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Generative Ai-Enabled Lean Healthcare : Examining the Impact of Ai-Assisted Process Efficiency on Patient Experience, Trust, and Loyalty in Hospitals Ntr (Dt)

Submitted by

Sureddi Sri Sai Kowtillya

KL Business School

Koneru Lakshmaiah Education Foundation (Deemed to Be University) Vaddeswaram,

Guntur, Andhra Pradesh, India

Email: 2501510185mba@gmail.com

Abstract - The healthcare manufacturing sector is increasingly adopting Artificial Intelligence (AI) and Generative Artificial Intelligence (GenAI) to improve decision-making, process efficiency, quality, resource utilisation, and operational performance. However, existing research largely examines AI applications independently, focusing on areas such as clinical decision support, patient experience, workflow automation, trust, diagnostics, and administrative efficiency. Similarly, Lean Six Sigma, supply chain management, procurement, and project management are frequently studied as separate approaches to operational improvement. This fragmentation creates a need for an integrated perspective on how AI capabilities can be aligned with established operational excellence practices in healthcare manufacturing. This study proposes an integrated conceptual framework examining the role of AI and GenAI in strengthening Lean Six Sigma practices, supply chain and procurement effectiveness, project management, and KPI-based performance management. The framework considers technological, organisational, and human factors, including AI readiness, trust, transparency, human oversight, and organisational readiness, while focusing on outcomes such as process efficiency, quality, cost reduction, waste reduction, productivity, and delivery performance. A structured review of relevant literature is undertaken to identify existing approaches, methodologies, technologies, findings, limitations, and research gaps. The study aims to contribute to the emerging literature by connecting AI-enabled transformation with cross-functional operational excellence rather than examining individual AI applications in isolation. The proposed framework is expected to provide a foundation for future empirical validation and practical guidance for healthcare manufacturing organisations seeking sustainable, data-driven operational improvement. It also seeks to support managers in designing coordinated, measurable, and responsible AI-enabled improvement initiatives across healthcare manufacturing operations effectively.

Keywords: Artificial Intelligence; Generative AI; Lean Six Sigma; Healthcare Manufacturing; Operational Excellence

1. INTRODUCTION

Healthcare organisations must balance service quality, patient safety, timely access, and the responsible use of limited resources. Hospitals coordinate many connected activities, including registration, appointment scheduling, diagnostics, clinical documentation, pharmacy services, discharge, inventory management, procurement, and communication with patients. A delay in one part of this system can affect other departments and the patient's overall experience. For this reason, operational improvement should be judged not only by whether a task becomes faster, but also by whether the service becomes safer, more reliable, and easier for patients to navigate.

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Artificial intelligence (AI) may help healthcare teams identify patterns, forecast demand, retrieve information, and support selected decisions. Generative AI (GenAI) can also create text and other content, so possible uses include drafting administrative summaries, helping staff find information, and preparing routine communications. These functions may reduce repetitive work, but they also introduce risks: a generated answer may be incomplete or incorrect, and a fast digital interaction may not meet a patient's need for reassurance or human explanation. The World Health Organization (WHO, 2021) therefore stresses that health AI must be governed with attention to safety, transparency, accountability, privacy, and human autonomy. The key question is not simply whether AI is available, but whether it is used in a well-defined process with suitable safeguards.

Lean management aims to improve value by identifying activities that do not contribute to the service outcome, while Lean Six Sigma adds a structured focus on reducing defects and variation. In a hospital, teams might use these approaches to study appointment delays, repeated data entry, handover problems, stock shortages, or discharge bottlenecks. Rathi, Vakharia, and Shadab (2022) found that healthcare Lean Six Sigma research has often focused on management processes and highlighted the need to sustain improvements over time. Polimeni and Adrower (2024) explore how GenAI might complement Lean principles, while also noting concerns about the quality of generated content and the challenges of implementation. Read together, these studies suggest that AI and Lean methods may be complementary: Lean helps define and improve the process, while AI may provide additional support within it.

This report connects operational efficiency with three patient-facing concepts: experience, trust, and loyalty-related intentions. Shorter waits and clearer instructions may improve a patient's experience, but speed alone cannot compensate for poor communication, a lack of empathy, inaccessible digital services, or concerns about privacy. Quigley et al. (2021), in a systematic review, found that positive care experiences were associated with greater likelihood of returning to a provider and recommending it, while communication and trust were important parts of the relationship. Building on this literature, the present report proposes-not proves-that AI-assisted process efficiency may be associated with patient experience and trust, and that these may in turn be related to willingness to recommend or return to a hospital when care is needed.

2. BACKGROUND AND SCOPE OF THE STUDY

The title submitted for the seminar emphasises hospitals and patient outcomes, while the submitted abstract also discusses healthcare manufacturing and cross-functional operational excellence. These perspectives can be connected through the wider healthcare value chain. Hospitals depend on reliable supplies of medicines, devices, consumables, and diagnostic materials, while also managing patient- facing service processes. This report therefore focuses on hospital operations and patient-facing outcomes, while treating procurement, supply chain management, and healthcare manufacturing as supporting operational systems that can affect service reliability.

AI-assisted process efficiency refers here to the use of AI or GenAI to support a healthcare workflow in a way that may improve timeliness, reduce unnecessary effort, increase consistency, or help staff make better-informed decisions. It does not mean replacing clinical judgement or assuming that automation is always beneficial. Patient experience refers to how patients perceive their interactions with the healthcare organisation, including access, communication, responsiveness, coordination, and respect. Trust refers to patients' confidence that the hospital and its technology-enabled processes are competent, reliable, transparent, and used responsibly. Loyalty refers to a patient's intention to return to or recommend the hospital when appropriate. In healthcare, loyalty should not be interpreted as encouraging unnecessary repeat

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use; it is better understood as confidence and willingness to recommend the provider when care is needed.

3. PROBLEM STATEMENT

AI adoption in healthcare is often discussed in terms of individual applications such as diagnosis support, clinical prediction, chatbots, documentation, or administrative automation. Lean Six Sigma and other operational improvement approaches are also frequently considered separately. This separation can make it difficult for managers to understand how AI tools should be integrated into end-to-end workflows and how operational changes may influence patient-facing outcomes.

A second issue is that operational efficiency and patient experience are related but not identical. A hospital may reduce waiting time while still providing confusing communication or impersonal service. Similarly, a GenAI tool may provide quick answers but weaken trust if its responses are inaccurate, difficult to understand, or unclear about the role of human staff. The adoption of AI therefore requires a balanced view that considers operational performance, the human experience of care, and responsible governance.

The problem addressed by this report is the limited integration of AI-assisted process efficiency, Lean healthcare practices, patient experience, trust, and loyalty within one conceptual perspective. The report does not claim that these relationships have already been empirically demonstrated in the present study. Instead, it develops a framework and propositions that can guide future data collection and testing.

4. RESEARCH AIM AND OBJECTIVES

The overall aim is to develop a conceptual understanding of how AI-enabled and Lean-oriented process improvements in hospitals may relate to patient experience, trust, and loyalty.

4.1 Research objectives

- To examine how AI and GenAI may support process efficiency in hospital service and administrative workflows.
- To explain how Lean and Lean Six Sigma practices can complement AI-assisted improvement.
- To explore the possible relationship between AI-assisted process efficiency and patient experience.
- To examine the role of trust, transparency, privacy, and human oversight in patient responses to AI-enabled healthcare services.
- To propose a conceptual framework and hypotheses for future empirical validation.

4.2 Research questions

1. How can AI and GenAI support more efficient hospital processes?
2. How can Lean healthcare practices help ensure that AI-enabled improvements address real workflow problems?
3. How may perceived process efficiency influence patient experience?
4. How may trust in the hospital and its AI-enabled processes relate to patient experience and loyalty?
5. What safeguards are needed to ensure that efficiency improvements remain patient-centred and responsible?

5. REVIEW OF RELEVANT LITERATURE

5.1 AI and GenAI in healthcare operations

AI applications in healthcare include pattern recognition, forecasting, decision support, information retrieval, and automation of selected tasks. GenAI adds the ability to generate language and other content, which may help staff prepare summaries, communicate routine information, or interact with digital systems

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using natural language. These capabilities may be useful in administrative and service workflows, where staff spend time locating information or preparing repetitive documents. Nevertheless, generated content can be inaccurate or incomplete, and it should be checked when it affects patient care or important operational decisions.

Polimeni and Adrower (2024) describe possible links between GenAI and Lean management, including potential gains in flexibility, waste reduction, and operational analysis. Their article is exploratory rather than proof that every AI implementation improves performance. This distinction matters for the current study: adopting a tool is an input, whereas reliable improvement in the process is an outcome that must be measured. A hospital should therefore define the task, decide which parts can safely be supported by AI, assign responsibility for checking outputs, and monitor whether the change improves the workflow in practice.

5.2 Lean management and Lean Six Sigma

Lean management seeks to improve value by identifying and reducing non-value-adding activity. Lean Six Sigma adds a structured focus on reducing defects and process variation. In a hospital, relevant examples may include reducing repeated data entry, preventing avoidable appointment delays, improving discharge coordination, maintaining appropriate stock levels, and reducing errors in routine administrative handovers. These methods encourage organisations to map processes, understand the causes of delays, involve frontline staff, test improvements, and monitor performance over time.

Rathi et al. (2022) report that Lean Six Sigma can support process capability and efficiency, but their review also points to a need for continuous improvement that lasts beyond the initial project. Polimeni and Adrower (2024) suggest that GenAI could support some Lean objectives, yet they also acknowledge technical limitations and concerns about generated content. The combined lesson is that hospitals should not assume that introducing AI automatically removes waste. Teams need to understand the existing workflow, identify the root cause of a problem, redesign the process, and then assess whether the AI- supported change produces a measurable and sustained benefit.

5.3 Patient experience and process efficiency

Patient experience develops across the whole care journey, not at one isolated service point. It may be affected by appointment access, waiting time, explanations from staff, coordination between departments, responsiveness, and the amount of support a patient receives. A systematic review by Quigley et al. (2021) found that better patient experiences were associated with return intentions and recommendations, although evidence for some broader business outcomes was mixed. This cautions against treating patient experience as a simple result of operational speed. Efficiency is most likely to be useful when patients notice fewer avoidable delays, receive clearer information, and can still obtain human assistance when needed.

The proposed relationship between process efficiency and patient experience should therefore be understood as conditional. AI-assisted processes may improve the experience when they are accurate, accessible, well integrated, and supported by staff. Their impact may be weaker or negative when patients cannot access digital services, when the technology provides unclear information, or when automation reduces meaningful human contact.

5.4 Trust, transparency, and responsible AI

Trust is a central concern in healthcare because patients may be making decisions while anxious, unwell, or uncertain. They need confidence that their information is handled appropriately and that technology-supported processes are reliable. Chettri, Deka, and Saikia (2025), in their review of trustworthy AI in Indian healthcare, identify challenges involving data privacy, ethical and legal standards, representative

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data, resources, and governance. Their work reinforces the need to consider the conditions under which AI is introduced, rather than evaluating technology only by speed or cost.

In practical terms, responsible AI adoption may require clear explanations of when AI is being used, limits on the information it can access, protection of patient data, monitoring for errors and unequal performance, and clear routes for human review. Staff should know when to rely on an AI output and when to question it. Patients should be able to reach a human staff member when a digital response is insufficient. These safeguards may help protect trust, although the precise relationship must be tested rather than assumed.

5.5 Patient loyalty

In this report, patient loyalty means willingness to recommend a hospital or consider returning when a future healthcare need arises. It does not mean that patients should use healthcare unnecessarily. Loyalty-related intentions are influenced by service experience and trust, but they may also depend on affordability, location, insurance, specialist availability, and the type or urgency of care. Quigley et al. (2021) found associations between positive experience and return or recommendation intentions, but this does not establish that AI itself causes loyalty. The proposed framework therefore treats loyalty as a possible downstream outcome of the patient's overall experience, not as a direct or guaranteed result of AI adoption.

This report proposes that efficient and well-managed processes may support a positive patient experience; positive experience and responsible technology use may support trust; and experience and trust may contribute to willingness to recommend or return to the provider. These are conceptual relationships for future testing, not findings from data collected for this report.

Overall, the literature suggests three points that should be kept distinct. First, Lean methods provide a structured way to identify process problems and sustain improvement. Second, AI may help with information handling and selected workflow tasks, but its contribution depends on implementation quality and governance. Third, patient experience and loyalty-related intentions are shaped by service interactions and trust, not by efficiency alone. The proposed framework connects these points as a set of relationships to investigate, rather than assuming that evidence for one relationship proves the entire model.

5.6 Research gap

The literature reviewed here provides several relevant but partly separate strands. Polimeni and Adrower (2024) examine the possible connection between GenAI and Lean management; Rathi et al. (2022) review Lean Six Sigma in healthcare; Chettri et al. (2025) consider trustworthy AI in the Indian context; and Quigley et al. (2021) review links between patient experience and provider-related outcomes. These sources do not jointly test the full pathway proposed in this report. The research gap is therefore a conceptual one: to bring AI-assisted process efficiency, Lean practices, patient experience, trust, and loyalty-related intentions into one framework while recognising human oversight and organisational readiness. Future data collection would be needed to assess whether the proposed relationships hold in a specific hospital setting.

6. PROPOSED CONCEPTUAL FRAMEWORK

The proposed framework treats AI and GenAI as enabling capabilities rather than as direct guarantees of better patient outcomes. Lean healthcare practices, process redesign, staff involvement, and KPI-based monitoring help convert technology into changes in the way work is performed. Those changes may be perceived by patients through shorter or more predictable waits, clearer communication, smoother coordination, and more responsive service. Trust and patient experience may then be associated with loyalty-related intentions.

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AI and GenAI capabilities (e.g., workflow support, information retrieval, forecasting, drafting routine communications)
>
Operational enablers (Lean / Lean Six Sigma • process redesign • staff training • supply chain coordination • KPI monitoring • human oversight)
>
Perceived process efficiency and service reliability (waiting time • consistency • responsiveness • fewer avoidable steps)
H
Patient experience and trust ---+ Patient loyalty-related intentions (recommendation and willingness to return when care is needed)

Figure 1. Proposed conceptual framework (developed for this report).

The framework also recognises contextual factors that may influence the proposed relationships. These include AI readiness, the quality and representativeness of data, staff acceptance, patient digital access, privacy protection, transparency, and the availability of human assistance. They may influence whether AI-supported efficiency is achieved and whether patients view the resulting service positively.

7. PROPOSED HYPOTHESES

The following hypotheses are proposed for future empirical testing. They are not confirmed findings.

- H1: Greater use of AI-assisted process support is positively associated with perceived process efficiency in hospital operations.
- H2: Perceived process efficiency is positively associated with patient experience.
- H3: A more positive patient experience is positively associated with patient trust in the hospital and its technology-enabled services.
- H4: Patient trust is positively associated with patient loyalty-related intentions, including willingness to recommend the hospital or return when care is required.
- H5: Responsible AI practices, including transparency, privacy protection, and human oversight, strengthen the positive relationship between AI-assisted process support and patient trust.

8. PROPOSED RESEARCH METHODOLOGY

This seminar report is conceptual and literature-based. No primary data have been collected for the present report, and no statistical analysis or empirical results are claimed. The proposed methodology below outlines a possible next stage for testing the framework.

8.1 Research design

A quantitative, cross-sectional survey could be used for an initial empirical study. Depending on access and research permissions, the study could focus on patients who have recently used selected hospital services and/or hospital staff who are familiar with AI-enabled administrative or operational processes. These groups should not be mixed into one analysis without a clear design, because patients and employees assess different constructs. A practical option would be to conduct a patient survey for experience, trust, and loyalty-related intentions, supported by a separate staff or manager survey on process and AI use.

8.2 Population and sampling

The target population should be defined before data collection. For a patient-focused study, eligible participants could be adults who have recently interacted with a hospital service in which digital or AI-supported processes are present. A non-probability purposive or convenience sample may be feasible for an initial student project, but its limitations should be acknowledged. The final sample size should be justified

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using the proposed statistical technique and the institution's research guidance rather than chosen arbitrarily.

8.3 Measurement and data collection

A structured questionnaire could measure perceived process efficiency, patient experience, trust, and loyalty-related intentions using clearly worded multi-item scales adapted from relevant published research. Any adapted items should be cited, reviewed for suitability, and pilot-tested for clarity. AI exposure should be measured carefully; respondents should not be asked to evaluate an AI system they have not knowingly encountered. If the hospital does not disclose AI use, the survey should focus on perceived digital service processes rather than assuming that patients can identify AI.

8.4 Data analysis

After checking completeness and response quality, descriptive statistics could summarise the sample and responses. Reliability and validity checks would be required before examining associations among constructs. Correlation and regression analysis may be suitable for a straightforward study; mediation or moderation analysis may be considered only if the sample size, measures, and research supervision support it. Any conclusions should distinguish association from causation, particularly in a cross- sectional design.

8.5 Ethical considerations

Participation should be voluntary and based on informed consent. The study should avoid collecting unnecessary personal or clinical information, protect confidentiality, store data securely, and follow institutional ethics requirements. No patient should be pressured to participate during treatment. If the study is conducted through a hospital, appropriate organisational permission must be obtained. AI- related questions should be framed neutrally so that respondents are not encouraged to disclose sensitive health information.

9. EXPECTED CONTRIBUTIONS AND MANAGERIAL IMPLICATIONS

The report's main contribution is a proposed connection between AI-enabled process improvement and patient-facing outcomes. Instead of evaluating AI only through automation or cost savings, the framework encourages hospitals to ask whether operational improvements are experienced by patients as more reliable, responsive, and trustworthy service.

For managers, the framework suggests five practical considerations:

- Begin with a clearly defined process problem, such as avoidable waiting, repeated documentation, scheduling friction, or inventory-related disruption, rather than adopting AI because it is fashionable.
- Use Lean methods to map the existing process and identify root causes before introducing an AI tool. Automating a poorly designed process may preserve or amplify its weaknesses.
- Select KPIs that balance operational and patient-facing performance. Possible measures include waiting time, error or rework rate, response time, service reliability, patient-reported experience, trust, and complaint resolution.
- Keep human oversight in workflows where outputs can affect patient care, sensitive information, or important decisions. Provide a clear escalation route when the system is uncertain or a patient requests human support.
- Review outcomes regularly and include frontline staff and patients in improvement discussions. A change that improves speed but harms accessibility or trust should be redesigned.

The framework also has implications for supporting functions. Reliable procurement, stock visibility, and supply chain coordination can affect whether services are delivered on time. KPI-based performance

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management can help teams identify whether AI-enabled changes are creating sustained improvements rather than temporary gains. In this way, patient experience is connected to both frontline interactions and the operational systems that support them.

10. LIMITATIONS AND FUTURE RESEARCH

This report is conceptual and does not include primary data, a systematic database search with documented screening counts, or a statistical test of the proposed relationships. The literature discussed is selective rather than exhaustive. The title focuses on hospitals and patient outcomes, while the submitted abstract also refers to healthcare manufacturing and broader operational excellence. The report addresses this by placing hospital service processes at the centre and treating supply chain and manufacturing functions as supporting systems; future work should define the study setting more narrowly.

Future research could validate the proposed framework in one or more hospitals, compare AI- enabled and non-AI-enabled workflows where appropriate data are available, or examine whether trust mediates the relationship between patient experience and loyalty-related intentions. Further studies could also compare patient and staff perspectives, examine differences across digital literacy groups, and investigate how transparency and human support affect acceptance. Such research should use clearly defined constructs, appropriate sampling, and ethical safeguards.

11. CONCLUSION

AI and GenAI may help hospitals improve selected administrative and operational processes, but technology alone does not guarantee better healthcare experiences. Their value depends on how well they are integrated with Lean process improvement, staff capability, supply chain coordination, performance measurement, and responsible governance. Efficient processes may support a more positive patient experience when they reduce avoidable delays and improve communication without removing necessary human care.

This report proposes a conceptual framework connecting AI-assisted process efficiency with patient experience, trust, and loyalty-related intentions. It highlights trust, transparency, privacy, human oversight, and organisational readiness as important considerations. The proposed hypotheses and methodology provide a basis for future empirical validation. Until such testing is completed, the framework should be treated as a research proposal rather than evidence of confirmed effects. A patient- centred and measurable approach can help healthcare organisations assess not only whether AI makes a process faster, but whether it makes the service more reliable, understandable, and worthy of patients' confidence.

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