

ATTITUDES OF LANDSPITALI'S MANAGERS TOWARD LEAN MANAGEMENT

Kristjana Guðjónsdóttir¹, Eðvald Möller^{1, *},
Eydís Ý. Rosenkjær¹ and Vigdís Hallgrímsdóttir²

¹University of Iceland, School of Business
Reykjavik, Iceland

²The National University Hospital of Iceland
Reykjavik, Iceland

DOI: 10.7906/indecs.22.4.1
Regular article

Received: 10 June 2024.
Accepted: 17 August 2024.

ABSTRACT

This research aimed to evaluate the implementation of lean management at Landspítali, the National University Hospital of Iceland, by examining the current state of the methodology, the effectiveness of the methodology, and the factors influencing managerial attitudes and outcomes in the hospital. The study provides actionable insights to optimise lean management practices in healthcare and offers guidance for future improvements. Using a mixed-methods approach, the research combined quantitative and qualitative analyses. The quantitative component involved a questionnaire with 18 questions distributed to 115 managers at Landspítali. The findings revealed that while most managers were familiar with the lean management methodology, many needed more confidence in its effectiveness, mainly due to insufficient information about its benefits. These results underscore the need for enhanced communication and education to build confidence and motivation among managers, thereby supporting more effective implementation at Landspítali and similar institutions. Additionally, the study identified a critical need for further training and development among staff – for example, through the establishment of a dedicated training academy focused on lean management methods. This initiative will address the gaps highlighted in the research, ensuring more effective implementation and sustained success.

KEY WORDS

lean management, project manager, management, leader, leadership

CLASSIFICATION

JEL: M1, M2, M11, O3

*Corresponding author, *η*: eddi@hi.is; +354 8975656;
University of Iceland, School of Business, 102 Reykjavík, Iceland

INTRODUCTION

In today's rapidly changing healthcare environment, hospitals are facing increasing pressure to improve patient care, enhance operational efficiency, and reduce costs. Lean management, originally developed in the manufacturing industry, primarily by Toyota, has emerged as an effective model for addressing these challenges. Lean management focuses on reducing waste, optimising processes, and fostering a culture of continuous improvement. Over the past two decades, the application of lean management in healthcare has expanded globally, with hospitals implementing lean principles to streamline operations, improve patient outcomes, and eliminate unnecessary costs [1-5]. However, while lean management holds great promise for healthcare, its implementation in hospitals presents unique challenges. The complex, highly regulated nature of healthcare, combined with the need for personalised patient care, makes the direct application of lean principles more difficult than in industrial settings [4]. Additionally, hospitals must address staff resistance to change, insufficient training, and the need for sustained leadership commitment to ensure the successful integration of lean practices [6-8].

Despite extensive research on the application of lean management in healthcare, significant gaps remain in understanding its long-term effectiveness and the factors influencing its success in hospital settings [2, 3]. Much of the existing literature focuses on the immediate outcomes of lean interventions, such as cost reductions and improved patient flow [4, 5]. However, less attention has been given to how managerial attitudes and perceptions influence the sustainability and efficacy of these interventions over time [9]. Additionally, studies have often overlooked the unique challenges faced by hospitals in smaller or more specialised healthcare systems, such as those in Iceland [8, 10]. Given these gaps, it is essential to explore how lean management is perceived and implemented in various hospital environments and how these perceptions impact the overall success of lean initiatives [11]. Understanding these dynamics can provide valuable insights for healthcare leaders seeking to optimise lean management strategies in their organisations [1].

This study aims to evaluate the implementation of lean management at Landspítali, the National University Hospital of Iceland, by assessing the current state of the methodology, the effectiveness of the methodology, and the factors influencing managerial attitudes and outcomes in the hospital. By focusing on managers' perspectives, this research seeks to uncover the underlying drivers behind the successes and challenges of lean management at Landspítali, providing actionable insights to optimise lean practices in healthcare settings. The contributions of this study are twofold. First, it enhances the academic literature by exploring the underexamined area of managerial attitudes and their impact on the effectiveness of lean management in hospitals. Second, it offers practical recommendations for healthcare institutions aiming to implement or improve lean management strategies, ensuring that these initiatives are tailored to the specific needs of the healthcare environment.

Landspítali began its lean management journey in 2011, with the consulting firm McKinsey & Company providing guidance and advice during the implementation. One year later, training for the Landspítali staff in lean management methodology commenced. In 2015, a study by Möller and Rosenkjær [12] explored the attitudes of Landspítali managers toward lean management, revealing a lack of employee training and education. Subsequently, the Lean Academy was formally established in 2016 to address this need and provide training in lean management for all hospital employees.

The objective of this study is to examine whether managers at Landspítali are familiar with the lean methodology, have received adequate education and training in the methodology, and believe that lean management delivers results in their current work. The study also seeks to

evaluate the impact and success of the Lean Academy, examining whether it has benefitted managers and increased their skills and understanding of lean practices.

The study seeks to answer the following three research questions.

RQ₁: Have the attitudes of Landspítali's managers toward lean management changed with increased implementation?

RQ₂: What are the experiences of Landspítali's management with lean management?

RQ₃: Do Landspítali's managers feel they received adequate training and support to apply lean management in their work?

The research article is structured as follows: The next section explores the fundamental ideas of lean management, its origins, and the best practices for introducing lean management into business settings. The third section details the research methodology, including how lean management was introduced to managers at Landspítali. The fourth section presents the results from the data analysis, while the fifth section discusses these findings in depth. Finally, the sixth section offers concluding remarks, summarising key discoveries, limitations, and recommendations for future research.

PRINCIPLES OF LEAN MANAGEMENT

Lean management is not a theory but a methodology with a theoretical foundation that can be applied in various contexts [13]. Although much has been written about the evolution, characteristics, and implementation of lean management in Western countries, scholars have still not reached a consensus on its definition. The most commonly cited definition describes lean management as a holistic system (i.e., an integrated sociotechnical system) whose main objective is continuous flow and waste elimination [4, 14].

Lean management is a methodological tool and management approach [5]. Lean management takes a different approach to understanding work performance by entailing a diverse and multifaceted journey toward improving operations rather than merely focusing on processes. Lean management can be applied in any operation, and by introducing the methodology, managers can drive a new and targeted way of working [15].

ORIGINS OF LEAN MANAGEMENT

Lean management is not a recent development; its origins can be traced back to the 19th and early 20th centuries [2, 16]. In the late 1890s, Frederick W. Taylor conducted time studies analysing the work and movements of his employees. Based on this research, he standardised work procedures, which became one of the main tools in the lean management philosophy. Taylor labelled his idea “scientific management” with the primary objective of improving efficiency, particularly in the field of productivity [16].

Frank Gilbreth later contributed to the history of lean management through his motion and process mapping research. Subsequently, Gilbreth, his wife Lilian, Taylor, and others developed the concept of “eliminating waste”, a fundamental principle of lean management [16]. Taylor's scientific management also significantly impacted Henry Ford, the founder of Ford Motor Company. In 1910, Ford Motors took a major step in developing lean management by introducing assembly lines in its automobile production, thus standardising work at each workstation [16].

While Ford's mass production system flourished during the growth period in the United States, Toyota sought to design a different production system. After visits by leading Toyota

executives to Ford Motors' factories, Taiichi Ohno, Shigeo Shingo, and Eiji Toyoda began developing a production system based on Ford's approach. Toyota's new production system made continuous improvements and achieved maximum efficiency with minimal capital, with its underlying philosophy prioritising the continuous flow of processes and elimination of all waste. This process included eliminating any activity that did not add value to the product and addressing issues such as overproduction, inventory, transportation, waiting time, space, defects, and supply time [16, 17].

Introducing Lean into Business Practices

In *The Lean Management System Handbook*, Charron et al. [18] outline the steps for introducing lean management methodology into business practices. The process begins by assembling an implementation team with representatives from various parts of the organisation, including management and frontline staff. The authors emphasise the importance of commitment and leadership for a successful implementation.

Nonetheless, Lima et al. [6] found that despite the effectiveness of lean management methodology in improving healthcare processes, its implementation was challenging due to issues such as employee resistance, a lack of leadership, difficulty in measuring results, and the complexity of the healthcare industry with multiple stakeholders, complex processes, and a robust regulatory environment. Lima et al. also states that a successful implementation requires strong leadership, employee participation, and a focus on continuous improvement.

Eight Types of Waste

Waste elimination is crucial for streamlining the healthcare system to improve patient care, reduce costs, and enhance employee well-being. Lean management aims to eradicate inefficiencies from the value chain; inefficiencies are defined as any activity that takes time, space, or resources for which the customer is reluctant to pay. Indeed, it is necessary first to identify waste in order to eliminate it [5, 19, 20]. In *The Toyota Way*, Liker [2] specifies seven types of waste: defects, overproduction, transportation, waiting, unnecessary inventory, motion, and overprocessing. Scholars have identified an eighth type: untapped knowledge or talent [20, 21].

LEAN MANAGEMENT TOOLS

Applying lean management methodology requires a comprehensive toolkit. This section outlines the methodology's main tools and those used by Landspitali, although the list is not exhaustive.

A3 Method

The A3 method is a problem-solving and improvement approach commonly used in lean management, named after the A3-sized paper typically used to document the process. The method aims to find solutions to problems using the A3 template, where the problem is defined, root causes are identified, countermeasures are developed, and an action plan is implemented. The A3 method involves developing a hypothesis, testing it, and drawing conclusions [19]. Organisations can use this method to approach problem-solving organizationally and systematically, ensuring that solutions are impactful, sustainable, and aligned with desired future states [19].

The 6Ss

Japanese experts developed the 6Ss methodology to establish and maintain quality systems in organisations. The methodology aims to create and maintain a well-organised, clean, and

efficient workplace while serving as the foundation for continuous improvement. The methodology originally consisted of five Ss: sort (jpn. seiri), set in order (jpn. seiton), shine (jpn. seiso), standardise (jpn. seiketsu), and sustain (jpn. shitsuke); however, a sixth S was later added to emphasise safety [2, 10, 14, 20, 22]. The benefits of the 6Ss include contributing to quality, reducing defects, minimising waste, and promoting a clear workflow where everyone knows exactly where things are located.

The Plan-Do-Check-Act Cycle

The Kaizen methodology follows the Plan-Do-Check-Act (PDCA) cycle, a repeated process referring to ongoing or continuous improvement involving each employee – managers and workers alike [23]. Lean management provides tools to address this process, which involves making a plan, executing it, checking the results, and making systematic corrections. The PDCA cycle is employed to enhance products and services continually. Plans begin by brainstorming the best ideas for improving efficiency, which are then actualised to ascertain if they work in practice. The results of the changes are then examined to understand the impact. If the results indicate that the process works better after the changes, targeted adjustments are made, and work standards are reviewed to ensure standardised procedures [20, 24].

Value Stream Mapping

Value streams are defined as all value-added and non-value-added activities required to produce a product from raw materials until its delivery to the customer. Value streams consist of product, service, and information flows created based on customer demand from delivery orders [5, 20]. Moreover, value stream mapping is a lean management tool used to illuminate and analyse the material and information flow in a series of work processes. Mapping provides a visual overview of all processes needed to deliver value to the customer, helping to map and analyse the value stream process from the customer's perspective and identify areas and actions needing improvement [2, 5, 20, 25].

Poka-Yoke

'Poka-yoke' is a Japanese term that means mistake-proofing. This approach emphasises preventing mistakes before they occur, thereby avoiding human errors. 'Poka-yoke' can range from simple measures such as checklists and warning labels to more tangible interventions that prevent the execution of incorrect actions. 'Poka-yoke' methods are simple and easy to implement, such as using colour coding to help employees identify items and designing equipment with tactile features to prevent errors [21].

Toyota Quality House

The Toyota Quality House is a metaphor symbolising lean management's foundation, pillars, and roof. This metaphor conveys that every house must be built on a solid foundation since it is never stronger than its weakest link. The foundation is built on the core principles of the organisational structure and consists of three primary elements: standardised work, visual management, and culture. The corresponding definitions for Landspítali are as follows: flow, respect for people, and quality, Figure 1. These pillars comprise the fundamental principles of lean management, such as continuous improvement, waste elimination, flow, and pull [2, 18, 26].

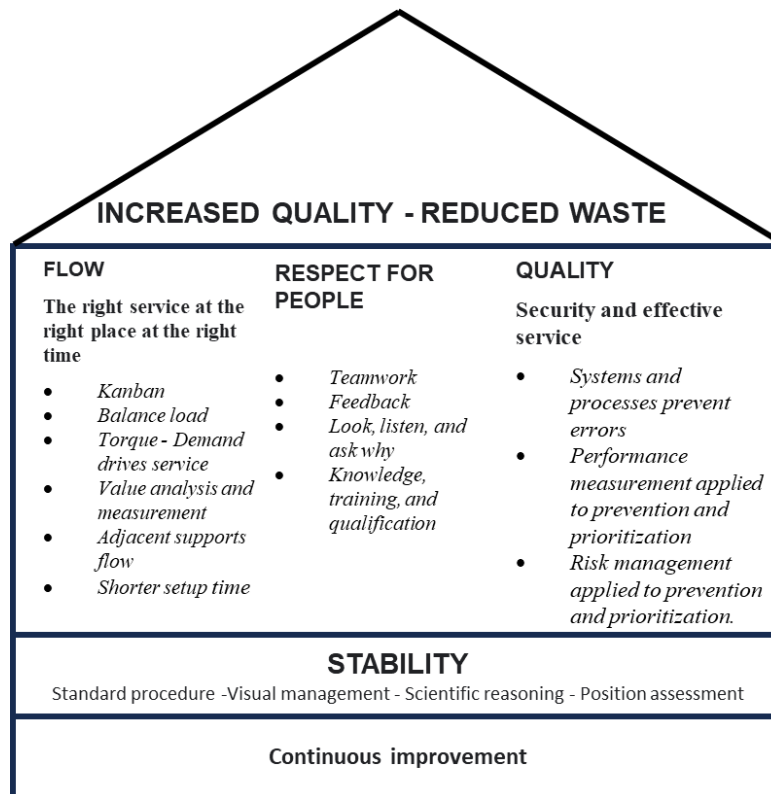


Figure 1. Toyota Quality House at Landspitali.

METHODOLOGY

RESEARCH APPROACH

This study employed a mixed-methods approach to evaluate the implementation of lean management at Landspitali. By combining quantitative and qualitative research methods, the study aims to comprehensively explore managerial attitudes, experiences, and the effectiveness of lean management practices. The research design incorporated both quantitative surveys and qualitative interviews to ensure a well-rounded understanding of lean management's impact at Landspitali. The mixed-methods approach was selected to allow for triangulation of data, thereby enhancing the reliability and depth of the findings.

A structured questionnaire was developed to assess managers' familiarity with lean management, the training they received, their involvement in lean projects, and their perceptions of lean management outcomes. The survey consisted of 18 questions, including a mix of Likert scale items, multiple-choice questions, and open-ended questions to capture additional qualitative insights. The survey was distributed to 115 managers across various departments at Landspitali, including clinical, research, and support services. Managers were selected based on their involvement in or responsibility for lean management initiatives. The final sample included 63 respondents, resulting in a response rate of 55%. To increase participation, follow-up reminders were sent, and anonymity was ensured to encourage candid responses.

Quantitative data were analysed using statistical software. Descriptive statistics were employed to summarise the data, while inferential statistics, such as *t*-tests and chi-square tests, were used to explore relationships between variables and identify significant trends and correlations [27]. This analysis provided insights into the distribution of attitudes, experiences, and outcomes across different groups of managers [28].

The quantitative research methodology involved the use of statistics to examine the distribution of responses, the objectives chosen for the research method, and other critical contextual factors. Additionally, statistical methods were applied to test hypotheses, assess their validity, and compare differences and relationships between the factors under investigation, thereby determining their impact on the results. Quantitative research is focused on measuring specific phenomena and describing subjects such as people's opinions and attitudes, relying on statistical processing of data that are measurable, countable, and interpretable based on the sample. The results are typically explained using graphs and tables, with statistical analysis providing the basis for interpretation [29, 30].

In comparison, qualitative research seeks to reveal underlying significances, patterns, and insights instead of only concentrating on numerical measures or statistical analysis. Researchers frequently utilise thematic analysis, content analysis, or grounded theory methodologies to evaluate the data and produce findings. Qualitative research offers a more profound comprehension of human experiences, views, and social situations, enabling researchers to delve extensively into intricate matters and capture the subtleties of human behaviour and interaction [31].

To complement the quantitative data, semi-structured interviews were conducted with a purposive sample of 10 managers who had significant involvement in lean management projects. These interviews focused on exploring managers' experiences with lean management, the support they received, and the challenges they encountered during implementation. The qualitative data were analysed using thematic analysis, which involved coding the interview transcripts to identify recurring themes and patterns related to managerial attitudes and experiences. The analysis was conducted iteratively, with preliminary findings reviewed and refined based on participant feedback.

The ethics committee at the University of Iceland approved the study. All participants were informed of the study's purpose, the voluntary nature of their participation, and the measures taken to ensure confidentiality. Informed consent was obtained from all participants prior to data collection.

While the study attempted to provide comprehensive coverage, it is acknowledged that the emphasis on managerial perspectives may not fully capture the experiences of frontline employees and other stakeholders. Efforts were made to minimise researcher bias by using validated survey instruments and incorporating multiple data sources. However, the inherent subjectivity in qualitative analysis remains a limitation, which was mitigated by employing multiple coders to ensure inter-rater reliability.

LANDSPITALI

Landspítali is Iceland's national and university hospital, providing diverse general and specialised healthcare services. It also serves as a centre for education, training, and research in the field of health sciences, actively contributing to innovation through knowledge-based initiatives [32].

Landspítali had worked on quality improvements for many years but needed help to sustain its achievements. Hospital leaders aimed to adopt methods to support progress in quality and facilitate the long-term maintenance of advancements. After various options were explored, the decision was made to implement the lean management methodology [10]. The hospital introduced lean management in 2011 with assistance from McKinsey & Company and the Karolinska University Hospital in Sweden [10, 33]. McKinsey introduced the hospital to value analysis, waste reduction, and project prioritisation. This training served as the foundation for establishing an in-house lean school. In the initial stages of implementation, significant

emphasis was placed on the education and training of staff, with the goal that all Landspitali managers would apply lean methodology in their work [12].

RESEARCH PARTICIPANTS

Research participants were required to hold managerial positions at Landspitali; they included executive directors, department heads, nursing department heads, and chief physicians. Managers are appointed for up to 5 years, and their positions demand extensive and specialised knowledge of management, hospital operations, and leadership skills [34]. Therefore, their insights provide a comprehensive and authoritative perspective on the implementation and effectiveness of Lean management practices within the hospital, making their input crucial for evaluating the success and challenges of such initiatives.

The research population comprised managers in clinical research and support services, women's and children's services, geriatric and rehabilitation services, surgical and operating room services, pharmaceutical and emergency services, cardiac and vascular services, oncology services, nursing, and medicine. In the qualitative and quantitative parts of the research, voluntary sampling allowed participants to volunteer for inclusion in the sample [30]. All managers from the areas mentioned earlier were invited to participate in both parts of the research. As a result, 63 volunteers participated in the quantitative part, and saturation was achieved when 10 managers participated in the qualitative part of the research. The quantitative part of the research consisted of a questionnaire with 18 questions sent to 115 Landspitali managers; 63 managers responded, resulting in a response rate of 55%. All responses were analysed, with no responses deemed invalid.

Three themes were used to analyse the interview data in the qualitative research. The first theme explored managers' attitudes, examining their perceptions and feelings toward Lean management. The second theme focused on experience, investigating how Lean management supported managers in their work. The third theme was education and support. It looked into how managers perceived the training they received on Lean management and the support they experienced while applying and using it post-training.

RESULTS

One of Landspitali's cornerstones is continuous improvement. The hospital implemented lean management in 2011 in collaboration with consultants from McKinsey & Company. One year later, training in lean management began, following the knowledge gained from this collaboration. The Lean Academy at Landspitali was formally established in 2016, offering employees education in the lean management methodology.

Three distinct themes were introduced to derive significant conclusions. The findings were subsequently examined following these themes. Each theme was analysed individually, and conclusions were derived from the findings. The three themes were managers' attitudes, experience, and education and training.

Table 1 shows the results of the 62 managers who responded to the study questionnaire. In total, 98.4% were aware of what the lean management methodology entailed, indicating that the managers generally understood the methodology. The results showed that 43 managers (70.5%) perceived visible success from implementing lean management, while 95% believed there was a high or relatively high need for changes within their workplace. Moreover, 22 of 62 (35.5%) managers were more satisfied with their work after implementing lean management.

Table 1. Results of Key Questions in the Research.

Question	Answer, %	
	Yes	No
Did you know that lean management increases patient safety, improves the quality of services, develops work processes, and reduces waste?	98,4	1,6
Have you received training in lean management?	80,6	19,4
Do you have training in lean management?	51,6	48,4
Have you participated in an improvement project where the lean methodology was applied?	67,7	32,3
Do you feel that results are visible from the use of lean management?	70,5	29,5
Do you feel that you have received information about the success of lean implementation?	65,0	35,0
Do you feel that changes made with the methodology of lean management are becoming more established than before?	58,9	41,1

When respondents discussed their experiences with the support they received using lean management in their work, all agreed that they received support from their immediate superiors. For example, one of the interviewees stated, “All ideas are always very well received” When most respondents talked about support from their superiors, they primarily referred to their superiors’ attitudes toward the improvement projects to be implemented, with the supervisors agreeing that such work should be undertaken.

However, despite all respondents implementing lean management in their work, not everyone agreed on its benefits. Some respondents, along with their department staff, expressed negative attitudes toward the methodology, even though they were actively using it. These negative attitudes seemed to arise because the managers felt that the principles of lean management were self-evident – many believed they had already been applying similar practices before formally being introduced to the methodology.

The findings also indicate that 33 of 56 managers (59%) strongly agreed or somewhat agreed that lean management practices were becoming more established at Landspítali than before. The researchers believe that this discrepancy can be explained by the increasing culture of bureaucracy at Landspítali, which is characterised by little tolerance for change. Bureaucratic culture entails control, stability, and predictability; processes are transparent, and power is centrally controlled, giving individuals at the top of the hierarchy considerable control over the organisational structure. Bureaucratic culture dominates organisations, prioritising stability, supervision, effective innovation, creativity, and flexibility. Therefore, leaders must be willing to listen to their subordinates, encourage creativity and innovation, and allow employees at lower organisational levels to hold decision-making power to change this culture [11].

Furthermore, 39 of 60 managers (65%) positively responded when asked if they had been informed about the outcomes of implementing lean management. Kuhn [35] and Kotter [8] highlight the importance of managers being informed about performance and vision in order to achieve successful changes. Another role of managers is to communicate information to their employees. Indeed, managers who are uninformed about performance cannot communicate the information to employees. This hindrance can lead to resistance to change, which can occur when employees experience uncertainty.

During the qualitative research, it emerged that the managers' experiences varied considerably. It was common for managers to have good experiences with streamlining management, which was used to explain the reasons for change to the employees. The participants mentioned that streamlining management prevented work redundancy and reduced decision-making stress and errors, thereby increasing patient safety.

The researchers also assessed that the managers' knowledge of the project map of streamlining management and the innovation that could arise in the process allowed them to fully utilise the staff's skills, resulting in a good experience. Managers also reported that streamlining management was used to improve working conditions for employees and coordinate processes. The starting point for continuous improvement is continuous flow, referring to an uninterrupted process.

The findings reveal significant variation in how lean management is perceived and implemented at Landspitali. While all managers had adopted the methodology, some viewed it as redundant, believing they were already applying similar practices before its formal introduction. This suggests a gap between the intended benefits and the perceived value of lean management.

To address this, more tailored training and clearer communication about the unique advantages of lean management are necessary. These adjustments could better align managerial perceptions with the methodology's goals, leading to more effective implementation. The next section will explore strategies to enhance understanding and appreciation of lean management among managers.

DISCUSSION

This section answers the three main research questions presented in the introduction. Landspitali has undergone extensive implementation of the lean management methodology, requiring alterations in the organisation, culture, and employees' attitudes. Thus, Landspitali has experience with the implementation process, making it timely to examine current circumstances and assess how the process has unfolded. This paper aimed to determine the managers' attitudes toward the lean management methodology and whether they felt that they received adequate education and support in applying it. The latter question was formulated based on the earlier study's findings [12], which suggested a need for improved education and follow-up practices for managers.

RQ₁: Have the attitudes of Landspitali managers toward lean management changed with increased implementation?

Most managers were familiar with the methodology, but some felt they needed to be more informed about the outcomes achieved through its application. Therefore, employees must be informed about the results of lean management in order to maintain the changes. However, it is promising that approximately half of the managers believed that the lean management methodology was becoming more established than before.

The results revealed that fewer managers responded affirmatively when asked if they thought the changes made with lean management were becoming more established than before. Indeed, this outcome can be explained by a culture of bureaucracy characterised by little tolerance for change. To transform or alter the existing culture, leaders must be open to hearing from their subordinates, foster creativity and innovation, and empower lower organisational-level employees to wield decision-making authority [11].

RQ₂: What are the experiences of Landspitali's management with lean management?

The interviews and open-ended questions in the questionnaire revealed that the managers' experiences with lean management varied considerably. Managers perceived the lean management methodology as valuable for communicating with staff, improving processes, and reducing waste. However, they found the methodology time-consuming and unsuitable for their work environment. Both the quantitative and qualitative research revealed that not everyone was equally satisfied with lean management. However, in both cases, lean management was identified as time-consuming. In the qualitative study, the managers revealed that the methodology needed to be better tailored to each department.

RQ3: Do Landspítali managers feel they received adequate education and support to apply lean management in their work?

According to the results, most managers claimed to have received education in the methodology; however, only about half felt moderately or very familiar with lean management, while only one-third expressed that they had received adequate education and training. Regarding support for the application of the methodology, the managers needed guidance about where to seek support if needed; however, they believed that they had support for changes in the form of approval from their superiors. The qualitative study indicated that the managers needed more clarity regarding the sources of support for the improvement projects they oversaw. Support could be enhanced through the establishment of a dedicated team, a topic that was discussed in connection with the topic of managerial expertise.

The results suggested that Landspítali should increase follow-up on implementing lean. Employees must believe that the methodology will improve services and the working environment. Emphasis must be placed on informing managers and staff about the success of the lean management methodology, thereby laying the groundwork for embedding changes. This goal can be achieved by creating milestones and increasing faith and support for the ongoing changes. The researchers believe that the results of this study indicate successful implementation, although there have also been slight setbacks. The results provide an opportunity to reassess and evaluate the need for adjustments, such as information flow, training, and support.

CONCLUDING REMARKS

This study has significant implications for the practical application of lean management in healthcare settings and the broader theoretical understanding of lean management implementation across various industries. The findings underscore the importance of tailoring lean methodologies to the unique needs of healthcare environments, where the complexity and variability of operations differ markedly from those in manufacturing and other sectors. The results suggest that a one-size-fits-all approach to lean management may not be effective and that adaptation and customisation are critical for successful implementation.

The study aimed to answer three key research questions: (1) RQ1. How have the attitudes of Landspítali managers toward lean management evolved with increased implementation? (2) RQ2. What are the experiences of these managers with lean management? (3) RQ3. Do the managers feel they have received adequate training and support to apply lean management? The findings revealed that while most managers were familiar with lean management, only about half felt they had received adequate training. Many expressed concerns about the sustainability and effectiveness of lean practices. These outcomes highlight broader challenges, such as bureaucratic resistance and the need for sustained leadership commitment, and provide valuable insights for improving theoretical lean management models. Specifically, the study emphasises the need to incorporate organisational culture and leadership dynamics into these models to predict better and enhance the success of lean initiatives in non-manufacturing settings.

While the study provides valuable insights into implementing lean management at Landspítali, several limitations should be acknowledged. The focus on managerial attitudes may not fully capture the experiences and perceptions of frontline employees or other stakeholders who are also critical to the success of lean initiatives. This limitation could affect the generalizability of the findings, as the perspectives of those directly involved in daily operations are essential for a holistic understanding of lean management effectiveness.

Additionally, the reliance on self-reported data from surveys and interviews introduces potential biases, such as social desirability bias, where respondents might overstate their positive experiences or downplay challenges. The inherent subjectivity in the qualitative analysis could also affect the interpretation of the findings despite efforts to mitigate this by using multiple coders. Furthermore, the study's limitation to a single institution in Iceland, which may have specific cultural and organisational characteristics, raises questions about how these findings can be applied to other settings, particularly in larger or more diverse healthcare systems.

To address these limitations, future research should expand the scope of inquiry to include a more diverse range of participants, including frontline staff, patients, and other stakeholders. This would provide a more comprehensive understanding of how lean management is perceived and implemented across different levels of the organisation. Moreover, longitudinal studies that track the impact of lean management over an extended period would be valuable in assessing the long-term sustainability of the changes introduced and their effects on patient outcomes, employee satisfaction, and overall organisational efficiency. Such studies could also explore how managerial attitudes evolve, particularly in response to changes in organisational culture or leadership.

Additionally, further research could investigate the cross-cultural applicability of lean management principles by conducting comparative studies across different countries and healthcare systems. Such research would help identify specific cultural, regulatory, or structural factors that influence the success or failure of lean initiatives in healthcare, contributing to a more nuanced understanding of how to adapt these principles to various contexts. Moreover, expanding the theoretical framework to include concepts from organisational behaviour, change management, and leadership studies could enhance understanding of the conditions under which lean management thrives. For instance, examining how different leadership styles influence the acceptance and effectiveness of lean practices could provide actionable insights for organisations seeking to implement these methodologies.

In conclusion, while this study provides a solid foundation for understanding the implementation of lean management at Landspítali and addresses the key research questions, significant scope remains for further research to deepen understanding of the methodology's practical applications and theoretical underpinnings. The role of the Lean Academy in improving training and support should also be further explored and expanded. By addressing the limitations identified and exploring new avenues of inquiry, future research can contribute to more effective and sustainable lean management practices in healthcare and beyond.

REFERENCES

- [1] Mostafa, S.; Dumrak, J. and Soltan, H.: *Lean Maintenance Roadmap*. *Procedia Manufacturing* **2**, 434-444, 2015, <http://dx.doi.org/10.1016/j.promfg.2015.07.076>,
- [2] Liker, J.K.: *The Toyota way: 14 management principles from the world's greatest manufacturer*. 2nd ed. McGraw Hill, New York, 2021,

- [3] Womack, J.P. and Jones, D.T.: *Lean thinking: Banish waste and create wealth in your corporation*. Free Press, Los Angeles, 2023,
- [4] Rotter, T., et al.: *What Is Lean Management in Health Care? Development of an Operational Definition for a Cochrane Systematic Review*. *Evaluation & the Health Professions* **42**(3), 366-390, 2019, <http://dx.doi.org/10.1177/0163278718756992>,
- [5] Graban, M.: *Lean hospitals: Improving quality, patient safety, and employee engagement*. 3rd ed. Productivity Press, New York, 2016, <http://dx.doi.org/10.4324/9781315380827>,
- [6] Lima, R.M.; Dinis-Carvalho, J.; Souza, T.A.; Vieira, E. and Gonçalves, B.: *Implementation of lean in health care environments: An update of systematic reviews*. *International Journal of Lean Six Sigma* **12**(2), 399-431, 2021, <http://dx.doi.org/10.1108/IJLSS-07-2019-0074>,
- [7] Mead, E.; Stark, C. and Thompson, M., eds.: *International examples of lean in healthcare: case studies of best practices*. Routledge, Taylor & Francis Group, London, 2023,
- [8] Kotter, J.P.: *Leading change*. Harvard Business School Press, Boston, 1996,
- [9] Mazzocato, P.; Savage, C.; Brommels, M.; Aronsson, H. and Thor, J.: *Lean thinking in healthcare: A realist review of the literature*. *Quality & Safety in Health Care* **19**, 376-382, 2010, <http://dx.doi.org/10.1136/qshc.2009.037986>,
- [10] Aherne, J. and Whelton, J., eds.: *Applying lean in healthcare: A collection of international case studies*. Productivity Press, New York, 2010, <http://dx.doi.org/10.1201/EBK1439827390>,
- [11] Charron, R.; Harrington, H.J.; Wiggin, H. and Voehl, F.: *The Lean Management Systems Handbook*. CRC Press, Boca Raton, 2015,
- [12] Möller, E. and Rosenkjær, E.Ý.: *Executive attitudes to lean management at the National University Hospital of Iceland*. *American International Journal of Social Science* **5**(3), 75-81, 2016,
- [13] Åhlström, P., et al.: *Is lean a theory? Viewpoints and outlook*. *International Journal of Operations & Production Management* **41**(12), 1852-1878, 2021, <http://dx.doi.org/10.1108/IJOPM-06-2021-0408>,
- [14] Omogbai, O. and Salonitis, K.: *The Implementation of 5S lean tool using system dynamics approach*. *Procedia CIRP* **60**, 380-385, 2017, <http://dx.doi.org/10.1016/j.procir.2017.01.057>,
- [15] Drew, J.; McCallum, B. and Roggenhofer, S.: *Journey to Lean: Making Operational Change Stick*. Palgrave Macmillan, New York, 2004,
- [16] Dav, P.: *The History of Lean Manufacturing by the view of Toyota-Ford*. *International Journal of Scientific & Engineering Research* **11**(8), 1598-1602, 2020,
- [17] Lean Enterprise Institute: *A brief history of lean*. <https://www.lean.org/explore-lean/a-brief-history-of-lean>,
- [18] Charron, R.; Harrington, H.J.; Wiggin, H. and Voehl, F.: *The lean management systems handbook*. CRC Press, Boca Raton, 2015,

- [19] Bercaw, R.: *Taking Improvement from the assembly line to healthcare: The application of lean within the healthcare industry*. 2nd ed. Productivity Press, New York, 2021, <http://dx.doi.org/10.4324/9781003034322>,
- [20] Pyzdek, T.: *The Lean Healthcare Handbook: A Complete Guide to Creating Healthcare Workplaces*. 2nd ed. Springer, Berlin, 2021,
- [21] Dennis, P.: *Lean production simplified: A plain-language guide to the world's most powerful production system*. 3rd ed. CRC Press, Boca Raton, 2016,
- [22] Filip, F.C. and Marascu-Klein, V.: *The 5S lean method as a tool of industrial management performances*. IOP Conference Series: Materials Science and Engineering **95**, No. 012127, 2015, <http://dx.doi.org/10.1088/1757-899X/95/1/012127>,
- [23] Imai, M.: *Kaizen (Ky'zen): The key to Japan's competitive success*. McGraw-Hill, New York, 1986,
- [24] Naydenov, P.: *The PDCA Cycle: A practical approach to problem-solving', Kanban Software for Agile Project Management*. Businessmap. <https://businessmap.io/lean-management/improvement/what-is-pdca-cycle>,
- [25] Martin, K. and Osterling, M.: *Value stream mapping: How to visualise work and align leadership for organisational transformation*. McGraw-Hill, New York, 2014,
- [26] Fritze, C.: *The Toyota production system - The Key Elements and the role of kaizen within the System*. https://www.researchgate.net/publication/289519018_The_Toyota_Production_System_-_The_Key_Elements_and_the_Role_of_Kaizen_within_the_System,
- [27] McCusker, K. and Gunaydin, S.: *Research using qualitative, quantitative or mixed methods and choice based on the research*. Perfusion **30**(7), 537-542, 2014, <http://dx.doi.org/10.1177/0267659114559116>,
- [28] Cui, X.; Dickhaus, T.; Ding, Y. and Hsu, J.C., eds.: *Handbook of multiple comparisons*. CRC Press, Boca Raton, 2021,
- [29] Bogdan, R. and Biklen, S.K.: *Qualitative research for education: An introduction to theories and methods*. 5th ed. Pearson, London, 2017,
- [30] McMillan, J.: *Educational Research. Fundamentals of the Consumer*. 5th ed. Pearson, London, 2008,
- [31] Saldaña, J.: *The coding manual for qualitative researchers*. 4th ed. SAGE Publishing, Thousand Oaks, 2021,
- [32] Landspítali: *Starfsemisupplýsingar*. In Icelandic. <https://www.landspitali.is/um-landspitala/spitalinn-i-tolum/starfsemisupplýsingar-lsh>,
- [33] Landspítali: *Umbótastarf*. In Icelandic. <https://www.landspitali.is/um-landspitala/raudur-thradur/umbotastarf>,
- [34] Landspítali: *Nýtt skipurit Landspítala - Yfirlæknar*. In Icelandic. https://www.landspitali.is/library/Sameiginlegar-skrar/Gagnasafn/Um-Landspitala/Stjornendur/yfirlaeknar_220110.pdf,
- [35] Kuhn, M.H. and Lewin, K.: *Field Theory of Social Science: Selected Theoretical Papers*. The Annals of the American Academy of Political and Social Science **276**(1), 146-147, 1951, <http://dx.doi.org/10.1177/000271625127600135>.