the country's current economic scenario. As previously indicated, the private health industry faces challenges in maintaining a competitive edge. As such, the authors emphasized three key objectives to manage: cost reduction, waste management, and quality service (Habidin et al., 2014). In consideration of all these factors, the private hospitals in their competition with one another, should give close attention to customer satisfaction, service quality, and medical supply chain efficiency. Given these and other considerations, the goal of this study is to examine how lean strategies could assist private hospitals to reach their objectives and gain a competitive edge by enhancing performance and service quality (Sengun, 2017). The majority of the practical lean supply chain management tools include the Toyota

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Production System concepts, which were created to address the need of boosting production efficiency by reducing waste, stock, and labor (Kelendar, 2020).

Having been quickly embraced by the manufacturing processes, the Toyota Manufacturing System subsequently extended to the service industries as well. Lean philosophy originated in Toyota manufacturing company and had since grown and moved to the healthcare sector. The fundamental concepts and guiding philosophies have been developed to improve lean healthcare practices in the field of medicine (Kelendar, 2020). The lean supply chain techniques, such as Kanban, Kaizen, the 5S method, and Just-in-Time are widespread in the medical industry. The Kanban lean technique is an approach for managing the flow of goods among customers, external suppliers, and parties involved in the production process (Alemsan et al., 2022). The Kaizen strategy, which is based on a continual improvement approach, motivates employees who frequently participate actively in improving corporate operations. Businesses can use all of their resources to create a methodical process that continuously reduces waste in industrial operations by using this Kaizen tool (Machadoa et al., 2015). Instead of placing components through production based on future demand, the just-in-time manufacturing strategy encourages gathering goods via manufacturing based on actual demand. Inventory levels can be significantly decreased by using the JIT method, which also improves cash flow and requires less space (Wijewardana and Rupasinghe, 2013). Through the application of the 5S technique, businesses can improve productivity, reduce waste that occurs from disorganized work processes, and prevent unexpected costs brought on by waste and procedures that are spontaneous. Currently, there is a lack of information available regarding the adoption of lean supply chain strategies in Sri Lanka's private healthcare industries, and how it has affected the competitive advantage among the private healthcare service providers. To fill this research gap exists on the impact of lean supply chain management on the competitive advantage of the Sri Lankan private medical sector, the authors have conducted this study and came up with findings that can be beneficial to the improvement of the private medical sector in Sri Lanka.

When applied to operational procedures, lean appears to be a technique that could help healthcare organizations improve. Lean has also received recognition from several authors for producing substantial particularly long-lasting effects (Machadoa et al., 2015). In this perspective, an organization's capacity and competitiveness are determined by its capability for knowledge generation and dissemination. Encouraging sustained advancement and competitive advantage through information transfer and execution among companies is likely the most important factor in actively participating in lean initiatives in the health sector. Because the private healthcare industry depends on the efficacy and efficiency of each of these processes, it must apply the lean methodology in order to improve. To prosper in this extremely competitive and ever-changing market, private hospitals must establish a competitive advantage.

2. Literature Review

Applying lean supply chain tools to the hospital and healthcare industry has made a major impact on organizations in different aspects, solidifying the overall performance of those hospitals and leading to a higher rate of customer satisfaction. Lean management is a philosophy that seeks to reduce waste while increasing value for customers. It is a method of managing an organization that focuses on continuous improvement, customer satisfaction, and employee empowerment. With the introduction of the lean concept to the business environment, those applications have been adopted by the hospital industry to a considerable extent that can be evaluated as an individual component that can affect the overall performance of those organizations in terms of working efficiency, cost reduction, and demand management leads to customer satisfaction and competitive advantage. It is important to identify the necessity of improving the knowledge regarding lean management methodologies to implement sustainable innovations and flexible frameworks to conduct medical-related processes in hospitals which can be used effectively to improve competitive advantage in the private healthcare sector as well. As a growing market, it is vital to improve the service quality of the healthcare sector to address the social pressure and the increasing demand of the public. When it comes to functions in a private hospital, it includes processes regarding treating the patients directly such as giving medicines, food, and conducting surgeries while some other aspects that help to maintain the organizational process which patients do not directly benefit such as human capital management, finance, infrastructure management, etc. However, when paying attention to the supply chain practices within the private medical sector, it feeds both functions that directly affect treating patients and functions that affect maintaining the organizational process. It implies that the supply chain is performing a vital role in the private medical sector, thus it is important to identify the loopholes, wastages, unwanted costs, and bottlenecks within the supply chain and eliminate them to maintain a smooth flow of material, information, and cash within the organization. There application of lean practices into the supply chain function of the private medical sector can ensure the quality standards of the supply chain while conducting such a smooth operational flow. The findings of literature reviews on this research area of interest are outlined in the following subsections as the foundations to the emperical study.

2.1 Private Health Care Sector

In the healthcare industry, the private sector refers to entities that offer health products and services but are not completely owned by the government of that particular country (Clarke & Paviza, 2018). The private sector is extremely diverse in all industries. According to Wolf and Toebes (2016), private hospitals are necessary to implement widespread health coverage. Organizations like non-profits and multinational corporations are involved in the direct provision of healthcare by offering healthcare facilities, medical supplies, and financial support related to healthcare in order to raise the bar for the global healthcare sector. The research conducted by Lawal, et al. (2014) discuss Private physicians, pharmacies, and hospitals can

be identified as the direct service providers of the private health care industry while technological and industrial firms related to healthcare act as the secondary elements of the privatized healthcare system. However, it leads to a higher quality of service and lower rates of accessibility that maintain the balanced shares of customers between the countries' private and public health sectors. Lean practices are implemented in different business sectors to eliminate waste while adding value to the end consumers. With time, the medical sector also has implemented some of the lean practices to make their processes efficient while the medical supply chain also adopted different lean practices to eliminate waste and reduce cost within different supply chain functions. Selecting the best lean practices and incorporating them with advanced technologies has been proven to be effective in terms of reducing unnecessary costs and minimizing time duration for each supply chain function. However, it is crucial to identify the degree of impact that each of the commonly used lean supply chain practices has on the competitive advantage of the private medical sector to achieve performance excellence while providing the best quality services to customers at considerably lower prices.

With the growing challenges due to high demand and the advancement of technology, the healthcare sector requires more dynamic and flexible approaches to satisfy the needs of the patients and to improve the quality of the healthcare service. Applying lean management to the supply chain aspect of the medical sector brought benefits to the healthcare industry by minimizing wastage, reducing costs, improving efficiency, and minimizing the workload of the employees which satisfies them about their professions. When it comes to the private healthcare sector, lean supply chain management can be used as a tool to earn a competitive advantage and will help to provide the best service to the customers with premium quality.

2.2 Private Health Care Sector in Sri Lanka

Nonetheless, the private medical industry has had a substantial impact on the nation by offering healthcare facilities at a premium with better quality and more effective service delivery. A significant proportion of Sri Lanka's 141 private hospitals are situated in the country's Western Province, according to the medical statistics unit of the Ministry of Health (Ministry of Health, 2017). By offering medical services to the public, these medical facilities make the required technical and human contributions to the nation while also lessening the workload and overall expenses of Sri Lanka's public health system. The research conducted by Ilangakoon et al. (2021) suggests that implementing technological innovations and lean management practices are important to boost the operational performance of the medical services.

2.3 Lean Supply Chain Management in Health Care Sector

In the healthcare sector, supply chain management can have a significant impact on customer satisfaction, organizational performance, and ultimately, gaining a competitive edge. Lean management techniques improve the overall process in the healthcare supply chain in terms of quality, efficiency, and cost reduction. They also improve the impact of lean management on healthcare supply chain management by integrating internal and external supply chain processes.

A study carried out by Chakraborty and Gonzalez (2018) about the supply chain framework of U.S. hospitals highlights the importance of an integrated supply chain framework that streamlined their internal and external process of supply chain functions using lean management tools becomes useful for providing superior treatment to patients who get hospitalized, and the research advises companies to lean and standardize three major sectors, such as physical goods, data, and financial components in both internal and external supply chains, to keep the integrated relationship between each other. Lean supply chain management is a key idea that has the potential to have an impact on the medical and healthcare sectors, according to Alemsan et al. (2022). However, according to this study, it is not sufficiently evident what relationship exists in the health supply chain between lean techniques and endurance competencies. As a result, it's critical to pinpoint the gaps in the healthcare sector and the need for lean management in the medical supply chain. It is crucial to comprehend responses and give healthcare management justifications for prioritizing the use of lean techniques to increase the necessary capacity for resilience in the supply chain of healthcare.

Using scientific measurements, ascertain the effect of the applied lean methods on the overall performance of those healthcare facilities research by Machado et al. (2013) compares the outcomes attained by several healthcare organizations in 15 worldwide countries. Similarly, Prado-Prado et al. (2020) also discussed the way of increasing competitiveness in healthcare through the adoption of lean management and further explained how the application of lean methods boosts customer trust and value in the organization. It is crucial to identify the scope of knowledge that passes by the local healthcare authorities to improve the lean management adaptations in the healthcare sector of a country. It is vital to explore new dimensions of lean supply chain management to improve efficiency and reduce waste in the operation process of the medical sector. According to a study by Regattieri et al. (2018), managing various materials in a hospital is essential from an economic standpoint as well as when considering its influence on patient care. This paper discussed the application of lean principles to supply chain management in the healthcare industry as the main finding of the research. Another research conducted by Chiarini (2013) indicates the reduction of waste in transporting patients inside big medical centers utilizing lean thinking techniques and hospital logistical solutions. The expense of patient transportation within large public hospitals is a worthy topic to be considered as this expense is frequently connected to transportation between hospital wards, divisions, and outpatient centers. Through a qualitative case study, this article tries to show how certain Lean Thinking tools, like spaghetti charts and activity worksheets, can assist cut expenditures associated with patient transportation and other types of waste. In particular, the case study examines the patient's journey from the emergency room to release or hospitalization in the event of trauma with

suspected fractures. Tiso et al. (2022) conducted a study to provide the most recent information regarding health lean management deployments while shifting the emphasis to the understudied context of local healthcare networks in general. The study examines key implementation factors for lean management, including its context, program features, implementation process, results, and enablers. Narayanamurthy et al. (2018) describe the lean applications for an Indian hospital and record the experience and effects of applying lean thinking at a healthcare institution.

While various recommendations and suggestions are available in these research publications, the private medical sector in Sri Lanka is unable to consider them all. Based on an analysis of the opinions of supply chain experts currently employed in Sri Lanka's private medical industry, the current study aims to determine the best recommendations and ideas that can be used to enhance quality standards and competitive advantage in the industry using lean supply chain practices.

2.4 Competitive Advantage through Lean Supply Chain Management

With the help of a lean supply chain, healthcare services can become competitive and sustainable through effective management of resources, and standardization of the chain of processes, which helps to reduce waste and costs incurred in the means of the supply chain within the organization. This will eventually help the organizations involved in the medical industry to improve their product quality and to make their customers well satisfied. While satisfying the customers, private medical service providers can enhance their profit margins by eliminating all types of wastage by using lean management and by eliminating existing bottlenecks of the supply chain by using lean applications to reduce the overall time duration taken to complete the supply process.

Khaddam et al. (2020) examine the indirect impact of supply chain management on the competitive advantage of an organization in the dimensions of relationships with suppliers, relationships with intermediaries as well as distributors, and relationships with customers. They took cost, quality, delivery time, flexibility, and creative commitments to their research as well. It implies the connection between supply chain management and the competitive advantage of an organization. However as discussed before it is crucial to identify the ideal lean management tools which should be adopted by different organizations attended in the healthcare industry according to their requirements, available resources, and expectations. According to Sengun (2017), the cost of healthcare has been rising rapidly in the world due to high supply and other costs, time wastage, and malpractices used in the healthcare sector brought up the requirement for new and easy approaches to reduce those elements which increase the cost of health care. Lean management can be identified as a mechanism that eliminates any activity that is unable to add value to the end product or service of the organization, the technical approach of the "just-in-time" lean tool is a successful strategy that can be applied to inventory management, which aims to reduce the size of the inventory and the costs associated with warehousing. Applying lean concepts to the healthcare supply chain can provide a wide range of benefits to the organizational process (Borges et al., 2020). Habidin et al. (2014) evaluate that the impact of Lean practices implemented on the supply chain of a public hospital can provide different advantages to the organization, and using lean management tools like Kanban and visual management techniques can acquire a competitive advantage by reducing wastage in every step of the supply chain process of those public hospitals. Less wastage in the supply chain process eventually increases the overall performance and the service quality of the organization resulting in a higher rate of customer satisfaction and a head start to gather more competitive advantage.

The research articles published by Prado-Prado et al. (2020); Antony et al. (2019) can be considered as important pieces of literature regarding the use of Lean Management Practices to increase competitiveness in the healthcare industry. Competitive advantage is a crucial component of competitiveness since it affects both rival organizations in the industry and the industry's ongoing development. To make it a reality, they have conducted this research to examine whether there is any utility in implementing lean practices in the healthcare sector. With rapid changes in lifestyles, the priority for all healthcare industries including hospitals, growing patient population, and growing demand for healthcare services has received special attention. To meet the desired results, it is important to check and identify the potential level that can be reached with an advanced level of health service supply. Durakovic et al. (2018) published about the application of Lean principles in different sectors in the past, the new trends in the use of Lean practices, tools, and the issues encountered when executing them for the initial time in organizations related to various industries. According to studies, the Lean concept is being improved and applied organizationally to cut costs and increase work efficiency, gain a competitive edge in markets related to industries, and avoid growth in the context of challenging new circumstances in the marketplace. The Lean approach has been proven to be effective in gaining a competitive advantage, and thus, research initiatives and knowledge sources are being produced in this area. The lack of awareness of Lean methods and procedures among many organization officials, including the officials who would deal with Lean processes, has been highlighted as the key barrier to the implementation of the Lean concept.

Khorasani et al. (2015) conducted a study on the effects of implementing lean approaches to improve healthcare quality and safety. Applying the lean idea can help an organization continuously develop, which will help the healthcare industry. These conclusions were based on several variables, including the utilization of technology, human knowledge of lean techniques, and the applicability of such approaches in the business organization to improve business operations. Wijewardana and Rupasinghe (2013) conducted a study in the Sri Lankan setting using that country's public healthcare system. This study assesses the lean concept's application to the healthcare supply chain system in Sri Lanka. Lean management was challenging to implement in Sri Lanka's healthcare supply chain, but the study suggests that by applying these principles to this area of the public sector of the country, superior performance and competitive advantage might be attained. The gap left by this study

of prior material is the lack of a comprehensive understanding of how lean management tools are applied in the healthcare supply chain in the private hospital industry in Sri Lanka. Even though there exists research on the implementation of a lean supply chain in Sri Lanka's public healthcare system, a thorough investigation of the effects that lean supply chain management may have on the private healthcare sector and the contribution of its results to the competitive advantage of those private medical institutions is needed. To gain the competitive advantage that those private medical institutes needed to boost demand and the profit margins of those organizations, this study carries out to fill the aforementioned research gap that identifies the significance of the use of lean supply chain management in the private healthcare sector of the Sri Lankan context. This study should be conducted to fill the above-mentioned research gap to identify the importance of lean supply chain management in the private healthcare industry of the Sri Lankan context to gain the competitive advantage that those private medical institutes require to increase demand and uplift the profit margins of those organizations.

Even though it was difficult to implement lean management in Sri Lanka's healthcare system, the study suggests that adopting these practices could lead to competitive advantage and performance excellence in the nation's public healthcare system. This review of past literature leaves the gap of not having a clear idea about the application of lean management tools in the healthcare supply chain in the private hospital industry in the Sri Lankan context. By conducting such a study, private hospitals in Sri Lanka can have healthy competition with each other and can improve their service quality, minimize costs, and reduce service rates which should be borne by the patients or customers to get treated by those hospitals. Such healthy competition between private hospitals in Sri Lanka ensures uninterrupted service to the customers that includes exposure to new technological aspects in the medical sector such as radiology equipment, robotics, and other surgical procedures. Implementing new technologies and trends provides backup for the public medical sector in Sri Lanka to build partnerships with the private sector hospitals to ensure the maximum level of medical safety for the general public in the country.

This current study provides an in-depth and critical analysis of the lean supply chain and how it should be engaged in the medical sector to enhance efficiency and effectiveness while eliminating waste, reducing costs, and gaining a competitive advantage. This literature review highlights the advantages that can be extracted from using a lean supply chain in the medical sector and by understanding common lean practices applied around the world and were taken into consideration as possible independent variables to derive the proposed conceptual framework of the study. This critical literature review supports to achievement research objectives of the study by consolidating the fact that, the lean supply chain can be effectively used as a tool to improve the competitive advantage of the private medical sector and helps to identify the impact of lean supply chain practices to the competitive advantage of private hospital sector in Sri Lanka. Furthermore, suggests some potential frameworks to enhance the effectiveness of applying lean tools in the medical sector while laying the foundation to choose the most suitable set of lean tools to be entertained in the Sri Lankan private medical sector to obtain high efficiency and effectiveness to deliver high-quality services to the community.

3. Data and Methodology

This study is conducted using a deductive approach which analyzes quantitative data collected from the private hospital in the Sri Lankan context. As a preliminary study, researchers identified some lean supply chain practices that were implemented in Sri Lankan context by conducting 12 in-depth interviews with supply chain experts. Based on the information explored from interviews and critical literature review, the researchers developed a questionnaire-based survey to collect quantitative data from the supply chain professionals in the private hospital industry in Sri Lanka, which is registered under the Ministry of Health. Stratified random sampling technique is used to collect the primary data from the respondents such as managers, executives, and workers in the private hospital supply chain field. The statistical software Smart PLS 4 was utilized to analyze the quantitative data that was gathered. The partial least squares structural equation modeling allowed for the determination of the crucial impact of lean practices on competitive advantage in the private hospital industry. This technique is used here because it is ideal for determining the relationship between different constructs selected for the study. Furthermore, the ability to analyze with small sample size, the ability to use non-normal data, the ability to cope with complex models, and the ability to conduct a predictive study are reasons for choosing partial least square structural equation modeling for analysis over other similar techniques such as factor-based structural equation modeling and sum regression (Khaddam et al., 2020; Alkhaldi and Abdallah, 2020). In this study, commonly implemented lean tools in the private hospital sector includes 5S, Kanban, Kaizen, and Just in Time, and the impact of lean supply chain practices on competitive advantage were measured. 5S, Kanban, Kaizen, and Just in Time reflective constructs have indicators that correlate with each other. The data was presented in interval form as one to five Likert scale responses that represented supply chain professionals' perceptions. After importing data, the model was built in Smart PLS 4 software, and the PLS-SEM Algorithm was calculated and yielded the results. Following that, these indicators were identified one by one, and the model was calculated until each construct achieved construct reliability and validity using Cronbach's alpha, composite reliability rho_a, and extracted average variance.

3.1 Conceptual framework for the study

To accomplish the objectives of the study, researchers use competitive advantage as the dependent variable and Lean practices such as Kanban, Kaizen, 5S, and Just in Time, as independent variables.

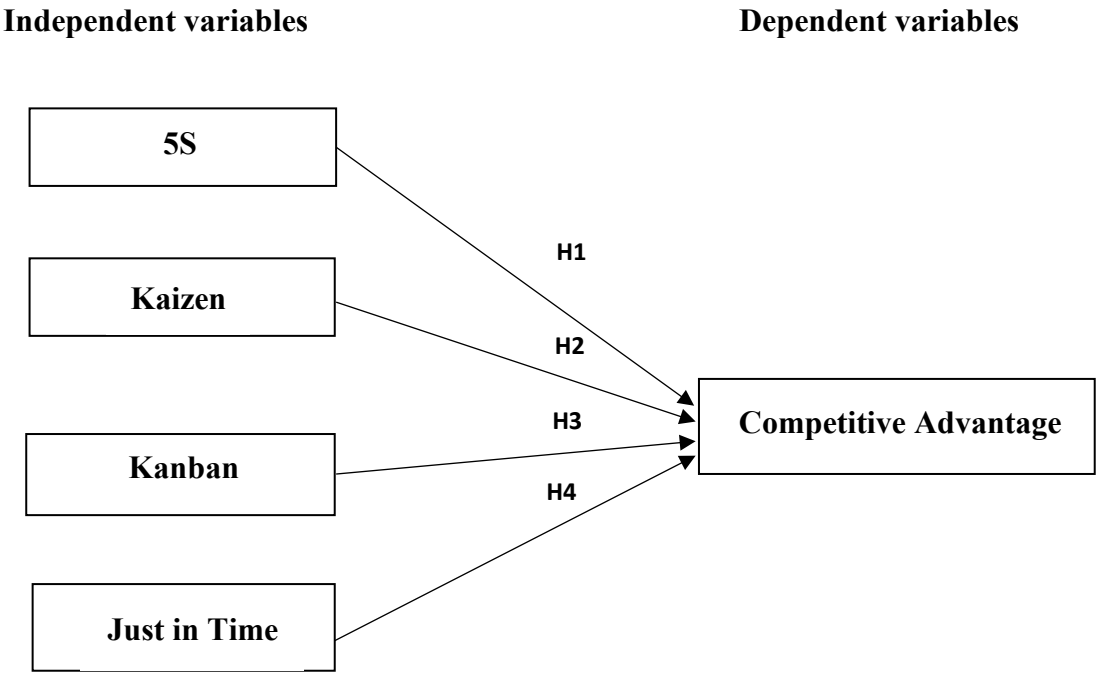

Fig. 1. Conceptual Framework

Source: Author's development based on the Literature & Preliminary Study

3.2 Hypothesis

Table 1
Hypothesis Development

No	**Hypothesis**
H1	5S has a significant impact on competitive advantage in the private hospital sector in Sri Lanka
H2	Kaizen has a significant impact on competitive advantage in the private hospital sector in Sri Lanka
H3	Kanban has a significant impact on competitive advantage in the private hospital sector in Sri Lanka
H4	Just in Time has a significant impact on competitive advantage in the Private Hospital Sector in Sri Lanka

Source: Author's development based on the Literature & Preliminary Study

4.Results and Discussion

This section outlines the results and discussion of this study.

4.1 Reliability and Validity

As an initial stage, authors paid attention to internal consistency, and the validity of data was gathered through a questionnaire-based survey. Cronbach Alpha is an internal consistency measure that determines whether all items in a construct accurately measure the construct. This is a measure of construct reliability, and to achieve it, the items in a construct must be highly correlated to each other (Khaddam et al., 2020). All items in all constructs have achieved an acceptable Cronbach's Alpha value, more than 0.70 ensuring internal consistency. Composite reliability measures whether the subscales are evaluating the single underlying construct accurately. When all elements are measured as a single scale rho_a is the suitable measure of composite reliability (Khaddam et al., 2020). When the components are viewed as distinct parts of an underlying construct rho_c is the suitable measure. In this study, since all constructs contain reflective items rho_a is an appropriate measure in the study. According to the study of Alkhaldi and Abdallah, (2020) indicate, two measures that measure two different constructs have discriminant validity if the total value of the correlations between the two measures is less than 0.9 after measurement error correction. In the validity test, where the authors set the minimum benchmark of acceptance at 0.50, KMO values greater than 0.60 were obtained. According to Table II, the Cronbach alpha value ranges from 0.748 to 0.910. As a result, there is strong internal consistency and dependability among the variables in the questionnaire items. In order to assess convergent validity, the authors looked at the loading factor, composite reliability (CR), and AVE value. It is required that the loading factor, CR, and AVE be greater than 0.5, 0.7, or 0.5. The proposed model has good convergent validity. The following table includes reliability and validity values for selected variables.

Table 2
Measurement construct validity with factor loading, composite reliability, and average variance extracted

Construct	Items	Factor Loading	Cronbach's alpha	CR (rho_a)	CR (rho_c)	AVE
5S	V1Q15S	0.816	0.804	0.816	0.866	0.567
	V1Q25S	0.835				
	V1Q35S	0.727				
	V1Q45S	0.763				
	V1Q55S	0.601				
Kaizen	V2Q1kaiz	0.784	0.784	0.800	0.874	0.698
	V2Q2kaiz	0.840				
	V2Q3kaiz	0.878				
Kanban	V3Q1kan	0.761	0.748	1.101	0.811	0.595
	V3Q2kan	0.610				
	V3Q3kan	0.912				
Just in Time	V4Q1JIT	0.669	0.836	0.861	0.885	0.611
	V4Q2JIT	0.638				
	V4Q3JIT	0.862				
	V4Q4JIT	0.884				
	V4Q5JIT	0.822				
Competitive Advantage	V1D1	0.922	0.910	0.932	0.927	0.527
	V1D2	0.817				
	V1D3	0.392				
	V2D1	0.912				
	V2D2	0.123				
	V2D3	0.79				
	V2D4	0.536				
	V3D1	0.501				
	V3D3	0.597				
	V3D4	0.816				
	V4D1	0.732				
	V4D2	0.699				
	V4D3	0.771				

Source: Author's development based on Structural Equation Modeling Analysis

4.2. R squared

R square explains the variance of an endogenous variable due to the exogenous variable. (Hair et al., 2013). In this scenario the endogenous variable competitive advantage has a variance of 0.944 due to the exogenous variables, 5S, Kaizen, Kanban, and Just in Time relationships, suggesting a substantial variance. This shows the variation in the independent variables explains the variation in the focus dependent variable of competitive advantage up to 94.4%.

Table 3
R squared Value

	R-square	R-square adjusted
Competitive advantage	0.944	0.944

Source: Author's development based on Structural Equation Modeling Analysis

4.3 Structural Model and Hypothesis Testing

This study examined the statistical significance of 4 initial hypotheses about the relationship between lean supply chain practices and competitive advantage in the private hospital sector in Sri Lanka. It determines the coefficients between independent and dependent variables. Furthermore, researchers analyzed the significance of the p-value on each coefficient derived from the SEM output.

Table 4
Significant path contribution

Path Diagram	T- Statistics	P Values	Significant
5S → Competitive Advantage	5.761	0.000	Yes
Kaizen → Competitive Advantage	5.803	0.000	Yes
Kanban → Competitive Advantage	2.639	0.008	Yes
Just in Time → Competitive Advantage	18.711	0.000	Yes

Source: Author's development based on Structural Equation Modeling Analysis

4.4 Path coefficients

The outer loadings show how each statement item affects the reflective construct based on the analysis done using Smart PLS software. The graphical representation of the results displays arrows that indicate the outer loadings, with the direction from the indicators towards the reflective construct (Khaddam et al., 2020). When all other variables in the model are held constant, the response of the dependent variable to a unit change in an explanatory variable is represented by the path coefficients, also referred to as the connection strength (Bollen, 1989). In the case of a positive coefficient, a unit increase in one construct causes a direct increase in the other construct to which it projects which is based on the size of the coefficient. A unit decrease in one construct in a negative coefficient leads to a direct decrease in the other construct it projects too, depending on the size of the coefficient. (McIntosh A. R. and Gonzalez-Lima, 1994). According to the given results, a unit increase in 5S has 0.247, Kaizen has 0.171, Kanban has 0.091, and Just in Time has a 0.545 increase in competitive advantage a positive relationship. Respectively, 5S, Kanban, and Kaizen show a minor contribution to the competitive advantage whereas Just in Time shows a high contribution to the competitive advantage in the private hospital sector in Sri Lanka.

With a significance value of less than 0.05 and a T-value of more than 2, Table 4 shows that all independent variables have a significant contribution to the path coefficient of dependent variables. The graphical results of the study are as follows (Figure 2).

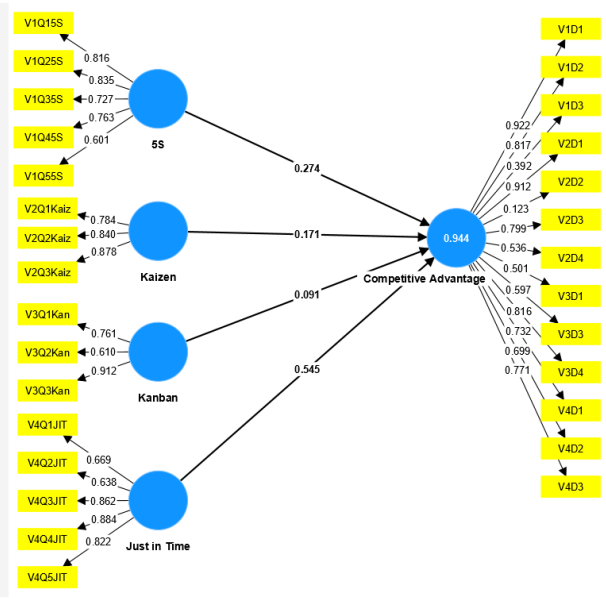

Fig. 2. Graphical result

Source: Author's development based on Structural Equation Modeling Analysis

The study by Regattieri et al. (2018) identified the importance of being innovative in lean supply chain management and discussed the secondary-level methodologies that can apply in the healthcare supply chain based on lean approaches to gain more competitive advantage. To determine the impact of the lean techniques implementation on the overall performance of those medical facilities that make use of scientific measurements, Machado et al. (2013) show the variations in results achieved by different healthcare companies in 15 different countries. This study creates value and eliminates wastage to satisfy the customer using kaizen as proposed in the model. Prado-Prado et al. (2020) investigate growing competitiveness in healthcare through the adoption of lean management and the application of lean methods boosts customer trust and value in the organization, as well as the lean managing view, which methodically seeks to restructure procedures in the medical services industry by utilizing the theoretical function to research approach. Munaa et al. (2021) proved their opinion based on the Indonesian healthcare context as a proven model of Just in Time and Value Stream Mapping. Borges et al. (2020) evaluate that the impact of Lean practices implemented on the supply chain of a public hospital can provide different advantages to the organization, and using the lean management tool Kanban can acquire a competitive advantage by reducing wastage in every step of the supply chain process of those public hospitals. Less wastage in the supply chain process eventually increases the overall performance and the service quality of the organization resulting in a higher rate of customer satisfaction and a head start to gather more competitive advantage. Lean tools have been used mainly for supply chain management, manufacturing businesses, and service businesses, and the next touch point is the healthcare sector. Many lean tools and techniques can be easily implemented and maintained for healthcare organizations, including Lean tools such as Kaizen, 5S, Kanban, and Value Stream Mapping (Antony et al. (2019); Senna et al. (2016)).

The study, which is based on Sri Lankan private hospital sector, identifies how selected lean practices can improve the competitive advantage. While reducing eight types of wastages, enhancing operational efficiency, uplifting productivity

growth, and minimizing inefficiencies in administrative and medical processes can lead to gaining a competitive advantage. Research has proved 5S, Kanban, and Kaizen have a minor contribution to the competitive advantage in considering supply chain professionals' perspective, whereas Just in Time has a high contribution to competitive advantage. In the Sri Lankan healthcare context, 5S is the most implemented lean practice but it does not much add value to the competitive advantage when comparing the results of Just in Time. Here, Just in Time is used to reduce the overall cost category, which directly helps to increase competitive advantage. Moreover, implementing Just in Time also has limitations, according to VEN (Vital, Essential, Non-Essential) inventory management policy, Just in Time applies to the non-essential inventory category only. When it comes to situations such as in case of emergency all equipment and medicines should be with the hospital. Kaizen has minor contribution to the competitive advantage while enhancing the continuous improvement of operational processes from upper management to lower coworkers. Increasing communication between departments indicates Kanban tool also adhering some minor contributions to the competitive advantage when considering the perspective of supply chain professionals' point of view. Researchers proved Just in Time has a high contribution to the competitive advantage as a foremost factor comparing other selected lean practices of the study with the supply chain professionals' perspective.

5. Conclusion

Lean management principles applied to the private hospital industry's supply chain and organizational structure may give the motivation needed to push boundaries and acquire the specialized knowledge needed to outperform rivals. Cost reduction, waste management, quality improvement, and increased efficiency are key attributes in a private hospital that can be developed using lean applications, and when combined with aspects such as safety and cleanliness, effective communication, and continuous improvement, these factors will ensure the organization's stability in the market with an advantage in performance, quality, and customer satisfaction. The use of lean tools helps the organization keep the operating environment clean, neat, and in a specific order to make the working process easier. These private medical service providers can reduce waste by employing lean tools, a technique known as "Eliminating Muda." Lean practices promote efficient inventory management in hospitals, resulting in fewer obsolete, expired, or damaged stocks. This will significantly reduce inventory holding costs and save the organization money. Furthermore, implementing the previously discussed strategies in the private healthcare sector can raise service standards and add value to organizations. Identifying current trends in lean supply chain management and hoping to implement them in a practical context can reap more benefits by reducing all types of waste and improving efficiency.

6. Future Research and Implications

The study's results suggest that further research on lean management is crucial for the healthcare sector, which is a highly dynamic industry focused on gaining a competitive edge through change adaptation. Both quantitative and qualitative research should be focused on the above context because of the volatility of the industry which leads to gaining more advantage while improving lean supply chain practices. Lean is a growing area of Supply chain sector, society should be aware of the applications, advantages, and limitations of lean practices. Future research must address the lean supply chain issue since knowledge of the supply chain improves understanding of lean in the supply chain. Extending similar research to focal organizations that deal with final consumers and other industry sectors like service industries, construction, and agri-food will further enhance the understanding of the field of lean manufacturing.

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