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Implementation and Sustained Use of Lean Logistics: An Integrative Review of Technical and Organizational Factors

Vusal Huseynov

Lecturer, Faculty of Economics and Management, Nakhchivan State University, Azerbaijan

Corresponding author: vusalhuseynov@ndu.edu.az

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Abstract

This article aims to analyze selected literature on the lean approach in logistics processes in terms of operational efficiency, organizational factors, and implementation barriers. The study is a narrative literature review based on a thematic analysis of academic articles, foundational books, and relevant theses and dissertations. Reported implementation outcomes, modeled improvement potential, and conceptual proposals are distinguished and compared. The review indicates that lean principles offer opportunities to reduce waste, improve flow, and enhance resource utilization in warehousing, transportation, distribution, and internal logistics. Realizing these opportunities and sustaining improvements are associated with managerial support, employee involvement, practical training, and the coordination of material and information flows. Inconsistent information, limited practical knowledge, weak organizational support, and coordination problems among partners may hinder implementation. The main conclusion is that the technical and organizational dimensions of lean logistics should be assessed together. The article recommends selecting tools according to specific process problems, monitoring outcomes across the entire logistics flow, and considering working conditions. The review's restriction to selected sources calls for caution when generalizing its conclusions.

Keywords: *Lean Logistics; Operational Efficiency; Organizational Factors; Implementation Barriers; Continuous Improvement; Narrative Literature Review*

INTRODUCTION

The efficiency of logistics processes is important for timely product delivery, service quality, and the effective use of resources. Transportation, warehousing, inventory management, material handling, and order fulfillment are interconnected activities. A delay or coordination problem in any of these activities can affect the performance of the overall process. Improving logistics therefore requires examining material and information flows as a whole, alongside accelerating individual operations.

The lean approach is based on reducing activities that do not create customer value, improving flow, and pursuing continuous improvement. Its principles, originally developed in manufacturing, are also applied to logistics activities. In logistics, lean provides a conceptual basis for identifying excess inventory, waiting, rework, unnecessary transportation, and information inconsistencies. However, lean extends beyond cost reduction; its central concern is coordinating processes and systematically eliminating resource waste while preserving customer value (Womack & Jones, 1996; Goldsby & Martichenko, 2005).

Existing studies show that lean principles can be adapted to different logistics environments. Research on warehouse operations emphasizes improvements in process flow and resource utilization, whereas transportation studies focus on improving routes and transport activities (Adeodu et al., 2023; Garza-Reyes et al., 2016; Villarreal et al., 2016). Theses and dissertations completed in Türkiye complement this literature by addressing the design of distribution systems, the analysis of warehouse value streams, and the organization of internal logistics (Özalp, 2013; Kocabaş, 2014; Ateş, 2018; Patır, 2019). Nevertheless, these studies differ in their methods and the nature of their findings: actual implementation outcomes and modeled improvement potential should not be treated as equivalent levels of evidence.

Lean implementation outcomes depend on organizational conditions as well as the selection of technical tools. Middle managers, employee involvement, training, and a culture of continuous improvement play important roles

in integrating changes into everyday work processes (Reynders et al., 2022; Adam et al., 2021). How employees perceive lean methods also warrants attention. Müller and Leyer (2024) show that employees' perceptions mediate the relationship between certain implemented lean methods and job satisfaction. In contrast, Mulholland and Stewart's (2014) study of a food distribution depot demonstrates that restructuring associated with lean logistics may, under certain conditions, be accompanied by intensified managerial control and deteriorating working conditions.

Operational outcomes, organizational factors, and implementation barriers should therefore be considered together when evaluating lean logistics. As these issues are investigated across different sectors, methods, and indicators in the reviewed literature, connecting the findings is important. In particular, a synthesis is needed to clarify the organizational conditions under which technical improvements become sustained outcomes, the constraints they encounter, and how they vary across logistics environments.

This article aims to analyze selected literature on the lean approach in logistics processes in terms of efficiency, organizational factors, and implementation barriers. The review examines the contribution of lean tools to operational processes, the roles of management and employee involvement, and conditions that may constrain the continuation of improvements. By connecting these areas, the article seeks to develop a better-grounded understanding of lean logistics implementation and identify issues requiring attention in future research.

LITERATURE REVIEW

Conceptual Foundations of Lean and Its Relationship with Logistics

Lean thinking begins with identifying customer value and analyzing the activities that contribute to its creation. Identifying the value stream, establishing continuous flow, implementing a pull system based on actual demand, and pursuing continuous improvement are its core principles (Womack & Jones, 1996). Lean thus extends beyond the use of individual tools: it requires examining the relationships between activities and how the overall process operates.

In logistics, activities that do not create value may take the form of excess inventory, waiting, unnecessary movement, repeated loading and unloading, error correction, and inconsistencies in information flows. However, not every activity that makes no direct contribution to customer value can be eliminated immediately. The necessity of certain activities related to safety, inspection, and operational requirements must be assessed separately. Lean analysis should therefore consider the purpose and function of an activity within the process, as well as its presence.

Lean logistics focuses on coordinating material and information flows (Baudin, 2005; Goldsby & Martichenko, 2005). In Özalp's (2013) thesis on a distribution system, order management, temporary storage, distribution network design, and milk-run transport are also presented as interconnected activities. This perspective indicates that translating an improvement in one operation into better overall logistics performance depends on its alignment with other activities.

Lean Tools and Operational Efficiency

Tools used in logistics processes include value stream mapping, 5S, Kaizen, standardized work, visual management, and Kanban. These tools have different functions: value stream mapping makes the relationships between activities and waiting visible; 5S supports workplace organization; standardized work aims to reduce operational variability; and Kanban links material movements to demand signals. Their selection should be based on an analysis of the specific problem and operating conditions.

Adeodu et al. (2023) report improvements in process efficiency in a third-party logistics warehouse using Lean Six Sigma and the DMAIC framework. However, as the outcomes were achieved through a combined improvement framework, attributing the effects solely to lean tools is difficult. The main relevance of the study lies in demonstrating the application of problem identification, measurement, and phased improvement to logistics operations.

Kocabaş (2014) investigated the goods receiving process at the logistics center of a retail company using value stream mapping and simulation. The study compared current and future states and developed proposals to reduce waiting and process waste. The reported improvements are based on future-state calculations and modeling. These findings should therefore be interpreted as the improvement potential of the proposed process configuration rather than changes measured after actual implementation.

Patır's (2019) study of an automotive components manufacturer illustrates the importance of examining production and logistics activities together. Savings in transportation, inventory, and space utilization are reported following value stream analysis and the establishment of Kanban arrangements with suppliers. These findings

indicate that improvements in internal logistics are linked to the organization of material flows between suppliers and customers, as well as to changes in production lines.

In transportation, Villarreal et al. (2016) combined lean thinking with value stream mapping and simulation to investigate routing operations. Garza-Reyes et al. (2016) evaluated the joint implementation of lean and green approaches. Although these studies demonstrate the adaptation of lean principles to transportation activities, their findings should be interpreted within the characteristics of the models, data, and specific operating environments involved.

Process Design and Information Coordination

Lean logistics concerns how a system is designed, alongside the improvement of existing activities. Ateş (2018) used an axiomatic design approach to evaluate transport alternatives in an internal logistics system and structure the functional requirements of the selected system. The study considers the selection of alternative transport methods against defined criteria, system design, and performance monitoring together. It demonstrates that lean logistics involves reasoned system design as well as tool application.

Braglia et al. (2024) introduced the Plan For Every Order tool for engineer- and design-to-order environments. Systematizing material and supplier information supports internal logistics coordination. The study highlights the importance of adapting lean tools developed in repetitive manufacturing to different operating conditions.

These studies suggest that information coordination can be regarded as an integral part of logistics flow. Delayed information on material availability, inconsistent order data, and weak communication between departments may cause waiting in the physical flow. Improving material movements should therefore be linked to improving information quality during lean implementation.

Management Employee Involvement and Organizational Learning

Sustaining lean implementation depends on an organization's ability to incorporate changes into everyday operations. Reynders et al. (2022) emphasize the role of middle managers in connecting strategic objectives with operational improvements, supporting employees, and encouraging continuous improvement. From this perspective, managerial support involves participation in identifying and resolving problems, alongside allocating resources.

Training quality is also an important condition. In their study of lean simulation training, Adam et al. (2021) demonstrate the importance of understanding concepts and undertaking practical tasks. For logistics, these findings suggest that knowing the names of tools does not ensure that employees can apply them appropriately to a specific operational problem. Training should be linked to real work situations, opportunities for experimentation, and feedback on outcomes.

Kocabaş (2014) also considers committed managerial support, employee involvement, and training important for improving warehouse processes. However, these organizational recommendations should not be presented as separately measured effects. They are conditions identified by the author for implementing the technical proposals.

How implementation is perceived should also be considered when assessing employee involvement. Müller and Leyer (2024) show that the relationship between certain lean methods and job satisfaction is mediated by employees' perceptions. Although the study does not directly measure logistics efficiency, it is useful for understanding the human dimension of lean implementation. Mulholland and Stewart (2014) identify adverse outcomes related to working conditions and control in the food distribution depot they examined. These differing findings suggest that lean implementation does not produce a uniform employee experience and that operational indicators should be assessed alongside working conditions.

Implementation Barriers and Relationships between Different Objectives

The reviewed studies allow lean implementation barriers to be considered across interconnected technical and organizational dimensions. From a technical perspective, incomplete process data, mismatches between material and information flows, and dependencies between activities may complicate improvement. From an organizational perspective, inconsistent managerial support, limited practical knowledge, and weak employee involvement in change may constrain the incorporation of lean into everyday operations (Braglia et al., 2024; Reynders et al., 2022; Adam et al., 2021).

The interorganizational nature of logistics operations should also be considered. Patır (2019) emphasizes coordinating the pull system with suppliers, while Özalp (2013) focuses on integrating order management and distribution activities. These examples indicate that changes within a company may not be sufficient to improve the entire flow; the organization of relationships with partners is also important.

The relationship between efficiency and other objectives is not straightforward. Sanchez Rodrigues and Kumar (2019) identify both synergies and misalignments between lean and green logistics practices. Reducing unnecessary travel distances may improve both costs and emissions. However, the relationship between more frequent deliveries and environmental performance requires separate assessment. An improvement in inventory or time indicators therefore does not automatically imply progress across all performance dimensions.

Synthesis of the Literature and Directions for Future Research

The reviewed studies indicate that the technical and organizational dimensions of lean logistics are interrelated. Value stream analysis, standardization, pull systems, and process design help identify and address operational problems. Management, employee involvement, training, and coordination create conditions for adopting and sustaining these changes. Assessing lean implementation solely by the number of tools used is therefore limited if this relationship is overlooked.

Methodological differences should also be respected when interpreting the literature. Company-specific implementation studies, simulation results, system designs, and studies of employee perceptions address different questions. Considering them together enriches understanding of the topic, but does not justify treating their findings as equally generalizable. In particular, the long-term maintenance of initial improvements and their transfer to other logistics environments require further investigation.

Future research would benefit from examining the relationship between technical changes and organizational conditions and from tracking employee experiences together with operational outcomes. Attention should also be paid to the relationships between efficiency within companies, coordination among partners, service quality, and working conditions. These directions can help explain both the tools through which lean logistics is implemented and the conditions under which it delivers sustained benefits.

RESEARCH METHODOLOGY

This article is a narrative literature review based on a thematic analysis of selected sources on the lean approach in logistics processes. Its purpose is to examine the relationship between lean implementation and operational efficiency, the organizational factors that support implementation, and the barriers that constrain it in an interconnected manner. No primary empirical data were collected for the review; findings and conceptual approaches from existing studies were analyzed.

The source base comprises books explaining the foundations of lean thinking, academic articles on logistics and related operational environments, and relevant master's theses and doctoral dissertations. Sources were purposively selected from a preassembled collection of materials. Selection considered their relationship with lean principles, the relevance of the information presented on logistics processes, and their contribution to analyzing efficiency, organizational factors, or implementation barriers. Studies connected to the topic only through general logistics optimization were not used as direct evidence of lean implementation.

The analysis prioritized sources that directly investigated logistics activities. Studies on management, training, and employee perceptions that were not restricted to logistics were used to explain organizational factors. Their findings were not equated with direct empirical evidence of logistics efficiency. Theses and dissertations were considered supplementary sources offering detailed accounts of specific operational environments and implementation approaches.

Source content was compared across three main thematic areas. The first concerns operational efficiency in relation to process flow, waiting time, inventory, transportation, and resource utilization. The second examines managerial support, employee involvement, training, communication, and organizational learning. The third addresses implementation barriers, dependencies between activities, and potential misalignments between different performance objectives. These areas were defined as an analytical framework aligned with the purpose of the article.

When interpreting findings, the research environment, method, and nature of the evidence presented by each source were considered. Changes reported after actual implementation were distinguished from calculated or simulated future-state improvements, conceptual system proposals, and author recommendations. Where lean was implemented alongside other methods, outcomes were not attributed solely to lean tools. Findings based on different indicators and operating conditions were compared qualitatively rather than combined into a single quantitative effect.

The main limitation of the review is its reliance on a preassembled collection of sources. Since no systematic search covering all relevant publications was conducted, the article does not claim to provide a comprehensive account of the literature in the field. Methodological differences between sources and the context dependence of

company-specific findings also limit generalizability. Accordingly, conclusions are presented as relationships and directions for future research identified through comparison of selected literature, rather than as statements confirming that lean logistics produces the same outcomes under all conditions.

DISCUSSION

The reviewed literature suggests that lean offers useful opportunities to improve the efficiency of logistics processes. However, outcomes depend on the tools applied, process characteristics, and organizational conditions. The main conclusion drawn from comparing the sources is that technical improvement and organizational change should complement one another. Identifying process waste provides a starting point for improvement; sustaining that improvement is associated with management, employee involvement, and coordination.

Assessing Operational Efficiency at the Process Level

Studies of warehousing, transportation, and internal logistics address different operational problems, but share a focus on flows between activities. Waiting and repeated operations are prominent in warehouses, route and time losses in transportation, and material supply and movement in internal logistics (Adeodu et al., 2023; Villarreal et al., 2016; Ateş, 2018). These differences highlight the importance of selecting lean tools on the basis of an analysis of the specific problem.

This review supports assessing efficiency across the entire process. For example, if accelerating one activity creates accumulation and waiting at the next stage, a local improvement may not improve the overall flow. Özalp's (2013) emphasis on integrating distribution activities and Patır's (2019) attention to the relationships between production, suppliers, and customers support this interpretation. Assessment should therefore consider the relationships between total order completion time, service quality, and resource utilization, alongside the duration of individual operations.

The Relationship between Technical Changes and Organizational Conditions

Lean tools can make problems visible and improve the organization of operations. Their incorporation into everyday work routines, however, depends on the organization’s adoption of change. The coordinating and supporting role of middle managers emphasized by Reynders et al. (2022) is relevant in this regard. Translating management objectives into employees’ daily activities requires clear priorities and opportunities to report and resolve problems.

Training is also an important part of this relationship. The findings presented by Adam et al. (2021) demonstrate the importance of linking theoretical knowledge with practical application. This suggests that the value of training should not be assessed solely in terms of teaching lean concepts. Employees’ ability to use that knowledge to identify and resolve specific problems is more important. Kocabaş’s (2014) recommendations on managerial support, involvement, and training also highlight the need to consider these conditions when implementing technical projects.

Employee Experiences and the Human Dimension of Efficiency

The literature indicates that lean implementation does not have uniform consequences for employees. Müller and Leyer (2024) identify the role of employee perceptions in the relationship between certain lean methods and job satisfaction. Mulholland and Stewart (2014), in contrast, show adverse aspects of control and working conditions associated with restructuring linked to lean logistics in the food distribution depot they examined. As these studies investigate different environments and outcomes, it would be inappropriate to characterize them as directly contradictory. Considered together, however, they highlight the importance of how implementation is organized.

This comparison supports including workload, employee participation in decisions, and perceptions of change in efficiency assessment. Reductions in costs and operating time are important outcomes, but they do not capture all organizational effects of implementation. Considering employee experiences can help explain the mechanisms through which improvements are achieved and the conditions needed to sustain them.

Coordination and Alignment between Different Objectives

Lean logistics implementation extends beyond activities within a company. As material supply and delivery flows depend on suppliers, customers, and logistics partners, the continuation of improvements is associated with coordination among these actors. Patır’s (2019) work on coordinating the pull system with suppliers and Braglia et al.’s (2024) systematization of material and supplier information illustrate different aspects of this issue.

Operational objectives also need to be assessed together. Sanchez Rodrigues and Kumar (2019) show that both synergies and misalignments exist between lean and green logistics. These findings suggest that the interactions between decisions concerning costs, inventory, delivery frequency, and environmental performance should be considered. Assessing an improvement in one indicator separately from changes in others may provide an incomplete understanding of the overall benefits of implementation.

Interpreting and Generalizing Findings

The sources used in the review provide different types of evidence. Kocabaş's (2014) modeled future-state results demonstrate the potential of proposed changes. Ateş's (2018) work makes a methodological contribution to system selection and design. Patır (2019) reports implementation outcomes in a specific company. These studies complement one another, but do not answer the same question at the same level of evidence.

The selected literature therefore does not support identifying a universal percentage improvement or a single implementation model suitable for all companies. A better-grounded conclusion is that lean principles can be adapted to different environments, while outcomes should be assessed within their process configurations and organizational conditions. The long-term maintenance of initial improvements, the joint monitoring of employee experiences and operational outcomes, and the effects of interorganizational relationships warrant particular attention in future research.

CONCLUSIONS AND RECOMMENDATIONS

This article has reviewed selected literature on the lean approach in logistics processes in terms of operational efficiency, organizational factors, and implementation barriers. The sources analyzed indicate that lean principles provide a useful basis for identifying process waste and improving flow in warehousing, transportation, distribution, and internal logistics. However, the extent and continuation of outcomes depend on specific operating conditions, implementation methods, and the organization's ability to adopt change.

The main conclusion is that the technical and organizational dimensions of lean logistics should be assessed together. Value stream mapping, standardization, visual management, and pull systems can help address process problems. Managerial support, employee involvement, practical training, and coordination between activities create important conditions for incorporating these changes into everyday work. The article's contribution is to connect operational improvements with the conditions that influence their implementation and continuation.

The following recommendations for logistics companies are proposed on the basis of the selected literature:

- Begin implementation with process analysis. Material and information flows should be examined together, and tools should be selected according to the problems identified.

- Assess improvements across the entire process. Total order completion time, service quality, inventory, and resource utilization should be monitored alongside savings in individual operations.

- Involve employees in improvement. Training should be linked to real operational problems, and opportunities should be provided for employee suggestions and feedback.

- Ensure coordination between management and partners. Responsibilities for changes should be clarified, and flows involving suppliers and customers should be considered.

- Monitor outcomes over time. The maintenance of initial improvements, their effects on workload and working conditions, and their alignment with other performance indicators should be assessed.

These recommendations arise from the review's synthesis and should be adapted to each company's circumstances. As the article relies on a preassembled collection of sources, it does not cover all relevant literature. Differences in research environments and methods also limit generalizability. Distinguishing actual implementation outcomes from modeled improvement potential is important when considering these limitations.

Future research should investigate the long-term outcomes of lean implementation, the interaction between employee experiences and operational indicators, and the role of interorganizational coordination. Empirical studies in logistics companies in Azerbaijan could also assess how the relationships identified in this review develop under local operating conditions.

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