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## Assessing Lean Thinking in Hospital: A Conceptual Framework

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### ABSTRACT

Currently, the lean thinking system has not been implemented in all hospitals in Indonesia, where there is a lot of waste that affects the low quality of service and patient safety. The aims of this study is to develop a conceptual framework as a basis for quantitative assessment of lean thinking systems in Indonesian Hospitals to improve services, increase patient satisfaction and improve hospital quality. In preparing the conceptual framework for the quantitative assessment model of the lean thinking system index, a literature study was carried out through a literature search for journals from several countries and textbooks using the keywords "lean thinking" and "hospital". Literature review was conducted through several data sources, including ProQuest, Taylor & Francis, SpringerLink, and ScienceDirect. The types of literature were research articles with range of years 2012–2022. In total, 86 articles were obtained. The next stage includes screening, checking for duplication of articles and filtering articles based on inclusion criteria, so that there are 8 articles remaining. The 8 articles were reviewed to create a new conceptual framework. The result of the study is lean thinking model designed based on current conditions, expected future conditions, implements lean thinking, and maintains it with continuous improvement. This model is still in the early stages of research and forms the basis for the preparation of subsequent instruments. Currently the model is used in the hospital where the author works. The proposed conceptual framework can become the necessary basis for index development, which can then be used as a basis for further policy interventions to improve services in hospitals. In the end, this model can also improve quality and patient satisfaction.

### 1. Introduction

High-quality healthcare satisfies patients aligned with average population satisfaction levels, following professional standards and ethics. Hospitals can provide good service by effectively managing and maximizing resources. More hospitals increase competition and public expectations for quality care. Lean operations management sees any resources spent without adding end-user value as waste. Lean uses specific tools and methods to help managers and employees eliminate waste through system redesign. These include value stream mapping, kanban, demand alignment, single piece flow, 5S, kaizen events, A3 reports, visual management, and more.<sup>1</sup>

Lean is a leadership style, management system, and process improvement methodology embraced by

hospitals since the 1990s. Lean is powerful but not a quick fix, requiring full participation to change thinking and culture. The practical tools within this framework have greatly improved patient safety, quality, wait times, costs, and morale. Lean is ongoing diligent practice and improvement, not perfection. "Lean hospitals" have humble, inquiring leadership enabling healthcare delivery reinvention. Customer satisfaction surveys identify desired service qualities and indicators reflecting target market needs. Doctors set parameters while clients/patients determine monitored, improved aspects within treatment specifics.<sup>2</sup>

Lean manufacturing's waste reduction focus increases customer service, delivering desired value. Lean is an operations model suitable for industries

and services like hospitals. Lean manufacturing in the industry is lean hospitals in healthcare, meeting patient needs optimally by reducing waste to create hospital value. Value stream maps depict product creation processes, identifying uninterrupted flow opportunities to increase productivity, competitiveness, and process improvements. They reveal wasteful activities, adding cost without value. Management eliminates waste to improve services with shorter lead times, fewer defects/errors, and lower costs.<sup>3</sup>

Hospital wastes include: Overproduction: Unrequested work; Waiting: Review and approval; Transportation: Document movement; Processing: Processing itself; Inventory: Data, work in progress, completed services; Motion: Information searching; Defects: Data or document errors; Behavior: Non-value-adding actions. Lean thinking involves five lean principles, namely: Determine value from the customer's perspective - Understand what patients/customers find valuable in their healthcare experience. This may include prompt access, effective treatment, clear communication, compassionate care, affordable costs, etc. Identify and eliminate waste in value streams - Look at all the steps in clinical and operational processes to remove non-value-adding waste, like waiting, unnecessary motion, overprocessing, defects, and inventory. Create seamless flow - Reorganize processes to maximize smooth flow from one step to the next without delays or interruptions. This requires connecting value-adding steps, removing bottlenecks, and preventing backups. Use pull, not push - Let patient needs to pull hospital activities along rather than pushing unneeded services. This includes designing point-of-use inventory systems. Continuously improve - Relentlessly look for ways to improve through kaizen events, daily improvements, and by engaging staff in problem-solving. Perfection is the goal, and excellence is the journey.<sup>4</sup>

## **2. Methods**

The initial preparation stage involved reviewing articles to examine and analyze the concept of lean thinking applied in hospitals across various countries, as well as prior related studies. The literature search used inclusion criteria with the keywords 'lean' and 'hospital'. Sources searched included ProQuest, Taylor & Francis, SpringerLink, and ScienceDirect databases, limited to English language publications. The types of literature sought were original research articles as well as general literature reviews, with a publication date range of 2012-2022. This initial search yielded a total of 86 articles. The next stage involved screening these articles, checking for duplication, and filtering based on the inclusion criteria. This resulted in 8 relevant articles remaining for in-depth review and analysis. In addition to the 8 journal articles, 5 textbooks discussing lean in healthcare were reviewed. The selected articles and textbooks were critically assessed, and key information was synthesized to obtain results relating to the research topic and support the development of a conceptual framework. The focus of the literature review was on examining applications of lean thinking, principles, and tools within hospital management across multiple countries. This rigorous, systematic literature review process provided a solid foundation of knowledge from recent research on how lean can be successfully implemented in a healthcare setting to improve quality, safety, patient satisfaction, and value. The conceptual framework emerged from the findings and insights gained through this comprehensive review.

## **3. Results and Discussion**

The literature review of 8 selected articles revealed several key tools utilized in lean thinking implementation at hospitals, including value stream maps, visual management, sort – straighten – scrub – standardize and sustain (5 S), plan-do-study-act (PDSA), 5 Whys.

**Value stream map**

The most frequently mentioned lean thinking tool is value stream mapping, considered the "main analytical tool". A value stream map is an enhanced process flowchart showing speed, flow continuity, work in progress, and bottlenecks, helping to understand patient and information flows. In healthcare, the primary customer is the patient. Value is created throughout the care process, which comprises actions completed properly in sequence at the right times. Every step focuses on increasing patient satisfaction. Employees are secondary customers, like waiting for laboratory or radiology results. But value determination centers on the patient.<sup>5</sup>

Value stream maps also graphically depict material and information flows parallel to patient flows. Creating a value stream map involves selecting a patient and directly observing their journey through the hospital system to understand their experience and chart process steps and durations. This identifies

value-added and non-value-added steps. The map reveals flow disruptions, bottlenecks, and waste to eliminate. Just mapping the current state can provide insights to improve work across departments by illuminating contributions. It is key to view processes through patients' eyes, centering steps around their value. Value stream maps also depict the future, ideal state with waste removed or at least reduced. Multiple steps can be combined for efficiency. The future map includes step durations, differentiating between the total processing time to be reduced and essential work time that remains constant (i.e., value-added steps cannot be reduced). Maps should be created by internal team members like doctors, nurses, or managers who experience processes firsthand. A multidisciplinary team trained in lean, including patients, provides diverse perspectives for improvement. Value stream mapping is commonly applied in healthcare lean transformations like hospital billing processes.<sup>6</sup>

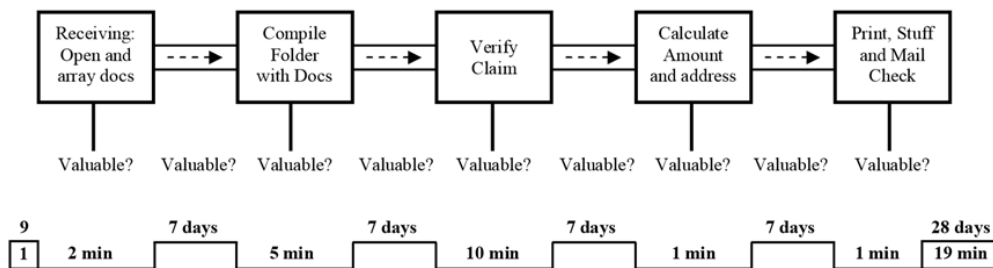


Figure 1. Example of a value flow map of the current state of a billing claim process.

Figure 1 shows a current value flow map showing the nine steps and their duration and asking whether each step is value added or not. The process took

about 28 days, even though the actual processing time needed was only 19 minutes. Thus, there are many areas of waste that must be eliminated.

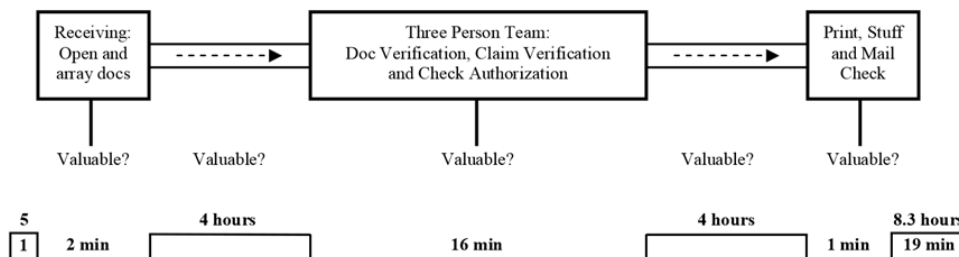


Figure 2. Example of future status value flow map of the invoice claim process.

Figure 2. shows a flow map of future state values. It shows how the process should be after lean improvement. The previous nine steps are combined into three. Most of the wasted time is eliminated, so the elapsed processing time is now just 8.3 hours, which is a great improvement compared to the previous 28 days.

### **Visual management**

Visual management complements 5S to organize workplaces in an orderly, uncluttered way. Signs, labels, color coding, and visual controls eliminate guesswork, searching, and information/material hoarding. Visuals can enable flow by allowing staff to easily “go and see the next problem to solve without distracting others from value-work”. Additionally, visuals demonstrate if processes are operating properly and reveal quality issues and errors. Simple images can remind staff to follow standard procedures. Visuals can communicate culture change plans throughout an organization. The renowned visual tool is kanban (signboard), which displays process requirements and signals when to manufacture, move, or order materials. Kanbans like cards, lights, floor markings, or empty bins indicate item replenishment needs. Consequently, visual management facilitates 5S implementation, jidoka (detecting abnormalities), and just-in-time flow.<sup>7</sup>

### **Sort – straighten – scrub - standardize and sustain (5 S)**

Another commonly mentioned tool is 5S. This organizational method creates efficient workspaces where needed items are easily accessible for smooth workflows. 5S refers to five Japanese words: seiri, seiton, seiso, seiketsu, shitsuke meaning organize, orderliness, cleanliness, standardize, discipline. The English 5S uses: sort, straighten, shine, standardize, and sustain. Each step transforms workspaces. Sort removes unneeded items, eliminating clutter. Frequently used items are kept closer than rarely used ones. Straighten sets remaining items orderly to find easily. Labelling and location lists aid in searching and

returning. Just-in-time delivery, as Machado & Leitner (2013) did with glass-front cabinets, ensures availability when needed, reducing waiting. This minimizes buffers between steps. For healthcare unpredictability, heijunka averages uneven demand over time for predictable flow. Recalculating stock levels, recognizing consumption patterns, and jidoka (quick response to defects) also help optimize supplies. Shine cleans everything spotless for a comfortable, efficient workspace. Standardize maintains 5S gains through communication and training for the new systems. Sustain develops 5S habits over three weeks. The first steps are easier than ingraining discipline to execute them consistently. Management leads by example. Additionally, Machado & Leitner (2013) applied the supermarket first-in-first-out method, which puts the newest inventory at the back so older stock is used first, reducing waste and obsolete products.<sup>8</sup>

There are 15 ways for organizations to maintain 5S system in the long term: make 5S part of regular routines and standard work procedures rather than a one-time event; integrate it into onboarding, training, and daily management; schedule regular 5S audits and area "refresh" days to keep up with sorting, straightening, shining, and standardizing; conduct mini 5S events frequently; maintain visual controls like shadow boards, labeled storage, floor markings, and standards boards; update when changes occur; designate 5S area owners accountable for maintaining their zones; provide checklists for self-auditing; share before and after photos, metrics, and success stories to showcase 5S benefits and progress; celebrate wins. Include 5S responsibilities in job descriptions and performance reviews; recognize 5S excellence. Develop peer auditing teams and friendly 5S competitions between departments or shifts; track 5S performance indicators over time as part of departmental continuous improvement efforts; engage staff in problem-solving 5S gaps, rather than mandating changes, to gain buy-in; develop employee 5S suggestions and share best practices facility-wide. Provide ample time for thorough cleaning,

reorganizing, and standardizing during paid work hours; grow 5S coaches among staff who can reinforce practices and provide ongoing support.<sup>9,10</sup>

**Plan-do- study- act (PDSA)**

Value stream maps and process maps are often paired with the plan-do-study-act (PDSA) cycle for implementing and sustaining process improvements depicted in the future state. PDSA enables small changes to be made, results assessed, and adjustments incorporated for continuous refinement per the kaizen or continuous improvement philosophy. There is always room for more progress, as perfection through ongoing improvement is the goal. To create an optimal process, PDSA entails designing small tests of changes ("Plan"), trying them out on a small scale ("Do"), comparing performance to baseline and reflecting on enhancements ("Study"), then introducing adaptations more broadly ("Act"). This iterative method provides continuous gains for stable,

sustainable processes.<sup>11</sup>

**5 Whys**

The 5 Whys root cause analysis technique uses iterative questioning to deeply understand work processes and uncover the root causes of problems. By determining the root issue, problems can be more easily solved. The process starts by stating the initial problem and then asking "why" to reveal a related problem. Further "whys" continue probing until reaching the root cause so the original issue can finally be addressed. The technique name doesn't mean literally asking five times - more or fewer repetitions may be needed. It is key to stay focused on the original problem without getting lost in excessive questions or stopping at superficial symptoms before the root is reached.<sup>12</sup>

Based on the 6 tools used in lean thinking, a conceptual framework is then created in the hospital (Figure 3).

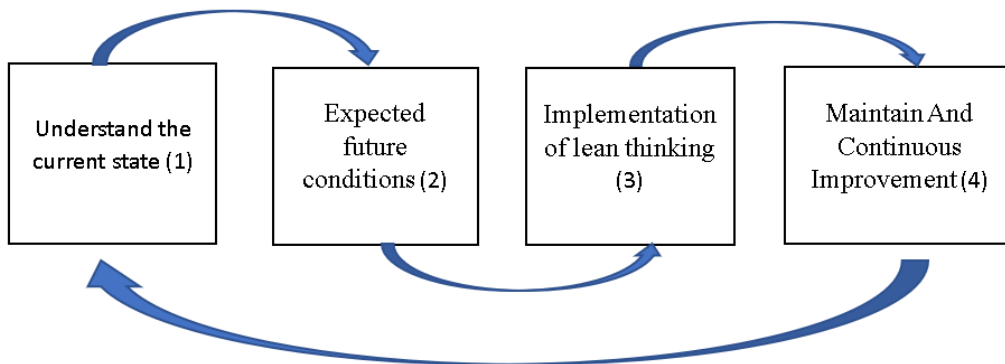


Figure 3. Conceptual framework of lean thinking in a hospital.

**The first step: understand the current state**

The first step in lean implementation is understanding the current state. Following lean principles, customer value must be determined. In hospitals, healthcare comprises interconnected processes, so a stepwise approach is needed, starting with the most crucial or core processes. After addressing one process, others follow incrementally. Beyond value stream mapping and cycle times,

quantifying costs, defects, lead times, efficiency metrics, and patient satisfaction baselines the process pre-lean. It is key to consider cross-process impacts since changing one process affects connected ones, potentially causing problems like “pillowcase syndrome” if forced output outpaces resources. By identifying value and mapping delivery via value stream mapping with a diverse team of staff, doctors, executives, and patients, value flow becomes clear.

Defining goals like reduced wait times or meeting future hospital demands sets transformation direction. The map illuminates how and when value is added across process steps.<sup>13</sup>

### **Second step: Expected future conditions**

After mapping the current state, value stream waste is easily identified by categorizing each step as value-added or non-value-added. The eight wastes (overproduction, waiting, transportation, processing, inventory, moving, defects, behaviour) highlight non-value-added steps. The goal becomes eliminating or reducing wasteful activities, but this can be challenging. While the map clearly depicts problem areas, solving them may prove difficult. Root cause analysis tools like 5 Whys help uncover underlying issues so they can be addressed following lean principles. Next, a future state map is drawn, showing the ideal process of moving toward perfection by eliminating waste. This becomes the target after lean transformation. With ongoing kaizen, the future state transitions into the next current state for further refinement. Additionally, an improvement plan detailing steps to achieve the future state can be developed. This includes which tools (standardization, 5S, visuals) and lean principles (flow, pull, perfection) to utilize for redesigning processes.<sup>14</sup>

### **Step three: Implementation of lean thinking**

The next phase is implementing lean to achieve the future state vision by modifying current processes based on the value stream map's improvement opportunities. Plans transition into action as the future state map is realized through lean principles and tools. Change is gradual, occurring over testing and redesign cycles. Communication between the redesign team and staff is vital to inform everyone of process changes and new standards for delivering improvements. However, it is optimal to engage all staff in the improvement process itself. During implementation, daily meetings can help identify and resolve problems, developing best practices. Methods like PDSA cycles drive ongoing kaizen. Success metrics

(patient satisfaction, defects, cycle time, wait times) should be continuously measured against goals and expected gains, indicating improvement quality and any redesign needs. Compared to initial baselines, this shows overall transformation success. Strong leadership commitment to change is crucial, with managers modeling lean thinking and supporting implementation. However, problem-solvers are the redesign team and staff. Lean requires leaders to ensure decisions are made, not make every decision.<sup>15</sup>

### **The fourth step: maintain and continuously improve**

After implementing lean and achieving set targets, many assume the transformation is complete. However, the hard work has just begun to sustain improvements. Without ongoing diligence, processes can revert to the pre-lean state as staff fall back to old habits. Changes must become ingrained. Strong commitment to lean standards from both leadership and staff is required, reinforcing them constantly. Again, a kaizen or continuous improvement mindset is key. Without it, organizations risk complacency and decline. Lean thinking never ends - there are always areas to improve and waste to eliminate. Employees and management must pursue excellence through kaizen: continually seeking waste, making enhancements, and ensuring long-term sustainability. Initial lean implementation is just the starting point. To reap ongoing benefits, the lean journey requires institutionalizing new systems while promoting a culture of engagement, accountability, and continuous improvement. This long-term effort and unwavering dedication to lean principles prevent backsliding and enable the agility to meet future challenges.<sup>16-18</sup>

## **4. Conclusion**

The conceptual framework was developed through a literature review of lean thinking implementations in hospitals, utilizing four key dimensions: (1) understanding the current state, (2) envisioning the improved future state, (3) implementing lean, and (4)

sustaining continuous improvement. In developing the framework, adjustments were made to align with hospital conditions. As shown in the literature, integrating lean thinking into a conceptual framework is a powerful way to increase efficiency in hospital workflows. A major benefit is cost savings, which is critical in healthcare's focus on resource efficiency. Lean does not compromise quality for cost like other methods. It can reduce costs while improving quality. Therefore, lean management holds promise as a premier approach to enhancing healthcare systems.

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