International Journal of Scientific Research and Management (IJSRM)
||Volume||12||Issue||05||Pages||6320-6330||2024||
Website: https://ijsrm.net ISSN (e): 2321-3418
DOI: 10.18535/ijsrm/v12i05.em06

Impact of Lean Manufacturing Practices on Waiting Time of Patients in Outpatient Department (OPD): A Study in the Sri Lankan Public Healthcare Industry.

J Thamilnila1[1], SP Aryarathne[2]

[1]Department of Operations Management, Faculty of Management, University of Peradeniya,
[2]Department of Operations Management, Faculty of Management, University of Peradeniya

Abstract:
This study aims to explain the impact of lean manufacturing practices on waiting time of patients at the outpatient department (OPD) in the Public hospitals. Cross-sectional data using a survey sample of 384 patients in the Kandy public hospitals with a satisfied random sampling were used. Data were analyzed using SPSS software. This study covers the four independent variables of lean manufacturing practices namely: 5S, visual management, kaizen, and Just in Time. The dependent variable is waiting time. The measurement instrument for lean manufacturing practices and waiting time was developed from comprehensive literature reviews. Results indicate that there is a negative significant impact of lean manufacturing practices on waiting time of patients in outpatient department (Beta = -0.626 & p=0.000). Therefore, these findings suggest that the theories of lean manufacturing and the knowledge-based view providing implementation of lean manufacturing practices can reduce waiting time for patients in outpatient department.

Keywords: Lean Manufacturing Practices, Waiting Time, Outpatient Department, Just In Time

1. Introduction

In this modern world, rapid changes in the environment has affected the smooth functioning of the business organizations (Errida & Lotfi, 2021). Organizations aim to become more decentralized and transform their traditional policies by implementing various strategic change tools to improve operations (Errida & Lotfi, 2021). With increased competition, sustainable development has pushed organizations to update their manufacturing frameworks to a smart level through the adoption of lean manufacturing practices (Kunyoria & Aila, 2022). Lean manufacturing, a philosophy centered on quality improvement and the reduction of waste, operates on the core principle of maximizing customer value while systematically eliminating the seven recognized forms of waste (Hammoudeh, et al., 2020). To address these forms of waste, lean manufacturing employs a range of tools and practices, including continuous process improvement (kaizen), the 5S methodology, value stream mapping, visual management, just-in-time (JIT) production, total quality management, and mistake-proofing (poka-yoke) (Sharma & Khatri, 2020).

The main goal of lean is to achieve the same performance using less inputs such as less time, less space, less power, less machinery, less materials, and less cost (Alefari, et al., 2020). Although lean manufacturing practices originally evolved within the manufacturing sector, they have found application in various industries, including healthcare (Hammoudeh, et al., 2020). While the goal of healthcare orientation is to maximize value for patients by minimizing waste and waiting time, a focus on patient value is expected to benefit others involved in healthcare (Hammoudeh, et al., 2020).

The Sri Lankan healthcare industry is an essential sector that plays a vital role in providing medical services to the patients. It is a mixed system consisting of a dominant tax-funded public system supplemented by a fee-for-service private sector (Kumar, 2019). The public sector provides most services in Sri Lanka's mixed health care system, accounting for all preventive care and most inpatient care (Kumar, 2019). The Sri Lankan government provides universal healthcare to its citizens and healthcare is free for all citizens (Rajapaksa, et al., 2021). Every year the government spends over Rs. 300 billion (Amarathunga, et al., 2021). Most people visit government hospitals for their medical requirements, and the Primary care or

contact care is provided by both the private sector and government sector (Amarathunga, et al., 2021). Moreover, in Sri Lanka mainly due to the high demand for free health services from government health institutions (Amarathunga, et al., 2021).

However, the public healthcare sector faces several challenges, including capacity constraints, waste, limited access to specialist care, and inconsistent service standards (Pujolar, et al., 2021). One of the most pressing issues in the Sri Lankan healthcare landscape is long patient waiting times, which have a direct impact on patient satisfaction. Prolonged waiting times not only influence how patients perceive their illness but also significantly contribute to dissatisfaction with healthcare services (Rajapaksa, et al., 2021).

Waiting times are a major component of patient satisfaction. Long waiting times have a negative effect on the patient's perception, increase the feeling of illness, and are the main cause of dissatisfaction with health services (Biya, et al., 2022). In many health care systems throughout the world, it is common of being postponed to access medical services. Long waiting times are a global phenomenon and more measures need to be taken to reduce patient waiting times in public hospitals (Biya, et al., 2022). In hospitals, there are several areas where patients may wait, including outpatient department, consultation room, laboratory, testing room, X-ray, etc (Lamb, 2021). Outpatient Departments (OPD) of hospitals represent an important stake in primary care provisioning (Amarathunga, et al., 2021).

In the Sri Lankan healthcare context, waiting time in public hospital OPDs is a significant challenge, with patients often complaining of experiencing long waiting times and queues (Rajapaksa, et al., 2021). The urgency of addressing this issue in the Sri Lankan context is evident, given the prevailing dissatisfaction among patients and the strain it places on healthcare providers (Jagoda, et al., 2019).

The performance gap of the study highlights that a large diversity of time duration spent between arrival to OPD and departure from the hospital, during which they go through a series of events, namely patients arrive at OPD, then being seated after getting the numbers (token), being registered for consultation, then waiting for a consultation, later on being consulted by a medical officer (Amarathunga, et al., 2021). Often, patients in hospital OPDs have to wait for a considerable period of time before seeking advice from medical or professional health workers. In a highly competitive healthcare management environment, long waiting times for patients at OPDs can adversely affect a hospital's ability to attract new business (Biya, et al., 2022). So, the first patient's impression on the healthcare delivery from the hospital begins at the OPD (Jayawardena, 2017).

Sri Lankan public healthcare industries, congestion in the OPD is primarily due to the limited space available in the waiting and consultation areas, leading to long queues at the registration desk and waiting room (Sabhapathige, et al., 2021). Another contributing factor is that doctors only examine a restricted number of patients per hour, resulting in delays and overcrowding. Also, Sabhapathige, R., Deerasinghe, D. and Ranasinghe, G. (2021) mention, some doctors tend to arrive late for their shifts, particularly during the morning hours. Additionally, the interruption of consultations for tea breaks lasting 15-20 minutes further exacerbates waiting times for patients (Sabhapathige, et al., 2021). Within the congested OPD, the small size of the laboratory inconveniences both patients and staff, as patients must wait for sample collection and report collection. In certain instances, patients are required to return to the OPD solely to show their lab reports, requiring them to obtain a new queue number. Participants also reported inadequacies in the OPD pharmacy counters, seating facilities, and the availability of pharmacists (Sabhapathige, et al., 2021). These are the practical reason for Sri Lanka's public healthcare industry waiting time of patients in OPD is exacerbated.

Theoretical gap of the study, focusing on queuing theory is a mathematical framework that can be used to analyze waiting lines and optimize service processes. It has been increasingly used as a decision-making tool in the service-providing sectors in developed countries to enhance service delivery. As an important part of lean methodology, in order to improve patient flow and reduce the number of queues, hospitals must implement queuing theory to schedule appointments (Alejo, 2021). In Sri Lanka, queuing theory has been used to reduce the waiting time at the Outpatient Department (OPD) of the hospital (Dilrukshi, et al., 2016). However, the potential of queuing theory as a strategic tool in the Sri Lankan public healthcare industry remains underexplored (Dilrukshi, et al., 2016), leaving a significant theoretical gap to be addressed.

Hence the problem statement of the study is: Is there is a significant relationship between lean manufacturing practices and waiting time of patients in OPD in the Sri Lankan public healthcare industry.

1.1 Research Objectives

- To identify the lean manufacturing practices in the Sri Lankan public healthcare industry.
- To investigate the impact of lean manufacturing practices on waiting time of patients in OPD in the Sri Lankan public healthcare industry.
- To identify the impact of 5S & Visual Management on waiting time of patients in OPD in the Sri Lankan public healthcare industry.
- To identify the impact of kaizen on waiting time of patients in OPD in the Sri Lankan public healthcare industry.
- To identify the impact of JIT on waiting time of patients in OPD in the Sri Lankan public healthcare industry.

2. Materials and Methods

The research methodology outlined based on the model on research onion by Saunders et al., 2009. The relationship between lean manufacturing practices on the waiting time of patients is investigated through the positivist research philosophy based on the quantitative research methodology. For this study, a survey has been used as the research strategy. This procedure has been used to address the developed research questions and conduct hypothesis validation, which is the basis of this study's deductive approach. This study has used a single cross-sectional time horizon since the researcher has collected data from a sample of individuals at a single point in time.

2.1 Population

The target population for this study consists of patients seeking healthcare services in OPD at public hospitals in Kandy district. There are 06 types of public hospitals in Kandy district (Ministry of Health, 2020). The research will focus on all 06 types of public hospital patients, such as teaching hospitals, district general hospitals, base hospitals (Type B), divisional hospitals (Type A), divisional hospitals (Type B), and divisional hospitals (Type C). According to the Ministry of Health, (2020), in Kandy public hospitals there are 2647468 number patients arriving in OPD at year.

Table 1: Population of the Study

Hospitals	Patients in OPD
Teaching hospitals	615,826
District general hospitals	214,816
Base hospitals (Type B)	257,695
Divisional hospitals (Type A)	712,156
Divisional hospitals (Type B)	673,609
Divisional hospitals (Type C)	173,366
Total number of hospital/ patients in OPD	2647468

(Ministry of Health, 2020)

2.2 Sampling

According to Krejcie and Morgan table the sample size is 384 patients. Stratifies sampling was chosen for this research because it allows for a representative sample to be selected from different strata within the population. In this case population consists of public hospitals in Kandy district in Sri Lanka. By dividing the hospitals into different subgroups (teaching hospitals, district general hospitals, base hospitals (Type B), divisional hospitals (Type B), divisional hospitals (Type C)), the researcher takes the sample includes a proportional method to select patients from each stratum.

Table 2: Sample of the Study

Hospitals	Patients in OPD
Teaching hospitals	89
District general hospitals	31

Base hospitals (Type B)	37
Divisional hospitals (Type A)	103
Divisional hospitals (Type B)	98
Divisional hospitals (Type C)	26
Sample of patients	384

2.3 Data Collection

The unit of analysis in this study is the individual patients of public hospitals in Kandy district. The primary data collection method will be a survey using a structured questionnaire. Questionnaire were distributed to individual level. The questionnaire will include validated scales by other researchers and a 5-point Likert scale. Questionnaire consisted independent variable as lean manufacturing practices (5S & Visual Management, Kaizen, Just In Time) and dependent variable as waiting time. The collected data will be analyzed uses the following data analysis techniques; descriptive statistics, outlier test, reliability test, validity test, test of multivariate assumptions, correlation analysis, and hypothesis testing using SPSS.

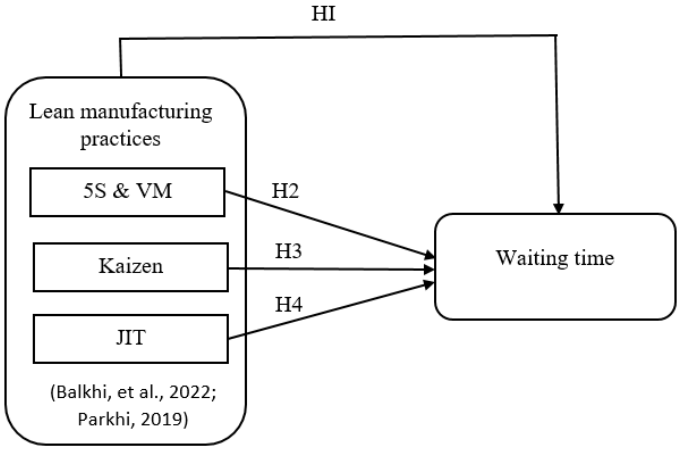

Figure 1: Conceptual Framework

This Figure one shows the conceptual model developed on this study. Based on the conceptual framework, this study develops four hypotheses. Flowing hypotheses are developed for this study.
Hypotheses 1 (H1): Lean manufacturing practices have a significant impact on waiting time.
Hypotheses 2 (H2): 5S and visual management have a significant impact on waiting time.
Hypotheses 3 (H3): Kaizen have a significant impact on waiting time.
Hypotheses 4 (H4): JIT have a significant impact on waiting time.

3. Results

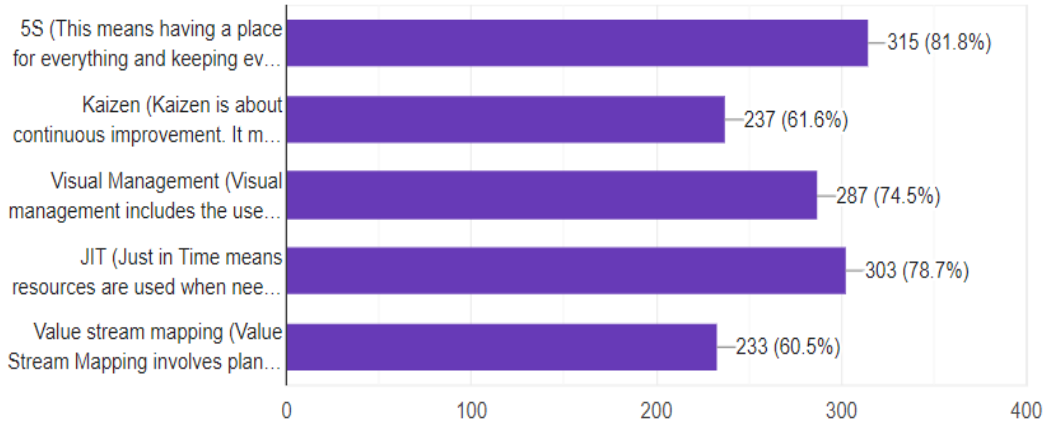

Figure 2: Lean Manufacturing Practices in Sri Lankan Public Healthcare
Sources: Survey data, (2024)

According to the analysis (figure: 2), exposed the lean manufacturing practices in Sri Lankan public healthcare industry. The survey data collected from 384 respondents provides valuable insights into the adoption of various lean manufacturing practices across healthcare facilities in Sri Lanka. It is evident from the data that lean manufacturing practices are indeed established within the Sri Lankan public healthcare industry. A notable majority of respondents reported the implementation of lean manufacturing practices, including 5S, Kaizen, Visual Management, JIT, and Value Stream Mapping. The significant presence of 5S practices, with 315 respondents acknowledging their adoption, highlights the importance placed on maintaining organized and efficient workspaces within healthcare facilities. Similarly, the kaizen principles by 237 respondents underscores a commitment to continuous improvement and innovation within Sri Lankan public healthcare industry. The utilization of visual management techniques by 287 respondents reflects efforts to enhance communication, facilitate process transparency, and promote standardization within healthcare industry. Furthermore, the implementation of JIT principles by 303 respondents shows a strategic approach to resource management and inventory control within Sri Lankan public hospitals. Also, the adoption of Value Stream Mapping techniques by 233 respondents underscores a commitment to identifying and eliminating inefficiencies within healthcare processes. So, according to the analysis confirm the widespread adoption of lean manufacturing practices within the Sri Lankan public healthcare industry.

3.1 Reliability & Validity

Table 3: Reliability & Validity Test

Variables	No Of Questions	Cronbach's Alpha	KMO and Bartlett's Test Values	P Value
Waiting Time	4	0.751	0.744	0.000
5S & Visual Management	7	0.760	0.798	0.000
Kaizen	7	0.709	0.726	0.000
Just In Time	8	0.899	0.925	0.000

Source: (Survey data, 2024)

Based on the reliability and validity analysis, Cronbach Alpha value have above 0.7 indicating high internal consistency among the data collected. Also the KMO measures of sampling adequacy for all variables are greater than 0.7 with the significance level of 0.000.

3.2 Normality Test of Variables

Table 4: Normality Test of Variables

Variables	Waiting Time	5S & Visual Management	Kaizen	JIT
Skewness	.961	-1.207	-1.124	-1.110
Std. Error of Skewness	.125	.125	.125	.125
Kurtosis	.495	.644	1.527	.738
Std. Error of Kurtosis	.248	.248	.248	.248

Source: (Survey data, 2024)

The table four indicates that all variables have skewness (+1 to -1) and kurtosis (-3 to +3) within normal limits. So, the researcher can conclude that the variables are normally distributed.

3.3 Multicollinearity

Table 5: Multicollinearity

Model		Collinearity Statistics	
		Tolerance	VIF
1	5S & Visual Management	.460	2.174
	Kaizen	.772	1.295

	Just In Time	.476	2.102
a. Dependent Variable: Waiting time			

Source: (Survey data, 2024)

The table indicates tolerance values above 0.1 and VIF values below 10. It confirming the research is free from multicollinearity.

3.4 Correlation analysis

Table 6: Correlation analysis

		Waiting Time	5S & Visual Management	Kaizen	Just In Time
Waiting Time	Pearson Correlation	1	-.585**	-.406**	-.559**
	Sig. (1-tailed)		.000	.000	.000
	N	384	384	384	384
5S & Visual Management	Pearson Correlation	-.585**	1	.456**	.716**
	Sig. (1-tailed)	.000		.000	.000
	N	384	384	384	384
Kaizen	Pearson Correlation	-.406**	.456**	1	.425**
	Sig. (1-tailed)	.000	.000		.000
	N	384	384	384	384
Just In Time	Pearson Correlation	-.559**	.716**	.425**	1
	Sig. (1-tailed)	.000	.000	.000	
	N	384	384	384	384
**. Correlation is significant at the 0.01 level (1-tailed).					

(Source: Survey data, 2024)

Based on the correlation matrix, it is evident that all independent variables; dimensions of lean manufacturing practices have a negative correlation with the dependent variable; waiting time and the correlation coefficients are significant at 1%. However, it is noted that the independent variable of 5S & visual management is a moderate negative correlation coefficient of -0.585, the independent variable of kaizen indicated a moderate negative correlation coefficient of -0.406, and the independent variable just in time indicated a moderate negative correlation coefficient of -0.559, with waiting time which was significant at 1%.

3.5 Regression Analysis

For multiple regression, the coefficients table shows the significance of each variable individually after controlling for the other variables in the model. Based on the regression statistics in table , the constant amounts to 6.426, which means the level of waiting time even in the absence of the independent variables.

Table 7: Coefficient Values

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	6.426	.310		20.696	.000	5.816	7.037
	5S & Visual Management	-.497	.087	-.336	-5.722	.000	-.668	-.326
	Kaizen	-.234	.074	-.144	-3.177	.002	-.378	-.089
	Just In Time	-.301	.067	-.258	-4.468	.000	-.434	-.169
a. Dependent Variable: Waiting Time								

(Source: Survey data, 2024)

For this table significant values must be P<0.05 that is the all variables (5S & visual management, kaizen, just in time) are making a significant contribution in the prediction of the dependent variable of waiting time.

$$Y = 6.426 + (-0.336)\,X1 + (-0.144)\,X2 + (-0.258)\,X3$$

Y - Waiting Time
X1 – 5S & Visual Management
X2 – Kaizen
X3 – Just In Time

3.6 Hypothesis Testing

Table 8: Hypothesis Test Result

N	Hypothesis	B	p-value	Result
H1	Lean manufacturing practices have a significant impact on waiting time	-0.626	.000	Supported with negative relationship
H2	5S and VM has a significant impact on waiting time.	-0.585	.000	Supported with negative relationship
H3	Kaizen has a significant impact on waiting time.	-0.406	.000	Supported with negative relationship
H4	JIT has a significant impact on waiting time.	-0.559	.000	Supported with negative relationship

The results highlights negative and significant relationship for all hypothesis. These findings shows that when a healthcare industry implement the lean manufacturing practices the waiting time can be reduced.

4. Discussion

4.1 What is the impact of lean manufacturing practices on waiting time of patients in OPD in the Sri Lankan public healthcare industry?

Lean manufacturing practices can positively impact the patients' satisfaction by reducing waiting times and improving the overall quality of care (Hammoudeh, et al., 2020). Additionally, Folinas et al, (2014) discussed, the positive effect of lean manufacturing on waste management. Notably, a study in Saudi Arabia highlighted waiting time was the only factor that had a significant impact on overall satisfaction, with those who waited longer than 30 minutes reporting less satisfaction with the service provided (Harajin, et al., 2019). Naidoo & Mahomed, (2016) mentioned that, lean have a significant impact of patient cycle and waiting times. In this study finding also have a significant negative relationship within lean manufacturing practices on waiting time. The findings from this study demonstrate that lean manufacturing practices have a significant negative impact on waiting time of patients in OPD of the Sri Lankan public healthcare industry.

4.2 What is the impact of 5S & VM on waiting time of patients in OPD in the Sri Lankan public healthcare industry?

5S approach has a positive effect in practice on reducing patients' waiting time in healthcare facilities providing healthcare services in various sectors of the outpatient department hospitals in Tanzania (Ishijima, et al., 2016). Furthermore, Take et al., (2015) highlighted the 5S has a significant correlation of willingness to provide better services with reduction of waiting time of patients. Visual management has been shown to have a positive impact on reducing waiting times (Ulhassan, et al., 2015). The findings from this study conclude that 5S and visual management have a significant negative impact on waiting time of patients in OPD of the Sri Lankan public healthcare industry.

4.3 What is the impact of kaizen on waiting time of patients in OPD in the Sri Lankan public healthcare industry?

Kaizen has s significant impact of waiting time of patients with OPD in the Sri Lankan public healthcare industry. The continuous improvement activities, such as process optimization and waste elimination, led to enhanced patient flow and a decrease in waiting time. This highlights the importance of regularly reviewing and refining processes to ensure ongoing efficiency. Empirical studies found the results of using Kaizen practices found that the average waiting time after process improvement and service procedures, waiting time from physical therapists, time was reduced from 25 minutes to 15 minutes (40% reduction). Total waiting time (Start to finish, excluding the procedure) decreased from 145 minutes to only 109 minutes (reduced by 36 minutes, representing 24.83%) and the average score of satisfaction after the improvement was higher than before the improvement (Jitreengarm & Sudharatna, 2023). Another study found Kaizen has a positive and significant effect on patient satisfaction. Kaizen application can reduce waiting time from 75.40 minutes to 57.85 minutes and patient satisfaction score increases from 84,00 to 91,90 (Abadi, et al., 2018). The findings from this study conclude that kaizen have a significant negative impact on waiting time of patients in OPD of the Sri Lankan public healthcare industry.

4.4 What is the impact of JIT on waiting time of patients in OPD in the Sri Lankan public healthcare industry?

The average waiting period of the pilgrims, who have taken darshan in the physical queue was recorded as 8 hours whereas it is about 30 minutes for those who use the Just in Time facility. It indicates that the waiting period is reduced by Just in Time (Aradhye & Kallurkar, 2014). Similarly, another study discussed, that Just in Time can substantially reduce patient waiting times (Nelson, 2014). This study finding highlighted the JIT have a significant negative impact on waiting time of patients in OPD of the Sri Lankan public healthcare industry. The adoption of just-in-time principles also proved to be beneficial in reducing waiting time in the OPD.

5. Conclusion

This study provides valuable insights into the impact of lean manufacturing practices on waiting time of patients in Outpatient Department (OPD) of the Sri Lankan public healthcare industry. Through the analysis of data collected from 384 patients across various public hospitals in the Kandy district. The results of this study confirm the adoption of lean manufacturing practices, including 5S, visual management, kaizen, and just-in-time principles, within the Sri Lankan public healthcare industry. These practices have been reducing waste within the OPD. Notably, the study findings demonstrate a significant negative relationship between lean manufacturing practices and waiting time, indicating that the implementation of lean manufacturing practices leads to a substantial reduction in waiting time for patients in the OPD. Specifically, 5S and visual management, kaizen, and just-in-time principles have been identified as key drivers in reducing waiting time. So, this research contributes to the existing body of knowledge by providing empirical evidence of the significant impact of lean manufacturing practices on waiting time in the OPD of the Sri Lankan public healthcare industry. Moving forward, healthcare policymakers and practitioners can leverage these findings to inform decision-making processes and implement targeted interventions aimed at reducing waiting times and enhancing patient satisfaction within the healthcare system.

5.1 Implications of the study

5.1.1 Managerial Implications

With the increasing lean manufacturing practices in the Sri Lankan public healthcare have become reduce waiting times. Also it underscores the importance of adopting lean manufacturing practices, including 5S, visual management, kaizen, and just-in-time, to enhance operational efficiency and reduce waiting times in outpatient departments (OPDs). Investing in comprehensive staff training on lean principles is crucial to ensure effective implementation and utilization of lean tools and techniques. Moreover, fostering a culture of continuous improvement among staff members is essential for sustaining the benefits of lean practices over time. Additionally, efficient allocation of resources, such as staff, equipment, and facilities, is vital for minimizing waiting times in OPDs, necessitating the application of lean principles to significant resource

allocation processes. By embracing these managerial implications, healthcare managers can strive towards creating more efficient and patient waiting time management in healthcare systems in Sri Lanka.

5.1.2 Theoretical Implications

The theoretical implications of this study extend beyond the empirical findings and contribute to the broader body of knowledge in several ways. Firstly, by empirically validating the relationship between lean manufacturing practices and waiting time in the healthcare context, this study adds to the growing literature on lean principles in service industries, particularly within the healthcare sector.

Secondly, the identification of specific lean practices, such as 5S, visual management, kaizen, and just-in-time principles, as significant predictors of waiting time reduction provides theoretical insights into the mechanisms through which lean principles operate within healthcare settings. These findings contribute to a deeper understanding of how different facets of lean philosophy, such as continuous improvement and waste reduction in service delivery and patient experiences. Moreover, the study's focus on the Sri Lankan public healthcare industry offers theoretical insights into the applicability of lean manufacturing practices within different industries.

Moreover, queuing theory, integrated with lean methodology in healthcare, optimizes patient flow by analyzing arrival patterns and resource allocation. This approach reduces wait times, enhances efficiency, and aligns with principles of continuous improvement and waste reduction for improved patient satisfaction. Additionally, the study's methodological approach, which combines quantitative analysis from survey data, contributes to theoretical discussions on research methodologies within the lean healthcare literature. By integrating quantitative data, this study provides a more comprehensive understanding of the complex relationships between lean practices and waiting time, offering methodological insights for future research in this field. So, the theoretical implications of this study underscore the importance of lean manufacturing principles in healthcare management and highlight avenues for further theoretical development and empirical research in the application of lean manufacturing practices in healthcare industry.

5.2 Limitations of the Study

Although this research makes significant contributions from both practical and theoretical points of view, it also has some limitations, which are described below. Considering these limitations may assist future researchers find ways to navigate around them.

Due to the limited number of observations collected through the survey questionnaire within Kandy district. Because the data was restricted to the examined location, it's possible that the results may not be applied to other contexts. The impact of lean manufacturing practices on waiting time of patients in outpatient department in the long run was not captured, since this was a cross sectional study, and done only during a short period of time. In this research, patients were taken as the respondents to answer items related to each dimension. Taking only a patient's aspect into consideration may not cover administrative aspects. Therefore, there's a chance that certain measurement inaccuracies occurred by using a single responder.

5.3 Directions for Future Researches

Directions for future research based upon the limitations discussed above and careful considerations of the research potentials.

First, future research could examine at the scalable and long-term lean methods are in healthcare context. Although this study shows how lean methods can reduce waiting times immediately, further long-term research is required to see whether these benefits will continue to hold up throughout time and whether they can be expanded to other departments or healthcare industry. Also future research could test other contexts.

Second, future research could delve deeper into the mechanisms by which specific lean practices reduce wait times. By using qualitative research methods such as in-depth interviews or case studies, researchers can uncover the underlying processes and organizational factors that facilitate or hinder the successful implementation of lean manufacturing practices in healthcare industry.

6. Acknowledgement

First of all, my grateful thanks to the supervisor Ms. SP Aryarathne who granted permission for the title "Impact of Lean Manufacturing Practices on Waiting Time of Patients in Outpatient Department (OPD): A Study in the Sri Lankan Public Healthcare Industry" for my research. From beginning to end, she was closely associated with all the work carried out. I remain grateful for her invaluable guidance, advice, suggestions, and support to make this research successful. Also, I would like to convey my heartiest thanks to my family, relatives, and friends who were always behind me to encourage me to complete the research successfully.

7. References

1. Abadi, I., Haming, M., Baharuddin, S., & Mahmud, A. (2018). A structural model of total quality management, kaizen, operational performanceon service quality and patient satisfaction. Archives ofBusiness Research, 6(11), 48-60.
2. Alefari, M., Almanei, M. & Salonitis, K., 2020. Lean manufacturing, leadership and employees: the case of UAE SME manufacturing companies. *Production & Manufacturing Research,* 8(1), pp. 222-243.
3. Alejo, J., 2021. Implementing the Lean Approach to Reduce Long Waiting Times in Philippine Hospitals. p. 117.
4. Amarathunga, K. D. A. M., Amarathunge, Y., Anthony, D. M. M. & Arampath, T. D., 2021. Patient Waiting Time, Consultation Time, and its effect on patient satisfaction at the Outpatient Department in Colombo North Teaching Hospital (CNTH). *Research Gate,* p. 34.
5. Aradhye, A. S. & Kallurkar, S. P., 2014. A Case Study of Just-In-Time System in Service Industry. *Procedia Engineering,* Volume 97, pp. 2232-2237.
6. Biya, M. et al., 2022. Waiting time and its associated factors in patients presenting to outpatient departments at Public Hospitals of Jimma Zone, Southwest Ethiopia.
7. Dilrukshi, D., Nirmanamali, I. M., Lanel, G. & Samarakoon, M. A. S. C., 2016. A Strategy to Reduce the Waiting Time at the Outpatient Department of the National Hospital in Sri Lanka. *International Journal of Scientific and Research Publications,* 6(2), pp. 281 - 287.
8. Errida, A. & Lotfi, B., 2021. The determinants of organizational change management success: Literature review and case study. *International Journal of Engineering Business Management,* Volume 13, pp. 1-15.
9. Folinas, D.; Aidonis, D.; Malindretos, G.; Voulgarakis, N.; Triantafillou, D. Greening the agrifood supply chain with lean thinking practices. Int. J. Agric. Resour. Gov. Ecol. 2014, 10, 129–145.
10. Hammoudeh, S. et al., 2020. The Impact of Lean Management Implementation on Waiting Time and Satisfaction of Patients and Staff at an Outpatient Pharmacy of a Comprehensive Cancer Center in Jordan. *National Institutes of Health (NIH),* 56(6), pp. 737-744.
11. Harajin, R. S., Subaie, S. A. A. & Elzubair, A. G., 2019. The association between waiting time and patient satisfaction in outpatient clinics: Findings from a tertiary care hospital in Saudi Arabia. 26(1), pp. 17 - 22.
12. Ishijima, H., Eliakimu, E. & Mshana, J. M., 2016. The "5S" approach to improve a working environment can reduce waiting time: Findings from hospitals in Northern Tanzania. *Emerald Group Publishing Limited,* 28(4), pp. 664-680.
13. Jagoda, T., Edirisinghe, K. & Meegoda, L., 2019. Service quality of nursing care and patient satisfaction in Sri Lanka: Perception of patients, student nurses and nursing professionals. Volume 2, pp. 37 - 51 .
14. Jayawardena, D. B. A. S., 2017. Patients waiting time at out Patient's Department at the National Hospital Sri Lanka. *Journal of Community Medicine & Public Health,* 1(3), p. 103.
15. Jitreengarm, J. & Sudharatna, Y., 2023. The effect of applying the kaizen concept to increase efficiency in reducing waiting time of service for physical therapy department case study Panyananthaphikkhu Chonprathan Medical Center. 2(5).
16. Kumar, R., 2019. Public–private partnerships for universal health coverage? The future of "free health" in Sri Lanka. *The Political Origins of Health Inequities and Universal Health Coverage,* 15(1), pp. 1-10.

17. Kunyoria, J. O. & Aila, F. O., 2022. Lean Manufacturing Practices A Structured Literature Review. *World Journal of Innovative Research ,* 13(4), pp. 9-22.
18. Lamb, M. D., 2021. Health Inequity by Design: Waiting Rooms and Patient Stress. Volume 6.
19. Lot, L. T. et al., 2018. Using Lean tools to reduce patient waiting time. *Leadership in Health Services,* 31 (3), pp. 343 - 351.
20. Naidoo, L. & Mahomed, O. H., 2016. Impact of Lean on patient cycle and waiting times at a rural district hospital in KwaZulu-Natal. African Journal of Primary Health Care & Family Medicine, 8(1).
21. Nelson, L., 2014. 'Just-in-time' method cuts waiting time for patients.
22. Pujolar, G., Anglès, A. O., Vargas, . I. & Vázquez, M. L., 2021. Changes in Access to Health Services during the COVID-19 Pandemic: A Scoping Review.
23. Rajapaksa, L. et al., 2021. Sri Lanka Health System Review. *Health Systems in Transition,* 10(1), pp. 1-225.
24. Sabhapathige, R., Dilrukshi, D. & Ranasinghe, G. . S. P., 2021. Causes of Obstruction in the Outpatient Department of National Hospital, Sri Lanka: A Qualitative Study.
25. Ulhassan, W. et al., 2015. How Visual Management for Continuous Improvement Might Guide and Affect Hospital Staff: A Case Study. *Quality Management in Health Care,* 24(4), pp. 222-228.