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Research paper



Linking Lean Hospitals and Management Control Systems: A Systematic Literature Review on Efficiency, Digital Transformation and Sustainability

Anastasia Susty Ambarriani *, Bartolomeus Galih Visnhu Pradana

Universitas Atma Jaya Yogyakarta, Indonesia
**Corresponding author E-mail: susty.ambarriani@uajy.ac.id*

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Abstract

Lean hospital practices have gained increasing attention as healthcare systems face pressure to enhance efficiency, patient safety, and financial sustainability under bundled payment schemes such as iDRG/JKN. While lean management reduces waste and improves service delivery, its effectiveness depends on robust Management Control Systems (MCS) to ensure alignment with organizational goals. This study systematically reviews the literature to examine the intersection of lean hospitals and MCS. Using the Scopus database, 114 peer-reviewed articles published between 2008 and 2025 were selected. Bibliometric and content analyses were conducted, supported by VOSviewer and R Studio, to identify research trends, thematic clusters, and knowledge gaps. The findings reveal four dominant clusters: (1) process-oriented lean practices, (2) organizational efficiency and performance, (3) integration with Industry 4.0 and sustainability, and (4) quality improvement and benchmarking. The results indicate a clear shift from operational process improvement toward broader strategic agendas involving digital transformation and sustainability. This review highlights research gaps in integrating lean hospitals with strategic MCS tools (e.g., balanced scorecard, activity-based management), the adoption of digital technologies (IoT, AI, digital twins), and sustainability-driven frameworks (green lean). The study contributes by framing lean hospitals not merely as operational toolkits, but as strategic frameworks for smart and sustainable healthcare transformation, offering new insights for both scholars and practitioners.

Keywords: *Lean Hospital; Management Control Systems; Systematic Literature Review; Efficiency; Digitalization; Sustainability.*

1. Introduction

Modern hospitals are increasingly pressured to deliver high-quality, patient-centered, and cost-efficient healthcare services. This challenge is particularly evident in countries with universal health coverage systems, such as Indonesia, which implements the National Health Insurance (JKN) scheme through the Indonesian Diagnosis-Related Group (iDRG) payment model. While this scheme expands healthcare access, it also creates financial constraints for hospitals, forcing them to enhance efficiency without compromising patient safety (Samanta et al., 2024).

One promising approach is the concept of the lean hospital, an adaptation of lean management and the Toyota Production System (TPS) within the healthcare sector. Lean emphasizes eliminating non-value-added activities and fostering continuous improvement. Empirical studies demonstrate that lean practices in hospitals can streamline workflows, improve clinical outcomes, and enhance patient satisfaction (Abdallah et al., 2025; Srijithesh et al., 2025).

However, the success of lean hospitals is strongly influenced by the presence of robust management control systems (MCS). Without adequate MCS support, lean initiatives risk generating misleading cost information or becoming unsustainable (Almagtome & Shaker, 2019). Instruments such as activity-based management (ABM), value stream costing, and the balanced scorecard have proven more relevant than traditional measurement methods in providing managerial decision-making data (Gündüz, 2015). MCS also plays a critical role in aligning efficiency strategies with healthcare quality (Harsono, 2015; Pribadi, 2015).

Leadership and organizational context further shape the effectiveness of lean implementation. Recent studies highlight the importance of "hybrid managers" (physicians who also serve as managers) in bridging clinical and managerial logics in public hospitals (Ivcovici et al., 2025). Moreover, lean leadership has been shown to positively influence hospital staff performance, although the effectiveness of specific lean techniques varies, particularly under external pressures such as pandemics (van Kleeff & van Harten, 2025).

Although research on lean healthcare is rapidly growing, integrative studies examining the link between lean hospitals and MCS remain limited. Most works focus on operational aspects, such as reducing waiting times or improving patient flow, while the role of MCS in sustaining and integrating lean initiatives is underexplored. Several studies stress the importance of information governance and digital control systems in supporting organizational transformation and healthcare efficiency (Harsono, 2015; Pribadi, 2015; Sedaghat & Hopkins, 2020). Others argue that a systemic approach to information management strengthens organizational learning and hospital performance monitoring (Paul, 2024).

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To address this gap, the present study conducts a Systematic Literature Review (SLR) on lean hospitals from the perspective of management control systems. This research aims to answer three central questions:
RQ1: What are the key characteristics of recent research on lean hospitals from an MCS perspective?
RQ2: What are the major research streams and thematic clusters in this domain?
RQ3: What research gaps and future opportunities remain to be explored?
This study systematically reviews the literature, maps existing gaps, and identifies thematic areas linking lean hospital practices with MCS. It includes peer-reviewed articles indexed in Scopus and other reputable academic databases, covering both early developments and the most recent contributions. Following this introduction, Section 2 outlines the SLR methodology, Section 3 presents findings and thematic analysis, Section 4 discusses theoretical and practical implications, and Section 5 concludes with key insights, limitations, and directions for future research.

2. Method

This study employs a Systematic Literature Review (SLR) approach to examine the body of research on lean hospitals from the perspective of Management Control Systems (MCS). Scopus was selected as the primary database due to its rigorous curation and adherence to quality and scientific integrity standards (Baas et al., 2020). In line with Podsakoff et al. (2005), the review focuses exclusively on peer-reviewed articles, as such sources are considered more credible and impactful.
The SLR protocol follows the framework adapted from Anggadwita & Indarti (2023), which involves planning the review, defining inclusion and exclusion criteria, designing the search strategy, selecting relevant studies, and conducting data analysis and synthesis. The research questions were developed to guide this review, focusing on the current research profile, key streams of inquiry, and gaps regarding lean hospitals and the role of MCS.
The inclusion criteria restricted the review to high-quality, relevant studies: English-language articles published in reputable academic journals (peer-reviewed, including those listed in the ABDC Journal List) that explicitly addressed lean hospitals, MCS, efficiency, service quality improvement, or performance management. Exclusion criteria included books, book chapters, conference proceedings, practice reports, theses/dissertations, working papers, and articles with relevant keywords but abstracts unrelated to the research focus.
The search strategy employed the following keyword string within the Scopus database:
(lean or lean management or lean thinking or lean principles or lean hospital) and (hospital or healthcare or medical or clinical) and (management control or control systems or performance management or governance) and (efficiency or waste reduction or process improvement or value stream) and (quality or patient care or outcomes or satisfaction)
The initial search yielded 1,068 articles. After filtering by subject area (Business, Management, and Accounting), article type, and English language, the number was reduced to 318. Applying the ABDC List criterion further narrowed the sample to 227 articles. A final screening, based on keyword relevance and abstract content, resulted in 114 eligible articles for analysis. This systematic selection process is illustrated in the PRISMA Flow Diagram (Figure 1), which depicts the stages of identification, screening, eligibility assessment, and final inclusion.

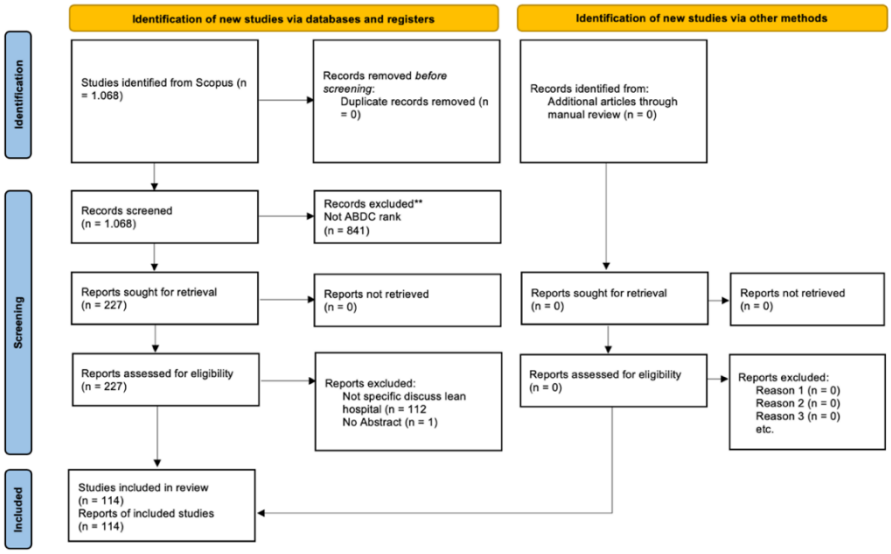


Fig. 1: PRISMA Review Protocol.

Data analysis was conducted using two complementary approaches. First, article profiling was performed to identify publication trends, including year of publication, journal outlets, publishers, journal rankings, and research methods. Second, content analysis was applied by reading full texts, coding relevant information, and clustering key insights into broader themes (Braun & Clarke, 2006). To enrich the analysis, bibliometric techniques were employed using two tools: VOSviewer, for co-word analysis and thematic clustering, and R Studio, for advanced techniques such as citation analysis, co-citation analysis, and thematic mapping (Fauzi et al., 2025; Sitalaksmi et al., 2024). The combination of these tools allowed for comprehensive visualization and interpretation of research trends.
In bibliometric analysis, the minimum threshold for keyword frequency is set at ≥5 occurrences to ensure that only terms with conceptual significance and adequate empirical representation are included in the analysis. Furthermore, in citation and co-citation analysis, only publications with a minimum number of citations are included to build a network structure that represents substantial scientific contributions. This threshold follows common practice in bibliometric studies and is adjusted to the size and characteristics of the corpus to improve cluster stability and avoid network fragmentation.
The study's validity was reinforced through the use of Scopus as a curated database (Baas et al., 2020), strict application of inclusion and exclusion criteria, and manual screening for article relevance. Reliability was ensured by systematically documenting each stage of the review, applying the PRISMA framework for transparency, and adopting dual-method analytical techniques supported by specialized

software (VOSviewer and R Studio), thereby enhancing consistency. These methodological safeguards are expected to yield findings that are credible, transparent, and replicable in future research.

3. Result

3.1. Current research profile on lean hospitals from a management control systems perspective

3.1.1. Main information

The bibliometric analysis identified 114 articles on lean hospitals and management control systems (MCS) published between 2008 and 2025 across 31 reputable international journals. The annual publication growth rate reached 12.13%, indicating steady progress in this field. On average, each article received 38.17 citations, with a total of 925 references analyzed.
These findings align with Yamamoto et al. (2019), who highlighted that lean principles—rooted in the Toyota Production System (TPS)—have evolved into a cross-sectoral managerial paradigm, including healthcare. Within hospitals, the integration of lean practices and MCS has been shown to enhance operational efficiency, reduce waste, and improve cost transparency (Almagtome & Shaker, 2019).

Table 1: Main Information on Lean Hospital–MCS Publications (2008–2025)

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2008:2025
Sources (Journals, Books, etc.)	31
Documents	114
Annual Growth Rate %	12,13
Document Average Age	5,03
Average citations per doc	38,17
References	925
DOCUMENT CONTENTS	
Keywords Plus (ID)	677
Author's Keywords (DE)	919
AUTHORS	
Authors	341
Authors of single-authored docs	7
AUTHORS COLLABORATION	
Single-authored docs	7
Co-Authors per Doc	3,56
International co-authorships %	37,72
DOCUMENT TYPES	
article	114

(Source: bibliometric analysis, Scopus).

3.1.2. Annual scientific production

The number of publications rose significantly after 2015, coinciding with the growing demand for efficiency in national health insurance systems across multiple countries. This increase also reflects heightened attention to digital health solutions and performance-based financing mechanisms.

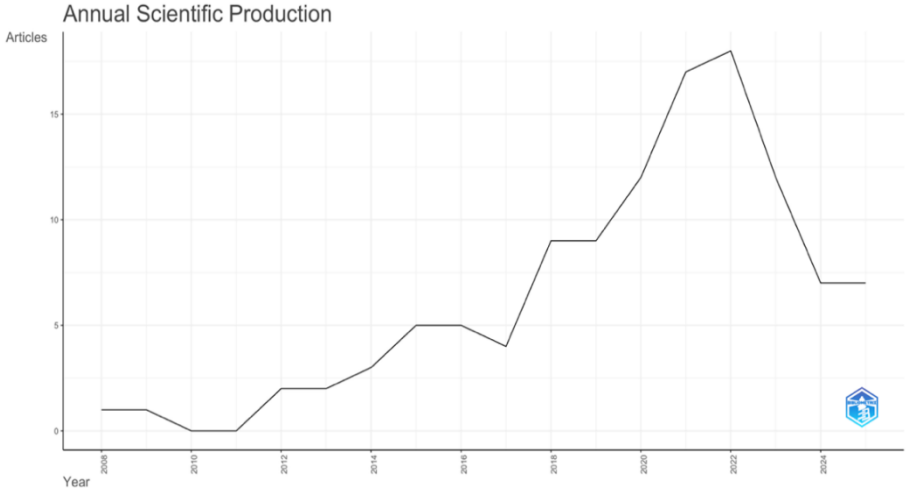


Fig. 2: Annual Scientific Production of Lean Hospital–MCS Research (2008–2025).

(Source: bibliometric analysis).

3.1.3. Average citations per year

Earlier publications accumulated higher total citations, while more recent articles exhibit greater annual citation intensity. This suggests that lean hospital–MCS has become a research front. For example, Samanta et al. (2024) demonstrated that combining Lean Six Sigma (LSS) with change management reduced emergency department length of stay by up to 40%.

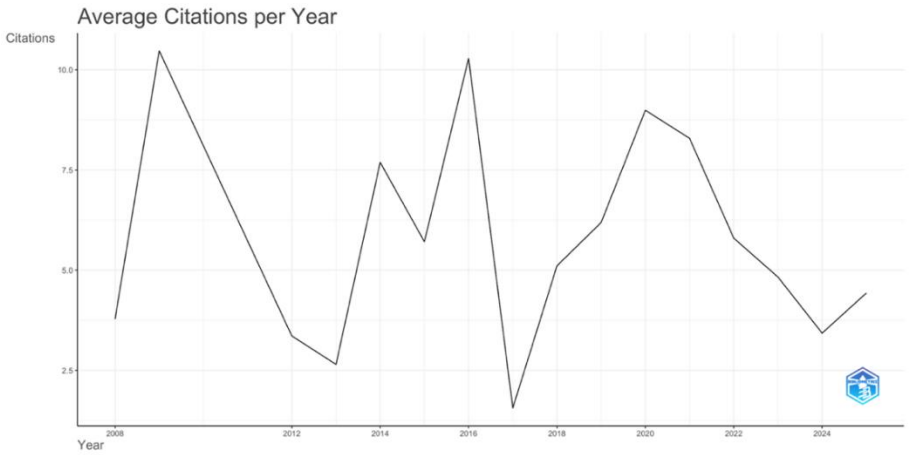


Fig. 3: Average Annual Citations of Lean Hospital–MCS Publications.

(Source: bibliometric analysis).

3.1.4. Most relevant sources

Key journals in this domain include Production Planning & Control, International Journal of Production Research, Journal of Cleaner Production, and The TQM Journal. The distribution of publications across these outlets underscores the intersection of operations management, sustainability, and digital innovation in hospital settings.

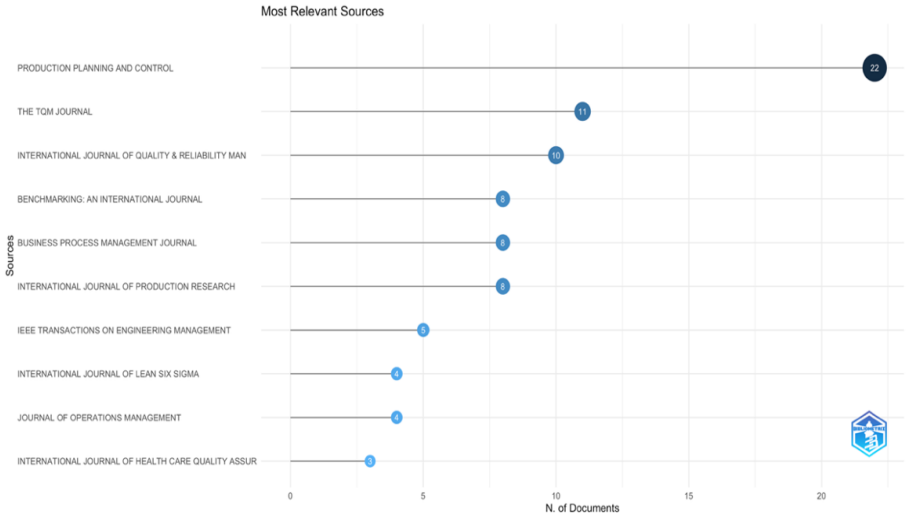


Fig. 4: Most Relevant Sources in Lean Hospital–MCS Publications.

(Source: bibliometric analysis).

3.1.5. Most globally cited documents

Influential studies include Costa & Godinho Filho (2016) and Tortorella et al. (2020) in Production Planning & Control, as well as Farris et al. (2009) in the International Journal of Production Economics. Jadhav & Deshmukh (2022) is particularly noteworthy for linking lean hospitals to Industry 4.0, opening new research avenues.

Leadership-related works also gained attention. For instance, van Kleeff & van Harten (2025) showed that lean leadership directly influences hospital staff performance, though the effectiveness of other lean techniques varied under external conditions such as pandemics.

Table 2: Most Globally Cited Documents on Lean Hospital–MCS

Paper	DOI	Total Citations	TC per Year	Normalized TC
LBM, 2016, PROD. PLAN. CONTROL.	10.1080/09537287.2016.1143131	206	20,60	2,00
GL, 2020, PROD. PLAN. CONTROL.	10.1080/09537287.2019.1702226	184	30,67	3,41
F, 2014, INT. J. PROD. RES.	10.1080/00207543.2013.879614	180	15,00	1,95
JA, 2009, INT. J. PROD. ECON.	10.1016/j.ijpe.2008.08.051	178	10,47	1,00
F, 2019, J. CLEAN. PROD.	10.1016/j.jclepro.2019.06.279	150	21,43	3,46
M, 2021, TECHNOL. FORECAST. SOC. CHANG.	10.1016/j.techfore.2021.120717	138	27,60	3,33
C, 2015, INT. J. PROD. ECON.	10.1016/j.ijpe.2015.05.029	137	12,45	2,18
DD, 2016, J. OPER. MANAG.	10.1016/j.jom.2016.03.001	130	13,00	1,26
IP, 2015, PROD. PLAN. CONTROL.	10.1080/09537287.2015.1049238	104	9,45	1,66
A, 2018, J. MANUF. TECHNOL. MANAG.	10.1108/JMTM-11-2017-0236	101	12,63	2,47

(Source: bibliometric analysis, Scopus).

3.1.6. Trend topics

Keyword analysis revealed an evolution in research themes. Early studies centered on "patient safety" and "quality control," later expanding to "value stream mapping," "health care," and "hospitals." Recent trends (2022–2025) emphasize "six sigma," "process monitoring," and integration with "human resource management" and "Industry 4.0."

These findings align with Abdallah et al. (2025), who confirmed that lean healthcare improves patient satisfaction, with process innovation mediating the relationship more strongly than quality performance. Similarly, Srijithesh et al. (2025) reported that Lean Six Sigma improved stroke intervention outcomes by 43%, although sustaining results remains a challenge.

Table 3: Trend Topics in Lean Hospital–MCS Research (2008–2025)

Term	Frequency	Year (Q1)	Year (Median)	Year (Q3)
human	5	2015	2015	2017
quality control	6	2014	2016	2019
patient safety	5	2012	2016	2023
value stream mapping	9	2017	2018	2021
mapping	8	2017	2018	2019
health care	25	2017	2020	2022
manufacture	7	2018	2020	2021
supply chain management	5	2018	2020	2021
nan	45	2019	2021	2022
lean production	23	2018	2021	2023
hospitals	19	2020	2021	2022
six sigma	9	2021	2022	2023
process monitoring	8	2022	2022	2023
action research	6	2017	2022	2023
efficiency	5	2022	2023	2024
human resource management	5	2023	2023	2023
industry 4.0	5	2023	2023	2025

(Source: bibliometric analysis, Scopus).

In summary, the research profile of lean hospitals and MCS reflects rapid, multidisciplinary growth. While early studies emphasized patient safety, recent work highlights the integration of lean practices with digitalization and Industry 4.0. Influential contributions, such as Almagtome & Shaker (2019) on lean accounting, Ivcovici et al. (2025) on hybrid managers, and Abdallah et al. (2025) on patient satisfaction, underscore that the success of lean hospitals depends not only on operational techniques but also on leadership, management control systems, and organizational innovation.

3.2. Research streams and thematic clusters

A co-word analysis of the 114 articles revealed four main clusters representing the evolution of research on lean hospitals from the perspective of management control systems (MCS). These clusters illustrate the shift from process-based applications toward broader strategic agendas, encompassing organizational efficiency, digital integration, sustainability, and benchmarking for quality improvement.

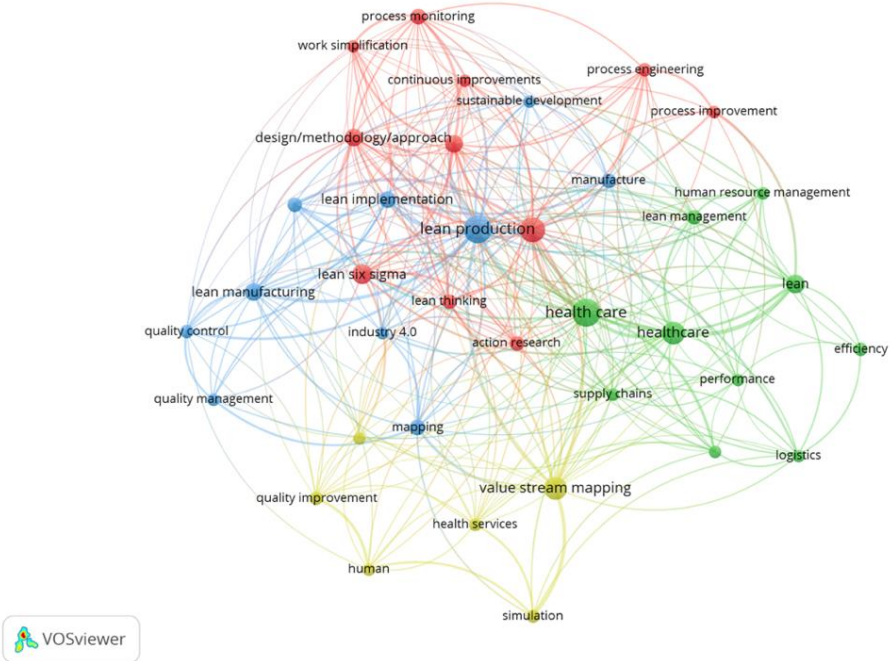


Fig. 5: Visualization of Thematic Clusters in Lean Hospital–MCS Research.

(Source: bibliometric analysis using VOSviewer, 2008–2025).

3.2.1. Cluster 1: process-oriented lean practices (red)

This cluster emphasizes process improvement through lean methodologies, with dominant keywords including action research, continuous improvement, lean six sigma, process monitoring, and work simplification. Studies in this cluster largely examine Lean Six Sigma and continuous improvement within hospital settings.

Leite & Quadros, 2025) explored lean applications across healthcare ecosystems, highlighting that successful implementation depends on adapting methodologies to the complexity of clinical units. Raval et al. (2020) emphasized that Lean Six Sigma not only reduces waste but also provides a framework for reorganizing clinical processes. Núñez-Merino et al. (2025) integrated lean principles into new service development, showcasing flexibility beyond direct patient care.

Further, Skalli et al. (2025) demonstrated how combining Lean Six Sigma with Industry 4.0 strengthens hospital process monitoring. Sunder et al. (2023), drawing on dynamic capabilities theory, argued that lean success in services depends on building adaptive organizational competencies. Collectively, this cluster shows the transition from technical applications toward lean as a strategic organizational capability.

3.2.2. Cluster 2: organizational efficiency and performance (green)

The second cluster addresses efficiency, performance, logistics, and human resource management, with dominant keywords such as efficiency, performance, HRM, logistics, and supply chain management.

Yun & An (2025) provided a bibliometric overview of lean healthcare's intellectual foundations, emphasizing organizational performance as key to sustainability. da Silva et al. (2025) linked lean with complexity-based risk management, showing its role in enhancing hospital resilience against operational uncertainties.

Deepu & Ravi (2020) proposed an ANP–QFD approach to prioritize lean initiatives, revealing direct links between lean, service quality, and strategic alignment. Skalli et al. (2025) added the Industry 4.0 perspective, arguing that digitalized supply chains reinforce organizational efficiency. This cluster thus positions lean hospitals as a strategic mechanism for overall organizational performance, rather than merely local process improvements.

3.2.3. Cluster 3: integration with Industry 4.0 and sustainability

The third cluster reflects new directions, integrating lean with digitalization and sustainability. Dominant keywords include Industry 4.0, lean production, quality control, and sustainable development.

da Silva et al. (2025) proposed a resilience-based approach linking lean with complexity management, underlining the role of digital technologies in strengthening hospital control systems. Núñez-Merino et al. (2025) illustrated how lean principles can be embedded into digitally designed processes.

Skalli et al. (2025) explicitly investigated Lean Six Sigma integration with Industry 4.0, finding that IoT and big data analytics enhance Lean's ability to reduce process variation. Singh (2019) connected lean healthcare with the Sustainable Development Goals (SDGs). Jiao et al. (2010) introduced artificial intelligence, showing how deep learning supports the development of smart hospitals. Overall, this cluster highlights the evolution of lean hospitals toward integration with cutting-edge technologies and long-term sustainability strategies.

3.2.4. Cluster 4: quality improvement and benchmarking

The fourth cluster emphasizes service quality improvement and benchmarking across hospitals, with key terms such as quality improvement, value stream mapping, simulation, and benchmarking.

Raval et al. (2020) confirmed the critical role of Lean Six Sigma in developing quality evaluation mechanisms. Wang et al. (2024) demonstrated how workflow simulation enhances efficiency while enabling performance benchmarking across hospitals. Narayanamurthy et al. (2024) proposed a qualitative leanness assessment framework, reinforcing continuous evaluation in hospitals.

Aissaoui et al. (2024) introduced BPMN–VSM for patient flow analysis, while Fontoura et al. (2023) developed real-time energy flow mapping to link lean efficiency with energy sustainability. Collectively, this cluster underscores the growing importance of comprehensive, data-driven performance evaluation tools in lean hospital research.

Table 4: Thematic Clusters of Lean Hospital–MCS Research (2008–2025)

Cluster	Item	Keyword	Issue
1	11	action research (19), continuous improvement (20), design/methodology/approach (23), hospitals (31), lean six sigma (19), lean thinking (17), process engineering (16), process improvement (9), process monitoring (19), six sigma (25), work simplification (17)	Process-Oriented Lean Practices
2	10	efficiency (6), health care (31), healthcare (21), human resource management (14), lean (16), lean management (17), logistics (12), performance (16), supply chain management (13), supply chain (18)	Organizational Efficiency and Performance
3	10	Industry 4.0 (15), lean healthcare (14), lean implementation (15), lean manufacturing (21), lean production (30), manufacturing (19), mapping (18), quality control (14), quality management (8), sustainable development (16)	Integration with Industry 4.0 and Sustainability
4	6	Benchmarking (14), health services (17), human (11), quality improvement (15), simulation (7), value stream mapping (23)	Quality Improvement and Benchmarking

(Source: bibliometric analysis, Scopus).

In summary, these four clusters demonstrate that lean hospital research from an MCS perspective has evolved from process-focused practices toward a multidisciplinary framework encompassing strategic management, digitalization, sustainability, and quality benchmarking. Cluster 1 remains grounded in strong empirical applications, while Clusters 3 and 4 represent the frontiers of research, moving toward digital integration and performance benchmarking. This confirms that lean hospitals are not merely an operational methodology but a strategic framework for smart healthcare transformation.

3.3. Research gaps and future research opportunities

The thematic map (Figure 6) categorizes lean hospital research from a management control systems (MCS) perspective into four areas: motor, basic, niche, and emerging themes. Lean Six Sigma and process improvement appear as major themes, reflecting rapid growth and central influence in the literature. Efficiency and performance management fall within the basic themes, highlighting their importance but limited conceptual depth. Value stream mapping and benchmarking emerge as niche themes, suggesting relevance yet fragmentation. Industry 4.0, digitalization, and green lean remain emerging themes, underscoring their potential but limited empirical validation.

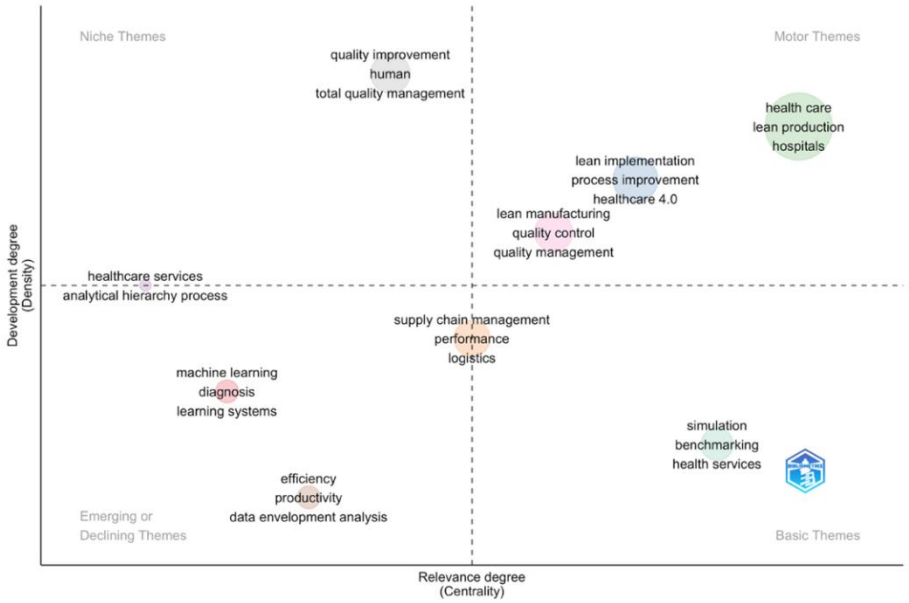


Fig. 6: Thematic Map of Lean Hospital–MCS Research.

(Source: bibliometric analysis using R Studio, 2008–2025).

Several gaps are evident. Most studies remain focused on operational aspects, while integration with strategic MCS frameworks is still limited. Although Pakdil & Leonard (2014) proposed a lean assessment framework, models linking lean with balanced scorecards or activity-based management are scarce. Digitalization and Industry 4.0, though recognized as critical frontiers, lack sufficient empirical studies. Tortorella et al. (2020) identified Healthcare 4.0 as the sector's future, but work on IoT, big data analytics, or AI-driven decision support in lean hospitals remains underdeveloped. Sustainability also receives limited attention; Abu et al. (2019) observed that most lean healthcare studies emphasize short-term efficiency rather than sustainable healthcare goals. Finally, human and organizational dynamics are under-researched. Leite & Quadros (2025) identified cultural resistance and weak leadership as barriers to implementation, while Ivcovici et al. (2025) emphasized the role of hybrid managers. However, longitudinal and large-scale quantitative evidence is still lacking. Thematic evolution analysis (Figure 7) highlights the progression of research between 2008 and 2025. Early studies (2008–2015) emphasized patient safety and quality control, reflecting a clinical quality orientation. Between 2016 and 2020, the focus shifted toward process improvement, Lean Six Sigma, and efficiency, signaling a stronger orientation toward organizational performance. More recent studies (2021–2025) highlight themes such as process monitoring, human resource management, Industry 4.0, and digitalization, pointing to the rise of smart hospital systems and digital transformation.

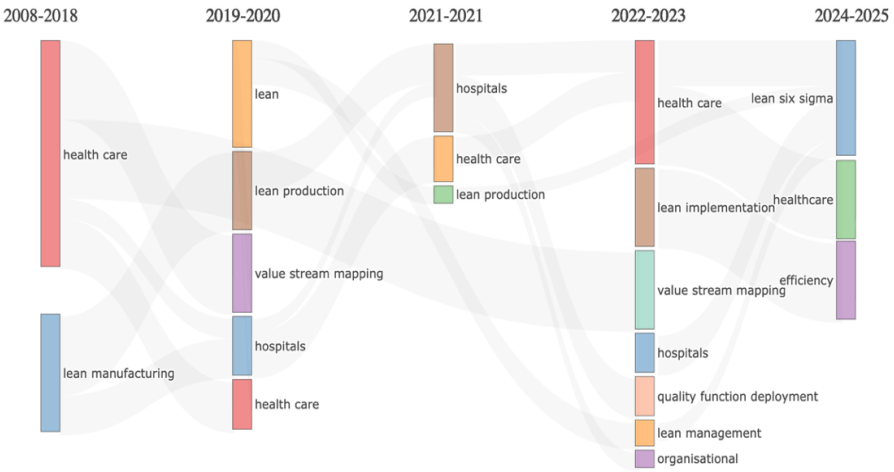


Fig. 7: Thematic Evolution of Lean Hospital–MCS Research.

(Source: bibliometric analysis using R Studio, 2008–2025).

Several promising avenues for future research arise from this evolution. One priority is the integration of lean with strategic MCS tools such as the balanced scorecard or activity-based management. Conceptual and empirical models that align operational efficiency with

patient safety and financial performance would advance the literature, as suggested by Mokogwu et al. (2024). Digitalization represents another promising direction. Jadhav & Deshmukh (2022) noted that digitalized healthcare supply chains support real-time lean integration, while Nguyen et al. (2022) demonstrated the potential of big data analytics and AI in predicting patient flows. Future studies could explore the use of digital twins, IoT, and AI-driven dashboards in strengthening data-driven MCS.

Leadership and organizational culture remain critical but underexplored. Comparative studies across different cultural contexts could provide insight into how local factors shape lean hospital effectiveness. Longitudinal studies are needed to assess the long-term impact of lean leadership on staff performance and patient satisfaction. Sustainability also presents a significant research opportunity. Fontoura et al. (2023) showed that energy flow mapping informed by lean principles can reduce environmental impacts while maintaining efficiency. Future research could develop tools such as lean–green scorecards and sustainable value stream mapping frameworks for hospitals.

Overall, the evidence indicates that lean hospital research from an MCS perspective remains largely operational, with insufficient exploration of strategic integration, digital transformation, human factors, and sustainability. Future work should address these gaps by advancing integrative lean–MCS frameworks, digitalization and smart hospital models, longitudinal studies on leadership and organizational culture, and lean–green approaches aligned with global sustainability goals. Collectively, these directions position lean hospitals as a multidisciplinary framework for advancing smart, lean, and sustainable healthcare systems.

4. Discussion

Findings from this Systematic Literature Review (SLR) confirm that research on lean hospitals from a management control systems (MCS) perspective has grown significantly between 2008 and 2025. Annual publication growth exceeds 12%, with studies distributed across 31 reputable international journals. The thematic focus has shifted from clinical quality issues toward strategic agendas such as organizational efficiency, digitalization, and sustainability. Bibliometric analysis identified four thematic clusters: process-oriented lean practices, organizational efficiency and performance, integration with Industry 4.0 and sustainability, and quality improvement and benchmarking. This evolution signals a transition from lean as a technical methodology to a multidisciplinary framework that integrates managerial innovation, digital technologies, and organizational governance.

Despite this progress, the analysis also highlights significant gaps. Much of the literature still emphasizes short-term process improvement, with limited exploration of links to strategic MCS (Pakdil & Leonard, 2014). Although themes such as digitalization and Industry 4.0 are gaining attention (Núñez-Merino et al., 2025; Skalli et al., 2025), empirical studies examining IoT, big data analytics, or AI-driven dashboards in lean hospitals remain scarce. Similarly, sustainability, including the concept of green lean hospitals, has been largely overlooked despite its growing importance for sustainable healthcare systems (Fontoura et al., 2023). Human and leadership dimensions, particularly the role of hybrid managers in bridging clinical and managerial logics, also lack longitudinal examination (Ivcovici et al., 2025).

4.1. Theoretical implications

This study extends the literature on lean hospitals from an MCS perspective in three major ways. First, bibliometric evidence shows that research has evolved from a technical–operational focus toward a multidisciplinary strategic framework. Early studies emphasized process improvement and patient safety, whereas recent work highlights the integration of lean with digitalization, Industry 4.0, and sustainability agendas (Núñez-Merino et al., 2025; Skalli et al., 2025). The convergence of these findings indicates a growing consensus that lean is no longer adequately understood as a set of operational techniques, but rather as a strategic managerial approach embedded in the organizational system. This reinforces the view that lean should be understood as a dynamic organizational capability (Sunder et al., 2023), rather than merely a tool for efficiency. However, divergence is still evident in how research conceptualizes the role of control systems, with some studies positioning MCS as a supporting mechanism, while others place it as the main driver of lean transformation.

Second, the findings underline the importance of integrating lean hospitals with strategic management control systems. Prior studies emphasize the inadequacy of traditional cost measurement approaches for capturing healthcare complexity (Almagtome & Shaker, 2019). The results support the development of integrative lean–MCS conceptual models, incorporating balanced scorecard, activity-based management, and value stream costing (Yun & An, 2025). A critical synthesis shows that research convergence occurs in the recognition of the importance of non-financial indicators, while differences arise in the level of integration between management accounting tools and lean practices at the strategic versus operational levels. Such approaches align operational efficiency with non-financial outcomes, including clinical quality, patient safety, and sustainability (da Silva et al., 2025).

Third, this review highlights leadership and organizational context as determinants of lean hospital success. Hybrid managers play a crucial role in bridging clinical and managerial logics (Ivcovici et al., 2025). This perspective aligns with contingency theory, which stresses that the effectiveness of management practices depends on contextual fit. Accordingly, the study contributes a socio-technical systems perspective to the lean hospital literature, emphasizing the interplay between digital technologies, control systems, and human factors.

Fourth, from the perspective of accounting and control theory, the findings of this study reinforce the relevance of contingency theory and strategic control in explaining variations in the implementation of lean hospitals. The integration of lean–MCS reflects a strategic control mechanism, in which performance measurement and cost control systems are not only used for monitoring, but also to support organizational learning and strategic adaptation (Rinawiyanti et al., 2021). In this framework, MCS functions as an enabling control that facilitates process innovation and continuous improvement, rather than as a coercive control that limits clinical flexibility (Janka, 2021). Thus, the main contribution of this study is to bridge the lean healthcare literature with modern management accounting theory, particularly in explaining how contextual control system design can strengthen hospital organizational transformation.

4.2. Practical and policy implications

Beyond theoretical contributions, the study provides several practical implications for hospital managers, healthcare practitioners, and policymakers. Lean hospitals should not be regarded merely as an operational toolbox but must be integrated with modern MCS instruments. In managerial practice, the MCS tools that best support the implementation of lean hospitals are strategic budgeting systems, balanced scorecards, and activity-based cost control mechanisms that enable the alignment of efficiency targets and clinical goals. Deepu & Ravi (2020) demonstrated that the ANP–QFD approach can help prioritize lean initiatives strategically, thereby reinforcing the role of MCS in aligning efficiency with organizational strategy.

Digitalization emerges as a key enabler of lean hospital implementation. Skalli et al. (2025) showed that integrating Lean Six Sigma with Industry 4.0 through IoT and big data analytics enhances real-time process monitoring. This suggests that hospitals need to invest in smart hospital infrastructures, including digital dashboards and AI-driven decision support systems, to maximize the impact of lean. In management accounting, this digitization facilitates more dynamic performance measurement, activity-based cost control, and budget preparation that is more adaptive to changes in service demand.

From a managerial perspective, the digital performance dashboard integrated with MCS enables hospital leaders to monitor financial and non-financial indicators simultaneously, thereby strengthening data-driven decision-making. Therefore, hospitals are advised to invest in smart hospital infrastructure, including digital dashboards, integrated management accounting systems, and artificial intelligence (AI)-based decision support systems, to maximize the impact of lean on organizational performance.

The integration of lean–MCS is particularly relevant for hospitals operating under bundled payment schemes such as iDRG/JKN. da Silva et al. (2025) demonstrated that lean practices enhance organizational resilience in the face of uncertainty and financial constraints. In this case, management accounting tools such as performance-based budgeting, variance analysis, and activity-based cost control can serve as key mechanisms to ensure that lean initiatives are aligned with funding constraints and performance targets. Regulators and policymakers may consider providing incentives or policy recognition for hospitals that adopt lean–digital MCS integration as part of accreditation standards and performance evaluation systems.

Finally, the integration of lean with sustainability agendas opens pathways toward green lean hospitals. Fontoura et al. (2023) demonstrated that real-time energy flow mapping links cost efficiency with environmental performance. In practice, hospitals can simultaneously enhance operational efficiency and contribute to achieving the Sustainable Development Goals (SDGs). From a sustainability accounting perspective, lean–MCS integration supports the development of ESG reporting through systematic measurement of energy consumption, waste, and emissions, as well as their relationship to cost performance and service quality. Thus, lean hospitals have the potential to become the foundation for more transparent and accountable governance in the healthcare sector.

In sum, the practical implications emphasize the need for hospitals to: (1) integrate lean with strategic MCS and management accounting tools such as budgeting, (2) invest in digitalization to advance smart healthcare systems, (3) strengthen lean leadership through the training of hybrid managers, and (4) adopt lean–green approaches aligned with global sustainability agendas.

5. Conclusion

This study confirms that lean hospitals need to be understood as a strategic approach that goes beyond technical and operational improvements. Integrating lean principles with management control systems (MCS) opens up opportunities for more comprehensive healthcare transformation, where operational efficiency, service quality, patient safety, and sustainability can be managed simultaneously within a single strategic framework. Thus, lean no longer stands as a set of process improvement tools, but as a managerial foundation for performance- and value-based decision making.

Unlike previous studies that tend to place lean in the operational realm, this research systematically demonstrates the importance of integrating lean with strategic MCS as the foundation for performance- and value-based decision making. Thus, this study expands the lean healthcare literature by placing MCS as the key link between strategy, lean implementation, and organizational outcomes, particularly in the context of the complexity of modern healthcare services.

Furthermore, this research identifies significant conceptual gaps in the literature, particularly regarding the limited empirical evidence on the role of strategic MCS tools, Industry 4.0-based digitalization, sustainability, and leadership and organizational context dimensions. These findings emphasize that the success of lean hospitals is not only determined by technical design but also by the alignment between control systems, technology, and human factors.

Based on a synthesis of the literature, this study proposes a future research agenda that focuses on developing an integrated lean–MCS model, exploring the role of digitization in strengthening control systems, conducting longitudinal studies on leadership and organizational culture, and integrating lean with the global sustainability agenda. This agenda offers relevant theoretical and empirical directions for research on management accounting and governance in the health sector.

Overall, the original contribution of this study lies in strengthening the position of lean hospitals as a management control-based strategic framework. The findings and proposed agenda are expected to serve as a foundation for further research and support hospitals in designing more efficient, accountable, data-driven, and sustainable healthcare systems.

References

[1] Abdallah, A. B., Basheer, S. N., & Alkhaldi, R. Z. (2025). Unraveling the interplay between lean healthcare and patient satisfaction: the mediating roles of quality performance and process innovation. *TQM Journal*. https://doi.org/10.1108/TQM-07-2024-0258.

[2] Abu, F., Gholami, H., Mat Saman, M. Z., Zakuan, N., & Streimikiene, D. (2019). The implementation of lean manufacturing in the furniture industry: A review and analysis of the motives, barriers, challenges, and the applications. *Journal of Cleaner Production*, *234*, 660–680. https://doi.org/10.1016/j.jclepro.2019.06.279.

[3] Aissaoui, N. O., Ben Mbarek, H., Layeb, S. B., & B. Hadj-Alouane, A. (2024). A BPMN-VSM based process analysis to improve the efficiency of multidisciplinary outpatient clinics. *Production Planning and Control*, *35*(5), 461–491. https://doi.org/10.1080/09537287.2022.2098199.

[4] Almagtome, A., & Shaker, A. S. (2019). Impact of Lean Accounting Information on the Financial performance of the Healthcare Institutions: A Case Study. *Journal of Engineering and Applied Sciences*, *14*(2). https://doi.org/10.36478/jeasci.2019.589.599.

[5] Anggadwita, G., & Indarti, N. (2023). Women entrepreneurship in the internationalization of SMEs: a bibliometric analysis for future research directions. *European Business Review*, *35*(5), 763–796. https://doi.org/10.1108/EBR-01-2023-0006.

[6] Baas, J., Schotten, M., Plume, A., Côté, G., & Karimi, R. (2020). Scopus as a curated, high-quality bibliometric data source for academic research in quantitative science studies. *Quantitative Science Studies*, *1*(1), 377–386. https://doi.org/10.1162/qss_a_00019.

[7] Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa.

[8] Costa, L. B. M., & Godinho Filho, M. (2016). Lean healthcare: review, classification and analysis of literature. *Production Planning and Control*, *27*(10), 823–836. https://doi.org/10.1080/09537287.2016.1143131.

[9] da Silva, P. F., Saurin, T. A., & Marodin, G. A. (2025). Resilience and risk: adding complexity-informed variables to patient-centered internal lean logistics in hospitals. *Production Planning and Control*. https://doi.org/10.1080/09537287.2025.2458590.

[10] Deepu, T. S., & Ravi, V. (2020). An integrated ANP–QFD approach for prioritization of customer and design requirements for digitalization in an electronic supply chain. *Benchmarking*, *28*(4), 1213–1246. https://doi.org/10.1108/BIJ-06-2020-0298.

[11] Farris, J. A., Van Aken, E. M., Doolen, T. L., & Worley, J. (2009). Critical success factors for human resource outcomes in Kaizen events: An empirical study. *International Journal of Production Economics*, *117*(1), 42–65. https://doi.org/10.1016/j.ijpe.2008.08.051.

[12] Fauzi, M. A., Muhamad Tamyez, P. F., & Kumar, S. (2025). Social Entrepreneurship and Social Innovation in ASEAN: Past, Present, and Future Trends. In *Journal of Social Entrepreneurship* (Vol. 16, Issue 1, pp. 146–168). Routledge. https://doi.org/10.1080/19420676.2022.2143870.

[13] Fontoura, L., Nascimento, D. L. de M., Neto, J. V., Garcia-Buendia, N., Garza-Reyes, J. A., Lima, G. B. A., Tortorella, G. L., Caiado, R. G. G., & Meiriño, M. J. (2023). Real-time energy flow mapping: A VSM-based proposal for energy efficiency. *Journal of Cleaner Production*, *419*. https://doi.org/10.1016/j.jclepro.2023.137871.

[14] Gündüz, M. (2015). Value Stream Performance Measurement in Lean Manufacturing Business. *International Business and Management*, *10*(3), 40. https://doi.org/10.3968/7128

[15] Harsono, A. (2015). Analisis Implementasi Sistem Informasi Manajemen Rumah Sakit Umum Daerah (SIM-RSUD). *EKSPLORA INFORMATIKA*, *5*.

[16] Ivcovici, A., Bamber, G., Bartram, T., Stanton, P., Borg, J., & Pariona-Cabrera, P. (2025). The regulation and reconciliation of hybrid professional-managerial identities in a public hospital: the case of Lean management. *Journal of Health Organization and Management*, *39*(9), 284–304. https://doi.org/10.1108/JHOM-02-2024-0058.

[17] Jadhav, J. S., & Deshmukh, J. (2022). A review study of the blockchain-based healthcare supply chain. *Social Sciences and Humanities Open*, *6*(1). https://doi.org/10.1016/j.ssaho.2022.100328.

[18] Janka, M. (2021). Enabling formal MCS design and use: A meta-synthesis of qualitative research. *Journal of Accounting & Organizational Change*, *17*(2), 133-163. https://doi.org/10.1108/JAOC-01-2019-0002.

[19] Jiao, H., Wei, J., & Cui, Y. (2010). An empirical study on paths to develop dynamic capabilities: From the perspectives of entrepreneurial orientation and organizational learning. *Frontiers of Business Research in China*, *4*(1), 47–72. https://doi.org/10.1007/s11782-010-0003-5.

[20] Leite, H., & Quadros, F. C. (2025). Lean applications across the healthcare ecosystem: Value creation, destruction and a research agenda. *Operations Management Research*, *18*(1), 24–47. https://doi.org/10.1007/s12063-024-00523-y.

[21] Mokogwu, C., Ozoemenam Achumie, G., Adeleke, A. G., Okeke, I. C., & Ewim, P.-M. (2024). A Conceptual Model for Enhancing Operational Efficiency in Technology Startups: Integrating Strategy and Innovation. In *International Journal of Engineering Research And Development* (Vol. 20, Issue 11). www.ijerd.com.

[22] Narayanamurthy, G., Gurumurthy, A., & Tortorella, G. L. (2024). Qualitative leanness assessment of hospital using benchmarking: a case study. *Production Planning and Control*. https://doi.org/10.1080/09537287.2024.2437040.

[23] Nguyen, A., Lamouri, S., Pellerin, R., Tamayo, S., & Lekens, B. (2022). Data analytics in pharmaceutical supply chains: state of the art, opportunities, and challenges. *International Journal of Production Research*, *60*(22), 6888–6907. https://doi.org/10.1080/00207543.2021.1950937.

[24] Núñez-Merino, M., Maqueira-Marín, J. M., Moyano-Fuentes, J., & Castaño-Moraga, C. A. (2025). Product development process for a new healthcare service in the Industry 4.0 context: an action research approach. *Production Planning and Control*, *36*(2), 177–196. https://doi.org/10.1080/09537287.2024.2349224.

[25] Pakdil, F., & Leonard, K. M. (2014). Criteria for a lean organisation: Development of a lean assessment tool. *International Journal of Production Research*, *52*(15), 4587–4607. https://doi.org/10.1080/00207543.2013.879614.

[26] Paul, J. (2024). Strategies for Effective Crisis Management in Healthcare Systems: Patient Safety and Lessons Learned. *Medical Research Archives*, *12*(7). https://doi.org/10.18103/mra.v12i7.5424

[27] Podsakoff, P. M., Mackenzie, S. B., Bachrach, D. G., & Podsakoff, N. P. (2005). The influence of management journals in the 1980s and 1990s. *Strategic Management Journal*, *26*(5), 473–488. https://doi.org/10.1002/smj.454.

[28] Pribadi, M. R. (2015). PENERAPAN TATA KELOLA TEKNOLOGI INFORMASI DENGAN MENGGUNAKAN COBIT FRAMEWORK 4.1 (STUDI KASUS PADA RSUD BARI PALEMBANG). *EKSPLORA INFORMATIKA*, *4*(2). https://www.researchgate.net/publication/350672075.

[29] Raval, S. J., Kant, R., & Shankar, R. (2020). Analyzing the Lean Six Sigma enabled organizational performance to enhance operational efficiency. *Benchmarking*, *27*(8), 2401–2434. https://doi.org/10.1108/BIJ-05-2019-0221.

[30] Rinawiyanti, E. D., Huang, X., & As-Saber, S. (2021). Adopting management control systems through CSR strategic integration and investigating its impact on company performance: evidence from Indonesia. *Corporate Governance: The international journal of business in society*, *21*(3), 463-478. https://doi.org/10.1108/CG-04-2020-0150.

[31] Samanta, A. K., Varaprasad, G., Gurumurthy, A., & Antony, J. (2024). Implementing Lean Six Sigma in a multispecialty hospital through a change management approach. *TQM Journal*, *36*(8), 2281–2296. https://doi.org/10.1108/TQM-02-2023-0043.

[32] Sedaghat, A., & Hopkins, C. (2020). Chronic rhinosinusitis disease control as a metric for guiding treatment. In *Rhinology* (Vol. 58, Issue 3, p. 193). International Rhinologic Society.

[33] Singh, P. (2019). Lean in healthcare organization: an opportunity for environmental sustainability. *Benchmarking*, *26*(1), 205–220. https://doi.org/10.1108/BIJ-04-2018-0104.

[34] Sitalaksmi, S., Indarti, N., Anggadwita, G., & Sambudi, A. D. (2024). Knowledge leakage and collaborative innovation: a systematic literature review. *Knowledge Management Research and Practice*. https://doi.org/10.1080/14778238.2024.2431111.

[35] Skalli, D., Cherrafi, A., Charkaoui, A., Chiarini, A., Shokri, A., Antony, J., Garza-Reyes, J. A., & Foster, M. (2025). Integrating Lean Six Sigma and Industry 4.0: developing a design science research-based LSS4.0 framework for operational excellence. *Production Planning and Control*, *36*(8), 1060–1086. https://doi.org/10.1080/09537287.2024.2341698.

[36] Srijithesh, P. R., Gijo, E. V., Raja, P., Bhat, S., Mythirayee, S., Taallapalli, A. V. R., Kulkarni, G. B., Siani, J., & Aravinda, H. R. (2025). Leveraging Lean Six Sigma principles in an Indian tertiary care hospital: a case study. *International Journal of Quality and Reliability Management*, *42*(2), 600–630. https://doi.org/10.1108/IJQRM-01-2024-0025.

[37] Sunder, V. M., Ganesh, L. S., & Marathe, R. R. (2023). A Dynamic Capabilities View of Lean in a Service Context. *IEEE Transactions on Engineering Management*, *70*(11), 3887–3901. https://doi.org/10.1109/TEM.2021.3089850.

[38] Tortorella, G. L., Fogliatto, F. S., Mac Cawley Vergara, A., Vassolo, R., & Sawhney, R. (2020). Healthcare 4.0: trends, challenges and research directions. *Production Planning and Control*, *31*(15), 1245–1260. https://doi.org/10.1080/09537287.2019.1702226.

[39] van Kleeff, R., & van Harten, J. (2025). Leaning on leadership? Understanding how a lean implementation impacts hospital workers' performance. *Production Planning and Control*, *36*(11), 1558–1575. https://doi.org/10.1080/09537287.2024.2386432.

[40] Wang, C. N., Vo, T. T. B. C., Hsu, H. P., Chung, Y. C., Nguyen, N. T., & Nhieu, N. L. (2024). Improving processing efficiency through workflow process reengineering, simulation and value stream mapping: a case study of business process reengineering. *Business Process Management Journal*, *30*(7), 2482–2515. https://doi.org/10.1108/BPMJ-11-2023-0869.

[41] Yamamoto, K., Milstead, M., & Lloyd, R. (2019). A review of the development of lean manufacturing and related lean practices: The case of Toyota production system and managerial thinking. *International Management Review*, *15*. https://www.researchgate.net/publication/340449306.

[42] Yun, G., & An, J. (2025). Revealing the intellectual foundations of healthcare supply chain risk: a bibliometric mapping and research agenda. *Benchmarking*. https://doi.org/10.1108/BIJ-10-2023-0703.