Jurnal Sistem Teknik Industri (JSTI) Vol. 26, No.1, 2024 | 113 – 119

JSTI
Jurnal Sistem Teknik Industri

Applying Lean in Healthcare to Reduce Waste: A Literature Review

Surya Indrawan[1] and Sirlyana[2]

[1,2]Industrial Engineering Study Program, Sekolah Tinggi Teknologi Dumai, Jl. Utama Karya, Dumai, 28817, Indonesia

Abstract. The high level of competition both in the industry and in the field of services, so it requires every organization to make improvements. For the quality of health services to continue to be guaranteed to patients, efforts need to be made to improve service quality and also reduce operational costs. Therefore, the concept of lean is proposed to address this problem in healthcare. This paper aims to explore lean implementation in healthcare using review literature obtained from the Google Scholar database of 150 articles with publication years from 2019-2023. The findings of this paper provide suggestions for future research regarding lean trends in healthcare, which shows the importance of adopting lean in healthcare for future improvement. In addition, this paper also shows to develop a lean healthcare model in industry 4.0, lean six sigma and also pay attention to the supporting and inhibiting factors of lean healthcare implementation.

Keyword: Healthcare, Lean, Literature Review, Waste

Received 17 December 2023 | Revised 14 January 2024 | Accepted 24 January 2024

1. Introduction

Healthcare Organizations (HOs) are required to provide more effective and efficient services by funding parties and regulators, stakeholders, patients, and employees [1]. Medical institutions have faced the challenge of improving patient care and quality of care while reducing operational costs over the past few decades, along with increased competition in the healthcare industry [2].

In recent decades, there has been increased competition at both local and international levels, which has affected the healthcare industry. Organizations have been forced to change their standard operating procedures as a result of the unstable global economy [3]. Including in Indonesia which faces increasingly high competition in the industrial world [4].

The Lean philosophy for continuous improvement has been widely used in service organizations, especially in the healthcare sector. Lean has been increasingly adapted and adopted in healthcare in recent years [1]. Although Lean has been used in healthcare for almost two decades, but many researchers and practitioners argue about its effectiveness [5].

*Corresponding author at: [Sekolah Tinggi Teknologi Dumai, Jl. Utama Karya, Dumai, 28817, Indonesia]
E-mail address: [suryaindrawan03@gmail.com]

p-ISSN: 1411-5247 | e-ISSN: 2527-9408 | DOI 10.32734/jsti.v26i1.14842
Journal Homepage: https://talenta.usu.ac.id/jsti

However, the amount of literature available on the application of lean in services is lacking, so it is necessary to explore the application of lean especially in healthcare. Thus, this study aims to explore Lean in the health sector so as to provide an overview of lean development in health services and can provide input for academics and practitioners to develop this concept.

2. Related Work

2.1. Lean Healthcare

Eliminating *Muda* (waste of process), *Mura* (inequality in operations), and *Muri* (excessive load on resources) are the main focus of Lean philosophy. According to Lean literature, found in seven forms: transportation, inventory, movement, waiting, overproduction, overprocessing, and defects [6].

The application of lean to healthcare identified two main characteristics of healthcare management Lean consists of the first lean philosophy, consists of lean principles and continuous improvement, as well as a second lean activity, which includes lean assessment and improvement [7].

Lean manufacturing has long been used in the healthcare industry (hospitals, primary care centers, and specialty facilities), Lean Healthcare aims to manage and enhance the health sector's operations by getting rid of everything that doesn't add value, enhancing patient safety, streamlining the job of medical experts, and creating adaptable, dependable organizations. [8].

3. Methodology

This paper uses bibliometric analysis methods to look at the growing literature on the relationship between lean and healthcare to reduce waste. Bibliometric analysis is one of the research evaluation methods in applied and scientific fields [9]. There are also those who use thematic analysis in finding and analyzing themes from the literature [10], and also use a literature review approach to see the topics to be researched [11]. In this study obtained a database from Google Scholar which has various publications. For the stages in this research can be seen in Figure 1.

In Figure 1. Explaining that the first stage is to select articles obtained from the Google Scholar database with criteria for the year 2019-2023 which amounts to 150 articles, the next stage is an analysis that is relevant to the concept of lean healthcare so that views on future research are obtained.

This paper begins by selecting literature related to lean in healthcare, then the selected paper from 2019 to 2023 so that 150 articles are selected. Papers that have been selected are subject to a more in-depth review including authors, years, objectives, methods, and findings. Finally, it is analyzed by looking at the results of the review conducted so as to produce lean development in healthcare.

Figure 1 Literature Selection Process Flow

4. Result and Discussion

Based on data obtained from the Google Scholar database that the type of article obtained was identified Journal article, for the year of publication it can be seen that the highest in 2019 was 37.58%, then the second in 2020 was 24.83%, in 2021 it was 18.12%, in 2022 it was 12.08% and in 2023 it was 7.38% reflected in Figure 2. In Figure 3. For distribution, the highest identified publisher is ResearchGate, followed by Springer, Emerald, mdpi, Elsevier and others.

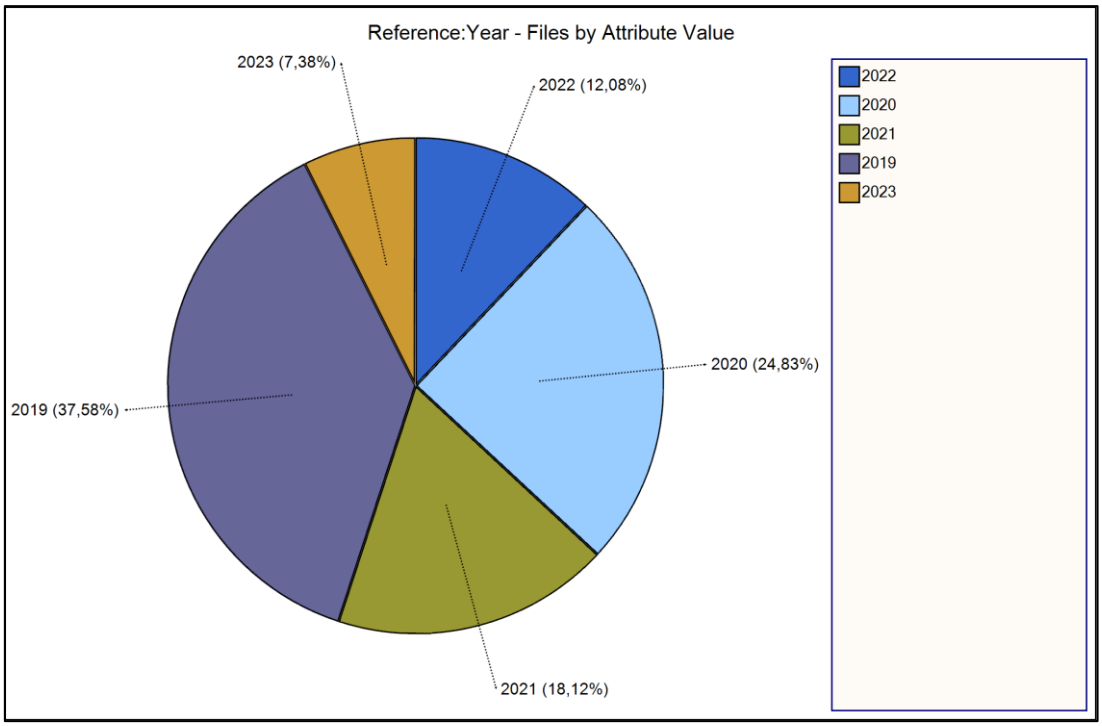

Figure 2 Publication Year Distribution

From Figure 2. Shows that the number of publications about lean in healthcare was highest in 2019 and continued in 2020, 2021, 2022 and 2023.

Figure 3. Shows that the highest number of journals publishing lean topics in healthcare are ResearchGate, then Springer, Emerald, mdpi, Elsevier and continued other journals.

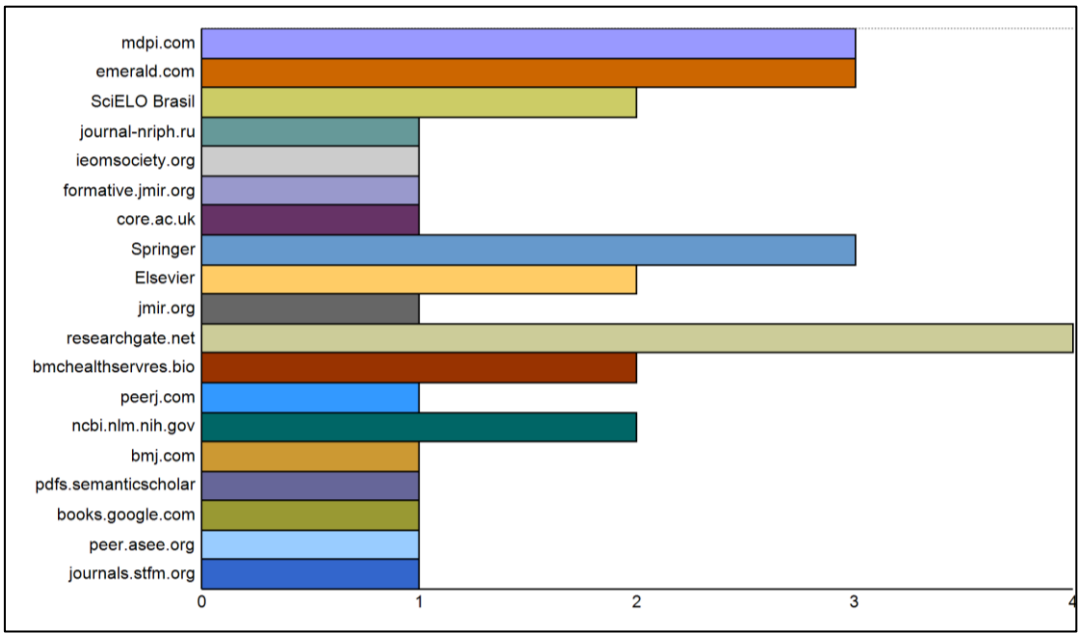

Figure 3 Publisher Distribution

This study aims to investigate lean in the healthcare, for which it is necessary to review the relevant literature. Shown in Table 1. Some summaries of relevant articles containing authors, years, objectives, methods and research contributions.

Table 1 Literature Summary

Authors	Year	Objective	Method	Key Contribution
[12]	2019	to present a detailed overview of the benefits and challenges of implementing Lean Six Sigma (LSS) in business organizations and the dissemination of LSS literature in various sectors, research methodologies, and journals.	Literature Review	It classifies the spread of four main Lean Six Sigma (LSS) sectors: healthcare, manufacturing, Human Resource (HR), finance, and education.
[13]	2020	to review the existing literature on Lean, Six Sigma and Lean Six Sigma empirical research in the health field	Critical review approach	From the analysis of the results, it is concluded that the number of empirical research articles on Lean, Six Sigma and Lean Six Sigma in the field of health is increasing very rapidly
[14]	2019	to investigate patterns, obstacles, and theoretical holes in the application of health services 4.0 (H4.0)	based on a scoping review of the literature	Multidisciplinary research on H4.0 has been carried out with a wide range of applications and purposes.
[7]	2019	Outlines the process used to develop operational definitions of Lean in healthcare.	Literature Review	Identify two key characteristics of Lean healthcare management: (1) Lean, sustainable philosophy (2) Lean activity.

Authors	Year	Objective	Method	Key Contribution
[15]	2019	The application of DMAIC in health care organizations provides guidelines on how to handle a quality service system towards patient satisfaction	Integration of TOC and DMAIC approaches	The reduction of medical expenses, medical errors, clerical errors, and disability will result from the integration of TOC and DMAIC techniques, which will enhance healthcare performance.
[16]	2019	to present the main driving factors, limitations or challenges of implementing Lean, the benefits of Lean in healthcare and major gaps in the literature as agendas for future research.	Systematic review	The systematic review helps authors identify evolution, current trends, research gaps, and the future agenda of Lean research in healthcare.
[17]	2020	To assess the impact of lean health care (LH) on patient flow in outpatient services and determine whether waiting times and length of hospitalization (LOS) are reduced after LH intervention.	A systematic review	LH (Lean Health) focuses on identifying and decreasing non-value-added activities (NVA), it helps reduce waiting times and LOS (Length of Stay) in outpatient care.
[18]	2020	Finding, evaluating, and classifying critical readiness elements for Lean Six Sigma (LSS) implementation in healthcare businesses is the aim.	Interpretive structural modelling technique	Researchers and practitioners can gain insight into preparedness factors prior to initiating the LSS implementation process by utilizing this research.

Results from Table 1. That the concept of lean is widely applied in health services, and also lean is widely combined with six sigma, non-value-added activities (NVA), DMAIC (Define, Measure, Analyze, Improve, and Control) and Industry 4.0.

5. Conclusion and Recommendation/Policy Implication

Lean methods focus on continuous improvement by eliminating waste in both manufacturing and healthcare [16] The application of lean has proven in various theories that it has a positive impact on health services. This paper aims to explore the implementation of lean in healthcare given the increasing competition in the field of services.

Based on the explanation above, that this paper has found an overview of lean in health services, including the year of publication of articles that continue to increase every year, in terms of the method used, namely using lean tools such as DMAIC and VSM, in the future you can try other tools to provide more consistent information.

REFERENCES

[1] A. D'Andreamatteo, L. Ianni, F. Lega, and M. Sargiacomo, "Lean in healthcare: A comprehensive review," *Health Policy (New. York).*, vol. 119, no. 9, pp. 1197–1209, 2015, doi: 10.1016/j.healthpol.2015.02.002.

[2] C. Kim and H. J. Kim, "A study on healthcare supply chain management efficiency: Using bootstrap data envelopment analysis," *Health Care Manag. Sci.*, 2019, doi: 10.1007/s10729-019-09471-7.

[3] M. E. Gonzalez, "Improving customer satisfaction of a healthcare facility: reading the customers' needs," *Benchmarking An Int. J.*, 2019, doi: 10.1108/BIJ-01-2017-0007.

[4] S. Indrawan, J. Suarlin, and S. Sirlyana, "Penerapan Peramalan Produksi Produk Semen Di PT XYZ Guna Memenuhi Permintaan Konsumen," *J. ARTI (Aplikasi Ranc. Tek. Ind.*, vol. 17, no. 1, pp. 91–97, 2022, doi: 10.52072/arti.v17i1.367.

[5] A. Akmal, J. Foote, N. Podgorodnichenko, R. Greatbanks, and R. Gauld, "Understanding resistance in lean implementation in healthcare environments: an institutional logics perspective," *Prod. Plan. Control*, vol. 33, no. 4, pp. 356–370, 2022, doi: 10.1080/09537287.2020.1823510.

[6] S. Gupta, M. Sharma, and V. Sunder M, "Lean services: a systematic review," *Int. J. Product. Perform. Manag.*, vol. 65, no. 8, pp. 1025–1056, 2016, doi: 10.1108/IJPPM-02-2015-0032.

[7] C. P. Thomas Rotter1, R. F. Adegboyega Lawal2, Liz Harrison3, Nazmi Sari4, Donna Goodridge5, J. Chan7, and and L. K. Michelle Fiander8, Bonnie Poksinska9, Keith Willoughby10, "What is lean management in health care? Development of an operational definition for a Cochrane systematic review," *Eval. Health Prof.*, 2019, doi: 10.1177/0163278718756992.

[8] J. A. Marin-Garcia, P. I. Vidal-Carreras, and ..., "The role of value stream mapping in healthcare services: A scoping review," *Int. J. ...*, 2021, [Online]. Available: https://www.mdpi.com/1660-4601/18/3/951

[9] P. Teixeira, J. C. Sá, F. J. G. Silva, L. P. Ferreira, G. Santos, and P. Fontoura, "Connecting lean and green with sustainability towards a conceptual model," *J. Clean. Prod.*, vol. 322, no. March, 2021, doi: 10.1016/j.jclepro.2021.129047.

[10] T. Amelia, R. Ginting, and A. Ishak, "with Fuzzy Logic : A Literature Review," no. 2, pp. 171–177, 2023, doi: 10.32734/jsti.v25i2.9571.

[11] N. Matondang and A. Ishak, "A Literature Review of Distribution Solving Problems by Various Transportation Methods," *J. Sist. Tek. Ind.*, vol. 2, no. 2, pp. 178–187, 2023, [Online]. Available: https://talenta.usu.ac.id/jsti/article/view/9741%0Ahttps://talenta.usu.ac.id/jsti/article/download/9741/6199

[12] M. Singh and R. Rathi, "A structured review of Lean Six Sigma in various industrial sectors," *Int. J. Lean Six Sigma*, 2019, doi: 10.1108/IJLSS-03-2018-0018.

[13] D. B. Henrique and M. G. Filho, "A systematic literature review of empirical research in Lean and Six Sigma in healthcare," *Total Qual. Manag. Bus. Excell.*, 2020, doi: 10.1080/14783363.2018.1429259.

[14] R. V. & R. S. Guilherme Luz Tortorella, Flávio Sanson Fogliatto, Alejandro Mac Cawley Vergara, "Healthcare 4.0: trends, challenges and research directions," *Prod. Plan. Control*, 2019, doi: 10.1080/09537287.2019.1702226.

[15] S. Ahmed, "Integrating DMAIC approach of Lean Six Sigma and theory of constraints toward quality improvement in healthcare," *Rev. Environ. Health*, 2019, doi: 10.1515/reveh-2019-0003.

[16] J. Antony, V. S. M, and R. S. Sreedharan, "A systematic review of Lean in healthcare: a global prospective," *Int. J. Qual. Reliab. Manag.*, 2019, doi: 10.1108/IJQRM-12-2018-0346.

[17] D. Tlapa, C. A. Zepeda-Lugo, G. L. Tortorella, and ..., "Effects of lean healthcare on patient flow: a systematic review," *Value in Health*. Elsevier, 2020. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S1098301519352179

[18] V. Vaishnavi and M. Suresh, "Modelling of readiness factors for the implementation of Lean Six Sigma in healthcare organizations," *Int. J. Lean Six Sigma*, 2020, doi: 10.1108/IJLSS-12-2017-0146.