Optimizing Healthcare Performance by Leveraging Lean Methodologies and Leadership Strategies

Teoh Mooi Shan[1], Nomahaza Mahadi[2*], Siti Azreen Habeeb Rahuman[2]

[1]Sabah State Health Department

[2]Azman Hashim International Business School (AHIBS), Universiti Teknologi, Malaysia

[*]Corresponding Author

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ABSTRACT

This paper examines how Lean; Six Sigma and their combined application contribute to better performance and service quality in healthcare organisations. Lean helps streamline processes and reduce unnecessary work, while Six Sigma strengthens accuracy and consistency, making both approaches useful for addressing the long-standing issues of delays, variation, and resource pressure in healthcare settings. When used together, they create a structured path for improving patient flow, safety and overall efficiency. The review also highlights the strong influence of leadership, noting that leaders who communicate clearly, encourage staff involvement and support continuous learning are better able to sustain improvement efforts. Although challenges such as cultural resistance and limited resources often slow adoption, the findings show that committed leadership and well-planned implementation can make Lean and Six Sigma effective tools for long term change. The paper concludes by pointing to emerging opportunities where continuous improvement can be linked with digital innovation and sustainability to meet the evolving demands of modern healthcare.

Keywords: Lean healthcare, six sigma, leadership, performance improvement, continuous improvement

INTRODUCTION

Healthcare systems continue to experience increasing pressure from rising patient volumes, chronic conditions, financial constraints, and post-pandemic operational disruption. These systemic demands have heightened the need for structured improvement methodologies capable of supporting workflow reliability, clinical safety, and service quality enhancement. Lean and Six Sigma have therefore become central to healthcare transformation, with Lean targeting waste elimination and flow optimisation, and Six Sigma focusing on precision, defect reduction, and statistical control (Henrique & Filho, 2018; Bhat et al., 2022).

Although developed in industrial environments, Lean and Six Sigma have progressively expanded into healthcare due to their potential to address long-standing inefficiencies such as delays, variation, error occurrence and resource strain (Hung et al., 2022; Noronha et al., 2021). When combined as Lean Six Sigma (LSS), the framework enables organisations to accelerate performance improvement, standardise clinical pathways, and improve overall safety outcomes (Rathi et al., 2022; Ibrahim et al., 2022).

Despite positive adoption trends, research consistently reports that gains associated with Lean and Six Sigma are not uniformly sustained over time. Implementation is often slowed by cultural resistance, fragmented workflows, staffing limitations, and organisational fatigue following project completion (Bhat et al., 2022; Van Rossum et al., 2016). These constraints suggest that Lean methodologies alone are insufficient without leadership structures that reinforce organisational commitment, improvement continuity, and behavioural alignment across clinical and administrative units.

Leadership therefore emerges as a decisive determinant of Lean maturity and sustainability in healthcare settings. Studies show that leaders who engage in transparent communication, gemba-based oversight, shared decision making, and continuous improvement support are more likely to sustain Lean outcomes beyond initial implementation (Aij et al., 2015; Azevedo et al., 2020). Leadership visibility and long-term commitment are

repeatedly identified as central to staff engagement, cross-departmental alignment, and improvement readiness (Tortorella et al., 2019; Ramori et al., 2019).

Existing literature primarily documents Lean's operational benefits, such as reduced waiting times, error minimisation, and improved patient flow—but less frequently clarifies how leadership behaviours translate improvement frameworks into durable organisational culture (Hung et al., 2022; Vanichchinchai, 2023). This gap highlights the need to interpret Lean not only as a technical system but as a leadership-driven transformation requiring deliberate cultural reinforcement rather than episodic project execution.

Accordingly, this study reexamines Lean and Six Sigma integration through a leadership-centred lens, emphasising leadership as an active mechanism in sustaining continuous improvement, ensuring staff participation, and enabling strategic alignment of Lean objectives with long-term organisational goals. By consolidating empirical findings on Lean, Six Sigma and leadership dynamics, the study contributes clearer understanding of the conditions required for durable implementation and improvement continuity across healthcare environments (Noronha et al., 2021; Ibrahim et al., 2022).

LITERATURE REVIEW

Adoption and Evolution of Lean and Six Sigma in Healthcare

The emergence of Lean and Six Sigma in healthcare reflects the sector's need to address persistent inefficiencies, fluctuating demand, and variability in service pathways. While Lean originated from Toyota's process optimisation philosophy and Six Sigma from precision-driven industrial quality control, their transition into clinical settings has been propelled by system-wide requirements for reduced delays, increased accuracy, and safer operational standards (Henrique & Filho, 2018; Ibrahim et al., 2022). The combined adaptation into Lean Six Sigma (LSS) has gained visibility since the early 2000s, marking a shift from isolated improvement initiatives toward sustained and integrated strategic reform within hospitals (Rathi et al., 2022; Noronha et al., 2021). Evidence indicates that LSS assists in diagnosing flow interruptions, tightening clinical variability, and improving reliability of diagnostic and procedural outcomes while maintaining long-term alignment with patient safety expectations (Hung et al., 2022).

Lean's Application in Operational and Clinical Workflows

Lean healthcare literature consistently describes process transparency, workplace organisation, reduction of non-value time, and communication clarity as primary gains associated with Lean-driven redesigns. In clinical settings, Lean directly supports timeliness, patient journey standardisation, and reduced care fragmentation by addressing root causes of delays in procedural handovers, laboratory turnaround, and interdepartmental communication (Van Rossum et al., 2016). Although improvements are well documented, several studies note that Lean benefits remain vulnerable when cultural alignment and leadership continuity are insufficient, resulting in temporary enhancement rather than enduring system advancement (Reponen et al., 2021; Bhat et al., 2022). Lean therefore operates not only as a technical framework but as a mechanism requiring behavioural reinforcement to avoid regression once project momentum stabilises.

Six Sigma Precision and Error Reduction

In parallel, Six Sigma's introduction into healthcare contributes statistical rigour and defect-minimisation capacity, particularly in laboratories, procedural units and high-volume patient interfaces. Six Sigma is positioned as a corrective architecture for clinical error, diagnostic inconsistency, and treatment variation, addressing measurable deviations that can compromise patient safety and resource utilisation efficiency (Henrique & Filho, 2018). Literature emphasises that while Six Sigma strengthens data-based decision-making, it rarely produces lasting change when introduced without reciprocal cultural participation or multidisciplinary ownership, conditions more characteristic of Lean leadership environments than of data-driven technical programmes alone (Ibrahim et al., 2022).

Integrated Lean Six Sigma Frameworks and Performance Stability

Increasing scholarly focus has been directed toward the convergence of Lean and Six Sigma as a singular

performance platform. Lean accelerates waste reduction and workflow clarity, while Six Sigma reinforces reliability by stabilising procedural outputs and reducing variance across care contact points (Noronha et al., 2021). Their conceptual union therefore responds directly to complex healthcare architectures where escalating demands require both speed and precision, not merely one operational axis. However, despite demonstrable impact on timeliness, safety, diagnostic throughput and cost containment, sustained improvement is rarely achieved where the integrated model is limited to project implementation cycles without governance-led institutionalisation (Hung et al., 2022; Bhat et al., 2022).

Leadership Influence on Lean Stability

Leadership has emerged as the defining element determining whether Lean functions as a transformative cultural practice or as a temporary operational experiment. Studies repeatedly acknowledge that leaders who participate visibly in improvement rounds, articulate Lean in strategic terms rather than operational slogans, and maintain proximity to frontline problem-solving are more likely to facilitate sustained behaviour change (Aij et al., 2015; Azevedo et al., 2020). Leadership presence reduces interpretive ambiguity, strengthens confidence in improvement routines, and builds internal capacity for iterative learning rather than episodic execution. Conversely, Lean deterioration is associated with leadership withdrawal, administrative delegation of improvement responsibilities, and the absence of symbolic modelling of improvement behaviour (Ramori et al., 2019).

Persistent Research Gap in Lean Sustainability Mechanisms

While Lean and Lean Six Sigma have been extensively validated as architectures capable of reducing delay, increasing safety, and promoting systematic clarity, few studies provide detailed explanation of the leadership mechanisms by which Lean sustains its identity beyond initiation phases. Existing scholarship largely focuses on implementation outputs rather than the leadership structures that maintain learning cycles, cross-departmental coordination, and standardisation discipline (Vanichchinchai, 2023; Noronha et al., 2021). This gap is not methodological but organisational, reinforcing a broad consensus that improvement frameworks must be strengthened through leadership integration to prevent procedural erosion and cultural fatigue (Van Rossum et al., 2016). Lean thus demonstrates resilience only in environments where leadership continuously renews alignment, psychological safety, and improvement literacy, cultivating transformation rather than project closure.

Summary of Established Position

Taken collectively, the literature indicates that Lean and Six Sigma can only fulfil their strategic potential when aligned with leadership structures that support accountability, behavioural continuity, and shared meaning. The persistent challenge is not the efficacy of Lean tools nor the precision of Six Sigma techniques, but the durability of leadership engagement as the sustaining force enabling Lean to evolve from technical improvement method to embedded organisational culture (Hung et al., 2022; Azevedo et al., 2020).

Theoretical Foundation

The theoretical grounding for Lean and Six Sigma within healthcare is shaped by their shared orientation toward systematic performance enhancement, though each originates from distinct operational philosophies. Lean derives from the Toyota Production System and is theoretically anchored in the principle that value is created when workflow disruptions, redundancies and all forms of waste are eliminated in order to support uninterrupted process continuity (Hung et al., 2022). In healthcare, this theoretical position translates into a requirement that patient pathways, diagnostic sequences and administrative flow be organised to minimise non-value movement, avoid procedural duplication and ensure that clinical resources are utilised in alignment with demand realities rather than historic practice patterns. Lean thus provides the theoretical basis for continuous improvement culture in which the pursuit of streamlined process design becomes not a corrective mechanism but an ongoing organisational intention (Noronha et al., 2021).

Six Sigma, in contrast, is theoretically grounded in the premise that systematic variation reduction is essential to quality performance. Developed from a statistical perspective on defect minimisation, Six Sigma assumes that undesirable care variability, diagnostic error and procedural inconsistency represent inherent risks to safety

and reliability outcomes (Henrique & Filho, 2018). When applied to healthcare, the Six Sigma worldview emphasises analytical measurement, error probability control, and structured investigation of deviation points in order to achieve consistent clinical outputs across changing resource conditions and fluctuating patient profiles (Ibrahim et al., 2022). Its theoretical emphasis is not on speed nor flow but on the predictability of clinical outcomes and the rigorous evaluation of process deviation.

Although Lean and Six Sigma originate from divergent assumptions regarding the primary obstacle to system performance, waste in Lean's model and variation in Six Sigma's, contemporary scholarship converges on the view that their combined theoretical lens is necessary for healthcare, where both timeliness and reliability must operate simultaneously (Rathi et al., 2022). Lean provides the theoretical basis for designing systems that move without interruption, while Six Sigma provides the theoretical basis for ensuring that such systems deliver accurate and defect-resistant output. Their integration therefore shifts healthcare improvement discourse away from episodic efficiency exercises toward sustained cultural recalibration, requiring organisations to perceive service quality not as procedural adjustment but as an embedded institutional ethic (Hung et al., 2022).

A central theoretical extension within this discourse concerns leadership as the sustaining condition through which Lean and Six Sigma can become stable rather than transitory. Multiple studies emphasise that Lean's theoretical ambition of continuous improvement cannot be achieved in environments where leadership presence is symbolic, intermittent or delegated, and that Six Sigma's theoretical dependence on disciplined measurement collapses when improvement intent is not reinforced through communicative continuity and decision-making alignment (Aij et al., 2015; Azevedo et al., 2020). Leadership therefore functions not as a practical vehicle but as the theoretical stabiliser that converts methodological tools into durable organisational identity. Its role is located not only in programme initiation but in the definitional construction of improvement as a shared cultural value rather than as a time-bound intervention.

This theoretical convergence ultimately positions Lean as the philosophy of continuous flow, Six Sigma as the philosophy of precision and leadership as the condition enabling both to crystallise beyond temporary procedural performance spikes. While Lean and Six Sigma supply structured knowledge architectures regarding what must change within care systems, leadership constitutes the interpretive and behavioural infrastructure determining whether such change endures. Lean and Six Sigma thus function as formal improvement doctrines, whereas leadership theory provides their operational legitimacy and cultural continuity (Vanichchinchai, 2023).

METHODOLOGY

This study is based on a narrative literature review approach, drawing exclusively from peer-reviewed academic sources that examine Lean, Six Sigma and leadership within healthcare settings. The review did not involve primary data collection and instead relied on existing published work to interpret how Lean and Six Sigma have been applied, sustained and influenced by leadership in clinical environments. The selection of literature focused on studies that reported healthcare improvement outcomes and those that specifically discussed implementation challenges and leadership involvement in sustaining Lean programmes (Hung et al., 2022; Noronha et al., 2021).

Articles were identified based on their relevance to process optimisation, patient flow, error reduction, organisational culture and leadership engagement in Lean healthcare adoption. Only credible academic publications were included, ensuring conceptual and methodological reliability. The review synthesis followed a thematic reading of the selected works, emphasising patterns of adoption success, sustainability barriers and leadership influence over ongoing improvement activity (Aij et al., 2015; Azevedo et al., 2020).

This method supports a clear interpretation of Lean and Six Sigma not as isolated operational tools but as improvement approaches that require leadership continuity to maintain long-term performance gains. The literature review format is appropriate given the study's aim to refine theoretical understanding rather than to measure intervention effects, allowing Lean sustainability to be analysed through existing empirical findings rather than new field data (Van Rossum et al., 2016).

DISCUSSION

The findings from the reviewed literature reaffirm that Lean and Six Sigma continue to serve as structural responses to operational inefficiencies and safety risks in healthcare, yet their long-term effectiveness remains contingent on organisational capacity to sustain improvement beyond the initial deployment phase. There is strong agreement that Lean creates clarity in workflow and reduces non-value tasks, while Six Sigma strengthens diagnostic consistency and error control; however, studies repeatedly show that methodological capability alone does not secure durability of outcomes (Hung et al., 2022; Henrique & Filho, 2018). Although the reviewed evidence demonstrates measurable improvements in timeliness, laboratory output, patient turnover and service reliability following Lean interventions, sustainability gaps are evident in organisations where improvement culture is not embedded and where leadership engagement declines once implementation objectives are met (Van Rossum et al., 2016).

The discussion further highlights the centrality of leadership not merely as a facilitator but as a sustaining force. Literature consistently reports that leaders who visibly participate in Lean transformation, communicate improvement expectations with continuity, and support staff involvement create stronger conditions for adoption confidence and post-implementation retention (Aij et al., 2015; Azevedo et al., 2020).

Conversely, settings characterised by leadership withdrawal, symbolic endorsement or delegative supervision demonstrate a higher tendency for Lean regression, reinforcing the premise that Lean effectiveness is organisational rather than procedural in character. While Lean tools such as value mapping, visual control and standardised work regularly improve care interactions, they do not produce sustainable transformation unless supported through leadership-aligned reinforcement structures, psychological safety and iterative learning space (Ramori et al., 2019).

A notable thread emerging across the reviewed studies is the distinction between improvement implementation and improvement institutionalisation. Immediate project gains, such as reduced waiting periods, streamlined handovers and error reductions which often mask underlying fragility when improvement remains technically driven instead of culturally maintained (Bhat et al., 2022). Lean becomes durable only when its rationale is repeatedly communicated, socially reinforced and structurally protected through leadership continuity. Where clinical pressure, staffing volatility and operational unpredictability are dominant, as is typical in contemporary healthcare systems, Lean requires leadership not as a managerial layer but as a stabilising architecture that ensures improvement identity does not collapse under competing workload demands (Reponen et al., 2021).

Taken together, the discussion affirms that Lean and Six Sigma are not weakened by methodological insufficiency but by contextual inconsistency, motivational erosion and cultural fatigue when system-level support is not sustained. Leadership therefore emerges as a non-substitutable condition for improvement permanency, shaping whether Lean remains an episodic operational fix or matures into an embedded organisational principle (Vanichchinchai, 2023). The reviewed evidence thus positions leadership not outside Lean but within its theoretical functioning, determining the longevity, interpretive clarity and behavioural retention of Lean adoption.

CONCLUSION

The review affirms that Lean and Six Sigma remain central contributors to healthcare performance advancement, improving timeliness, diagnostic reliability and workflow stability; however, their long-term impact is not secured by methodological soundness alone but by the degree of leadership continuity supporting implementation. Although Lean strategies reduce process inefficiencies and Six Sigma strengthens accuracy, the literature consistently demonstrates that improvement gains diminish when cultural reinforcement, leadership participation and behavioural alignment are not sustained beyond initial project periods (Van Rossum et al., 2016; Bhat et al., 2022). In this regard, the decisive factor in the durability of Lean performance is not the technical framework but the organisational stewardship that prevents improvement from reverting to episodic intervention. Leadership therefore functions as the structural mechanism through which Lean shifts from procedural activity to institutional identity, shaping staff commitment, communication discipline and cross-unit cooperation essential for maintenance of improvement (Aij et al., 2015; Azevedo et al., 2020).

Accordingly, healthcare organisations should move beyond project-based Lean deployment and formalise leadership-driven governance models that maintain improvement momentum as a continuous performance duty rather than an operational event. This requires leadership presence not as symbolic endorsement but as enduring engagement through gemba oversight, interpretive clarity and participative communication. In doing so, Lean becomes embedded within daily decision routines rather than confined to improvement cycles or campaign windows. Sustained leadership involvement further supports the establishment of shared improvement language, reinforcing Lean as a collective service ethic rather than a technical competency. In systems marked by fluctuating care demands, staff rotation pressure and resource strain, such continuity is essential for resisting improvement fatigue and sustaining Lean rationale over time (Reponen et al., 2021; Vanichchinchai, 2023).

Thus, the future of Lean healthcare must focus not on method expansion but on leadership-anchored institutionalisation. Organisations are encouraged to cultivate improvement literacy as an organisational norm, protect Lean alignment through executive accountability and embed review mechanisms that ensure Lean remains a durable performance philosophy. In doing so, Lean and Six Sigma move beyond episodic corrective strategy and achieve their intended role as enduring frameworks for quality, efficiency and clinical reliability in contemporary healthcare environments (Hung et al., 2022; Noronha et al., 2021).

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