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Original Article

Lean-Kaizen Operations Model for Improving Intralogistics in a Construction Materials SME: A Study from Peru

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Abstract: *The operational performance of construction material and hardware retail SMEs in Peru has long been constrained by inefficient logistics systems and inadequate process standardization. Previous research has offered theoretical models with limited empirical validation, especially in resource-constrained environments. This study addressed critical inefficiencies such as disorganized warehouses, extended picking and loading times, and high defect rates. It proposed a Lean-Kaizen operations model built on 5S, visual management, and standardized work practices. The implementation over four months resulted in measurable improvements, including a 26% increase in OTIF and a 63% reduction in defective materials. Search and loading times decreased by 33% and 36%, respectively, reflecting enhanced productivity and worker satisfaction. These results underline the model's potential for transformative impact on operational efficiency. Academically, the study contributes practical evidence to the field of industrial engineering. Socioeconomically, it strengthens SME competitiveness. Further exploration is encouraged to adapt this framework across sectors and regions facing similar logistical challenges.*

Keywords: *Lean Manufacturing, Kaizen, Warehouse Management, Construction Materials, Logistics Performance.*

I. INTRODUCTION

The significance of small and medium-sized enterprises (SMEs) focused on the commercialization of construction materials and hardware products is noteworthy around the world, especially in Latin America and Peru. These businesses are SMEs and an important driver of economic development and sustainability, given that they provide a high majority share of employment and other services, as well as serve as a barometer of local economic activities. [1] In Peru, these sector SMEs constitute a large proportion of the business ecosystem and are key players in the country's infrastructural development as they constitute the first stage in the construction materials supply chain. [2] These firms address the needs arising from the maintained demand for housing and commercial structures and are crucial for the demand surge post-pandemic in economically reactivating the region. [3] In this regard, construction related SMEs need to remain viable and expand for the country to compete globally.

Nonetheless, the production systems of these small and medium-sized enterprises (SMEs) encounter logistical problems that reduce their productivity and, therefore, the service level provided. A significant example is work organization which suffers from clutter at work sites leading to increased production time and, hence, additional costs [4]. This clutter is often the result of a lack of standard processes which inhibits efficient operation by businesses [5]. In addition, poor maintenance of sewing machines, including failure to lubricate, clean, or set them up properly, increases downtime and lowers product quality [3]. All these factors need to be managed to reduce the rate of defective products, a problem faced by construction SMEs that can damage their reputation and financial health.

Addressing these challenges is very important for the sustainability and competitiveness of SMEs operating within the construction and hardware industry. Improving operational efficiency not only increases a firm's productive capabilities but also has a positive impact on the client's satisfaction level [6]. Resolving these issues in a systematic manner is very important, as it provides a higher level of optimization to the internal business practices and supports greater business expansion opportunities in the future [7]. Adopting these strategies would enhance the production processes greatly by eliminating excessive operational waste and enhancing the overall product quality and could be done through Lean Manufacturing and Kaizen [8]. This not only resolves logistical weaknesses but places these enterprises as more responsive sector leaders to real-time market needs, which is a shift toward improved culture of development.

These methodologies are gaining attention, but the literature is limited on the use of these methodologies for construction SMEs in Latin America, and particularly in Peru. While other revisions exist on the implementation of Lean and Kaizen, a great number is centered on larger industries or have different scope [9]. Absence of relevant literature hinders the comprehension regarding effective adaption of these methodologies in construction and hardware SMEs [10]. This gap is filled by the proposed research which develops a production system based on the integration of Lean Manufacturing techniques like 5S and work standardization in conjunction with Total Productive Maintenance (TPM) [11]. This model

attempts to solve strategic problems while building organizational endurance for long-term sustainability so that these SMEs can compete in an ever-increasing demanding market.

Understanding the practical context of the Peruvian construction sector SMEs makes this research different from others. This study attempts to validate the practicality of the Lean and Kaizen tools with a real case instead of proposing generic theoretical answers like many other works do [12]. The findings are expected to contain not only a strategic plan to mitigate the operational challenges but also a model that is easily adapted by other industries or regions to improve productivity and competitiveness [13]. This means that cross-sector business and education policy could transform operational strategies in Peruvian SMEs by showing how continuously refined improvement techniques alter policy will result in altered outcomes.

Acknowledging the significance of SMEs operating in the construction and hardware industry, their ability to improve operational efficiency remains a major challenge. Identifying, analyzing these problems, addressing and filling the existing knowledge gap is how this research advances academic scholarship and provides the tools necessary to enact change in the sector.

II. LITERATURE REVIEW

A. Lean Manufacturing in SME Warehousing

Recent research indicates that small and medium-sized enterprises (SMEs) realize marked improvements in warehousing and dispatch processes by applying Lean Manufacturing techniques aimed at waste reduction and optimizing material flow [14]. The research also suggests that while many SMEs struggle with adopting Lean due to several factors such as resource constraints or inertia, those that overcome these hurdles report significantly lowered process times and reduced inventory levels [14][15]. As an example, a study on a consumer goods distributor warehouse demonstrated that the first attempt at applying Lean principles, including value stream mapping, layout redesign, and 5S, resulted in lowered cycle times and enhanced delivery performance, thereby elevating the logistics service level [16]. Similarly, a production warehouse within the pharmaceutical industry achieved 20 percent reduction in total supply time by applying Lean and process simplification as documented by the case study [15]. The application of several Lean techniques in “hybrid” warehouses (which combine receiving, storage, and order preparation operations) have also improved operational efficiency and shipment quality [17]. In total these studies support the claim that the Lean philosophy, which is predominantly associated with manufacturing, can be applied in SME warehouse operations to achieve reduced costs, faster order fulfillment, and minimized error in inventory control and management [14][15]. Lean in small enterprises is reported to encourage a more customer-centric

Lean Manufacturing along with its principles sustain a culture of continuous improvement which results in more competitive and stable logistics processes [14]. This implies that Lean Manufacturing serves as an appropriate underpinning for optimizing warehouse and dispatch operations in hardware and construction material SMEs, if the approach is tailored to scale and capabilities, due to its principles of simplification and value focus [16][17].

B. Visual Management in Logistics Processes

Visual management is a technique that supports Lean and gains relevance in SME warehouses by providing vital information process to all operators immediately. It is fundamentally described as a system of management that seeks to enhance organizational performance using visual aids as management tools conveying important information in a clear, unambiguous and instant manner [18]. In relation to logistics, this methodology employs the use of boards, graphs, color-coded signs, and labeled items to display operational indicators such as inventory levels, pending orders, response times, and incidents [19]. Studies conducted in factories and distribution centers show that visual management increases the ability to coordinate and makes real-time operations more efficient. For instance, the use of performance boards in warehouses helped the teams to detect and address potential bottlenecks, thus improving productivity while reducing idle times [19][20]. A case study in the construction sector found that the implementation of indicators visually integrated into the planning and logistics center enhanced storage and transport operations, improved on-time delivery, and optimized daily planning [21]. Additionally, visual management is known to enhance self-managed work environments.

Clarity on what, how, and when each task requires attention alleviates uncertainty and the need for constant supervision, thus promoting autonomy and faster reaction to anomalies [18][20]. In SMEs managing construction materials which uniquely possess multi-skilled stock-keeping units, efficient visual management such as labeled locations vertically organized by picking orders and order panels enhances retrieval communication and error mitigation in order preparation [19][21]. To conclude, scholarly research illustrates the strengthening of continuous improvement programs with the implementation of visual management, making processes accessible and comprehensible at every tier, leading to order, enhanced safety, and self-regulated deputy functions within the warehouses [18][20].

C. 5S Methodology in SME Warehouses

The 5S technique (Sort, Set in order, Shine, Standardize, Sustain) is one of the most widely used continuous improvement tools in warehouse management due to its simplicity and immediate impact. Multiple studies report that implementing 5S in SMEs leads to better organized storage spaces and a marked reduction in unproductive time associated with material searching and unnecessary movement [22][23]. For instance, a case study in an industrial warehouse showed that, after implementing 5S, the average time spent by staff to locate supplies dropped by 80%—from 900 to 180 seconds—thanks to the removal of unnecessary items and clear location signage [24]. In the metal-mechanic sector, the combined application of 5S and Total Productive Maintenance (TPM) in a Peruvian SME significantly improved warehouse quality and safety by keeping storage areas clean and uncluttered, thereby reducing defects and accidents [23]. Likewise, a research study in a local sugar company proposed 5S to enhance warehouse performance, and preliminary surveys revealed that over half the workers identified excessive and unnecessary stock clutter—issues directly addressed by the "Seiri" (sort and remove) and "Seiton" (arrange what is needed) phases of 5S [24]. After piloting 5S in the company, improved inventory handling and increased staff satisfaction with warehouse conditions were observed [24]. Similarly, a study in a spare parts warehouse demonstrated that systematic application of 5S, supported by training, sustained initial improvements over time and prevented relapses into old, disorganized habits [22]. In conclusion, 5S provides a solid foundation for continuous improvement in SME warehouses. By establishing order and cleanliness as norms, these businesses can expedite dispatch operations, free up useful space, and create standards that enable further Lean initiatives [22][23]. Notably, many cases in the hardware retail sector report 5S as the key starting point for professionalizing their warehouse management, resulting in increased service levels and customer trust [23][25].

D. Standard Work in Logistics Operations

Standardizing logistics processes is recognized as a fundamental enabler to sustain improvements and ensure consistent quality in warehouse operations [26]. It involves defining and documenting the best sequence of activities for each task—whether receiving goods, preparing orders, or dispatching—along with expected times and required resources, so that all operators follow the same optimal procedure [27]. Research shows that by implementing standard work, SMEs reduce variability in their dispatch processes and more easily detect anomalies when deviations occur [26][29]. A notable case involved a manufacturing company facing delays in order delivery. After developing standard operating procedures for packaging and shipping tasks, the company doubled its weekly dispatch capacity and reduced average customer wait time by 80% [28]. Similarly, a pharmaceutical distributor introduced standardized instructions for picking and packing, complemented with staff training, which raised the "perfect order" rate (complete, on-time, error-free deliveries) from 85% to over 95% within a few months [27]. Studies highlight that effective standardization requires investment in training and active employee involvement in developing the standards to ensure they are realistic and accepted by the operations team [26]. When such engagement is achieved, the benefits become evident: a study in a Peruvian textile SME reported an 82% productivity improvement and a drastic reduction in downtime after implementing a Lean management model that included 5S and standardized supply chain processes [29]. In the context of SMEs commercializing construction materials, standard work in warehousing translates into preparing and dispatching each order by following defined steps (e.g., double item verification, secure packaging, unified documentation), which helps reduce delivery errors and rework [26][29]. In summary, the reviewed literature agrees that standard work is the "secret weapon" of Lean organizations: it consolidates achieved improvements and prevents regressions, while establishing a baseline for systematic Kaizen implementation [28][30].

E. Kaizen Approach in Logistics Processes

Kaizen is defined as the incremental continuous improvement involving the whole workforce at all levels within an organization, everyone's participation in looking for more efficient methods of functioning is encouraged. In the small and medium-sized enterprises (SMEs), the usefulness of Kaizen culture becomes relevant to improving organizational resilience and adaptability which allows better responses to environmental shifts by constantly trained aid teams [32]. Academic research demonstrates that firms that have incorporated Kaizen within their logistics processes do enjoy immediate operational benefits (reduction of waste immediately) and sustainable benefits (organizational learning) [30][32]. For example, Kaizen was reported to have beneficial impacts in multiple industries—for services and manufacturing—after more than 30 years of implementation, and these were attributed to heightened use of improvement centers resulting in increased efficiencies, better quality, and reduced costs [30]. More recently in logistics, concentrated Kaizen have been successfully used to resolve bottlenecks at distribution centers. In one case, a cross-functional team in a single managed warehouse unit analyzed the order fulfillment lag and implemented simple changes (repositioning of frequently accessed items and rationalization of picking pathways) which led to a reduction in operational costs by 750,000 rupees annually while vastly improving the speed of outbound flows [33]. Kaizen is not limited by manufacturing sectors.

In the case of a catering company, applying a comfort-based Kaizen approach optimized food delivery services and

minimized food waste, illustrating the flexibility of Kaizen as an improvement methodology across varying contexts and operations [31]. In commercial small and medium-sized enterprises (SMEs), a Kaizen approach may take the shape of dispatch and warehouse personnel regrouping on a regular basis to discuss possible simplifications to the processes, eliminating unnecessary order management steps, or optimizing the spatial arrangement for faster loading. There is evidence supporting the notion that such continuous improvement activities substantially augment performance; In a study conducted within hardware retail clusters, it was revealed that sustained application of Kaizen enhanced supply chain performance by as much as 70% and increased overall logistics efficiency [33]. Lastly, more recent studies emphasize the addition of operational indicators and frontline worker active participation to adapt to changes as a result of Kaizen's bring put forward [32]. This is important for SMEs as usually each staff member wears multiple hats: a robust culture of Kaizen anchors fast and responsive logistics chains to the fundamentals of the business, making enduring improvement part of daily work at every level [31][32].

III. CONTRIBUTION

The materials and techniques section should include enough information to allow all operations to be replicated. If numerous procedures are presented, it may be separated into heading subsections. (Size 10 & Regular)

A. Proposed Model

Figure 1 presents an operations management model based on Lean Manufacturing principles and the Kaizen philosophy, aimed at optimizing key logistics processes within a small- to medium-sized enterprise (SME) engaged in the commercialization of construction materials and hardware products. The structure of the model is organized into three interrelated components that address the main operational problems identified, such as a low OTIF (On Time In Full) rate and delays in both order picking and unloading.

The first component focuses on optimizing the picking process through the implementation of visual management tools, which enhanced clarity in task execution and route planning. The second component seeks to improve the order and flow of materials within the warehouse by applying the 5S methodology, which serves as a foundation for efficient organization of physical space and resources. Lastly, the third component addresses the optimization of the packing process through work standardization, enabling more consistent and predictable execution of final tasks before shipment.

This integrated proposal is grounded in continuous improvement and the elimination of waste, which are core principles of the Lean-Kaizen approach.

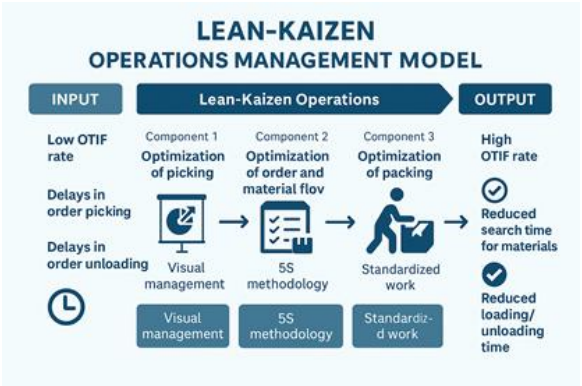

Figure 1 : Proposed Lean-Kaizen Operations Management Model

B. Model Components

The growing intricacy and competitiveness of global supply chains have put more strain upon organizations seeking to optimize their internal logistics. The efficient management of a warehouse's operations is crucial for small and medium-sized enterprises (SMEs) that often function with constrained resources if they are to meet service dependability, customer satisfaction, and financial viability. In this regard, the Lean-Kaizen Operations Management Model provides a systematic method to enhance intralogistics performance by merging the waste reduction principles of Lean Manufacturing with the continuous improvement tenets of Kaizen.

This model makes a substantial contribution to order fulfillment performance by offering a pragmatic approach for identifying and resolving common operational problems. Some of these problems include low on-time in-full (OTIF) rates, delays in material picking and unloading, and inefficient packing. The model is based on three interrelated components: picking optimization, order and flow enhancement, and packing standards. Each element combines specific tools designed for SMEs that are aimed at producing both immediate and long-lasting benefits. The ensuing sections describe the rationale

and design of each of these components in detail.

a) Component 1: Enhancing Picking Efficiency Through Visual Management

The visual management system deals with the picking process, encapsulating the multifunctional maneuvers across the warehouse floor. Efficient picking is critical for meeting customer expectations. Frequently, problems with low OTIF rates stem from the inefficiencies of this phase, where bottlenecks, misplaced items, or incorrect quantities jeopardize the entire delivery chain. In countless SMEs, picking is done devoid of formal dialed standard operating procedures, visual aids, or training, which makes the process heavily reliant on operator subjectivity and laden with errors.

What I propose here will focus on warehouse order picking strategies driven by visual cue management. This approach eliminates perceptual confusion of the warehouse environment by transforming it into a visually structured one, where information on order picking is presented as signs, labels, color coded sections, and schematic plans that ambiguously indicate order of suggested movements. Each warehouse is subdivided into rule defined areas with color coded borders designated for specific item families or types, as well as predetermined optimum routes for material retrieval. Such reorganization eliminates search time, as items are logically arranged, directed, and tagged spatially within the environment. It prevents time lost remedying errors.

In addition, visual management fosters the possibility of real-time feedback through the display of importance metrics in dashboards. This feature improves visibility while fostering responsibility within the personnel. When results are visible, efforts increase, helping the workforce embrace the culture of continuous enhancement. Training is simpler as well, since new operators can be trained with the use of guides that are simplified and standardized.

The advantages of this system are instant. Order preparation is now easier and can be followed more precisely. The improvement of OTIF indicators is directly helped by the decline in search time, while picking errors also fall. Moreover, in a fast-paced environment, precision and expediency are critical, thus these systems help ease cognitive fatigue and reduce overthinking. All these increases warehouse productivity.

Of equal importance is the fact that the optimization of picking through visual management strengthens the prerequisites for the effective implementation of the order's subsequent components within the model. Internally, these materials can be transported swiftly and accurately, resulting in minimal interruption to the operational flow within the facility. In this aspect, visual management plays a dual role — it empowers both as a technical and cultural support for the Lean-Kaizen model principles upon which the model was constructed.

b) Component 2: Structuring Internal Flow with the 5S Methodology

After optimizing the picking process, the model now directs its attention to the order and flow of materials on a movement level inside the warehouse. Orderless layouts and the presence of unused or misplaced materials, along with unclear routes for material handling, usually cause delays in this particular phase. Many SMEs suffer from these operational inefficiencies which, as frustrating as they are, are often much more serious issues in warehouse order and discipline.

To solve this problem, the model's second part incorporates the 5S methodology. This tool, which is grounded in five Japanese words for to sort, to set in order, to shine, to standardize, and to sustain—has been used for workplace organization for quite some time. Its use in internal logistics is remarkable because it bestows an orderly way of eliminating waste and providing a streamlined, organized, and clean environment.

Everything begins with targeted cleanup and order meticulously analyzing the work area for unnecessary items. After excess materials are removed, each item is then categorized based on how frequently they will be used. Each component is stored in its designated location and appropriate visual aids are placed to enhance real time identification. This enables reduced movement time while ensuring materials are always where and when they are needed.

“Shine” is the third step which focuses on cleaning the workspace and equipment in a manner that prevents loss and ensures functionality. It is important to note that cleaning is not solely a maintenance procedure. It is also an inspection which enables firms to identify defects or irregularities early on. This enables the warehouse staff to develop a proactive culture when it comes to problem detection and resolution.

The fourth step is Standardization and this step helps ensure uniformity in terms of shifts and operators. It is at this stage that the procedures are documented along with their corresponding duties which ensures every team member shall adhere to a defined standard operating procedure. Ultimately, the sustain phase identifies accountability zones aimed at upholding the standards set such as designated trainings, internal audits, and recognition programs that reinforce positive conduct while active monitoring prevents standard regression.

Utilizing the 5S technique improves the predictability and efficiency of the internal flow of materials. Cross traffic is

limited; congestion is alleviated; and materials are in relationship to where they operate along set logical paths. The operational improvements help alleviate stress and enhance the safety of warehouse workers alongside overall efficiency.

Strategically, however, the implementation of 5S serves to strengthen the overall Lean characteristic of workplace order and improvement. It helps promote a culture of active involvement, ownership, and care from the workforce in relation to their surroundings, encouraging them to improve their work environment. This change in culture is critical to prepare an organization for further measures aimed at sustaining operational benefits and enduring future tightening of improvement initiatives.

c) Component 3: Standardizing Packing Processes for Consistent Output

This final section focuses on the packing process, which is notoriously neglected despite its importance to delivery standards and customer perceptions. In the initial diagnosis phase, irregularities in packing processes contributed to delays, damages, and inconsistent adherence to standards. These not only undermine customer perception, they also add operational work, increase returns, and incur further costs for the company.

In view of resolving these challenges, the model suggests the standardization of work pertaining to the activities involved in packing. This strategy entails the determination of an optimal task time sequence, setting defined quality standards, and ensuring procedural compliance by all operators. The desired outcome is reduction of variability, errors, and ease in monitoring performance indicators such as packing time per unit and defect rate.

The first step in the implementation of work standardization involves observation and analysis of the actual work done. Best practices are being documented in pictorial and instructional sheet formats by skilled workers who are actively solicited for their input. These standards are further tested, improved, validated, and integrated with the operators' practical acceptance structures.

These standard procedures when put in place become the continual point of reference for daily tasks. The standard outlines the requisite materials, tools, and techniques for package folding, sealing, labeling, stacking, and even guiding s operators' routines by delineating the required seal precision borders for each bag done per a given time interval. Following these steps leads to reduced fuzziness in task completion and increased operator confidence.

Planning and controlling operations is made simpler and more effective through the improved clarity that comes with standardization. Accurate estimation of workloads and shift scheduling becomes feasible with predictable cycle times, enhancing transportation services coordination. In addition, enhanced standard deviations become easier to detect and enabling improved corrective actions. Another component's benefit deals with employee advancement. The newly employed associates Standardized works helps as this aids in training and skills development, allowing the new employees to reach their peak productivity in a shorter duration of time. In addition, it helps foster a common appreciation of quality standards and further improves the culture of ongoing enhancement.

With the packing procedures getting standardized, the organization attains enhanced consistency in output, reduced damage to goods, and a better reputation among customers. This final step integrates results from the other parts and guarantees the preservation of the value generated during the picking and internal movements until delivery.

The Lean-Kaizen Operations Management Model provides a practical approach for increasing intralogistics efficiency in small and medium-sized enterprises. Unlike other models, this one is structured in three parts: first, picking optimization with visual management, second, order and internal flow improvement through 5S, and third, packing standardization. This structure allows addressing the most prevalent warehouse operational inefficiencies.

Every component builds upon the results of the previous one, forming a virtuous cycle of refinements that result in an increasingly dependable, responsive, and streamlined logistics system. This model does not have high technological or capital intensive requirements, making it suitable to organizations with resource constraints. Rather, it depends on discipline, order, and employee engagement to achieve sustainable shifts.

In addition to direct operational efficiencies, the model supports the fostering of a continuous improvement culture rooted in Lean and Kaizen. It fosters increased responsibility among staff, providing them with the means to take ownership and ensuring that their daily tasks are linked to larger strategic goals. These cultural shifts are vital to ensure that the results achieved continue to be built upon, and evolve, over time.

The model adds to the body of knowledge on Lean in SMEs by illustrating how foundational tools have been integrated to yield profound transformation, demonstrating the power of concentrated and methodical efforts in resource-scarce settings.

To conclude, the Lean-Kaizen Operations Management Model provides value to both the practitioners and scholars of

the Industrial Engineering field. Particularly, it equips SMEs with a systematic set of steps to solve their logistical problems and opens further research opportunities regarding the application of Lean instruments to diverse industries. Its conceptual comprehensive framework and its people-oriented approach, combined with its intrinsic methodological rigor, not only make it a model of improvement, but a model of learning and development.

C. Model Indicators

The effectiveness of a Lean-Kaizen operations management model was assessed through performance indicators tailored to the logistics context of a construction materials and hardware retail SME. These indicators were defined to capture key dimensions of service efficiency and operational flow. Their formulation enabled consistent monitoring of internal processes and informed data-driven decisions throughout the case study. This structured evaluation approach supported a comprehensive understanding of the company's logistical performance and contributed to the identification of continuous improvement opportunities aligned with Lean and Kaizen principles.

a) Fill rate

This indicator measures the percentage of customer orders fulfilled on time and in full, reflecting service reliability and delivery performance.

$$\text{Fill rate} = \left(\frac{\text{Orders fulfilled}}{\text{Total orders}}\right) \times 100 \quad (1)$$

b) Percentage of defective materials

It quantifies the proportion of defective items over the total received, offering insight into material quality and inventory precision.

$$\%\ \text{of defective materials} = \left(\frac{\text{Defective materials}}{\text{Total materials}}\right) \times 100 \quad (2)$$

c) Time spent searching for materials and tools

This metric captures the average time operators spend locating items, highlighting inefficiencies in storage layout or visual organization.

$$\text{Search time} = \text{End time} - \text{Start time} \quad (3)$$

d) Material loading time

This indicator reflects the duration required to prepare and load materials for delivery, influencing overall process flow and lead time.

$$\text{Loading time} = \text{Time of loading completion} - \text{Time of loading start} \quad (4)$$

e) Material unloading time

It measures how long it takes to receive and unload incoming goods, a key element in warehouse turnover and inbound logistics.

$$\text{Unloading time} = \text{Time of unloading completion} - \text{Time of unloading start} \quad (5)$$

IV. VALIDATION

A. Validation Scenario

The validation scenario was carried out in a case study involving a microenterprise engaged in the wholesale and retail distribution of construction materials and hardware products. This organization is located in Lima, Peru, and has operated for over a decade, establishing itself as a relevant local supplier within its sector. Its organizational structure is limited in terms of both human resources and infrastructure, which constrains its logistical and operational capacities. The company's main activities include the reception, storage, preparation, and dispatch of products to small businesses and construction firms in the region. Over time, the business has experienced recurring operational difficulties that hinder the efficient fulfillment of orders, reflected in service delays, low customer satisfaction levels, and extended lead times in key warehouse activities. These persistent challenges prompted the research, which sought to identify improvement opportunities within its internal logistics processes.

B. Initial Diagnosis

The diagnosis conducted in the case study identified a low service level as the main operational issue, reflected in an order fulfillment rate (fill rate) of 69.3% in the last year—substantially below the 90% benchmark commonly achieved within the sector. This gap resulted in an estimated economic loss of S/ 103,520, equivalent to 4.4% of the company's annual revenue. The most significant contributing factor was the delay in order assembly, which accounted for 85.3% of the unfulfilled orders. This delay was mainly attributed to the presence of damaged products (25.8%), disorganization within

the warehouse (24.2%), delays in recording product dispatches (9.1%), and inadequate material loading methods (25.8%). Additionally, 11.6% of the service issues were related to delays during order unloading, primarily due to inefficient unloading practices (11.9%). A minor portion (3.2%) corresponded to other uncategorized causes. These findings clearly outlined the critical points within warehouse logistics processes that required targeted improvement efforts.

C. Validation Design

The proposed operations management model, based on Lean and Kaizen tools, was validated through a structured pilot implementation carried out in an SME dedicated to the commercialization of construction materials and hardware products. This validation process, which lasted four months, aimed to improve the service level by addressing key operational inefficiencies. A three-phase strategy was deployed, focusing on visual management, workplace organization, and process standardization. These actions helped streamline logistics tasks, reduce delays, and strengthen overall responsiveness. The evaluation was conducted using a data-driven approach, allowing for an assessment of the model's impact on operational performance and its feasibility in small-scale commercial environments.

a) Applying the Lean-Kaizen Model in the Case Study

The described answer came to be as a composite reaction to the operational challenges in a small and medium sized firm (SME) focused in selling construction materials and hardware products, which perpetually struggled with daily customer order fulfillment, as the SME could not meet scheduled daily customer orders on time. The first level diagnosis showed low service level performance indicators in terms of fill rate (OTIF) 69.3%. Also, a few organizational delays in loading and unloading processes, maze like searching for products, and unacceptable levels of defective material were also reported. To resolve these challenges, an operations management model derived from Lean philosophy and Kaizen principles was constructed. The model, as described in the outline, included three major structures: optimization of order picking, reconfiguration of warehouse flow, and enhancement of the packing process. Each detail of the described elements was addressed through specific strategies like Visual Management, the 5S standard, and Work Standardization. Functional validation of the model was carried out from January to April 2023, over a period of four months, during which it was tested and optimally modeled as a dynamic operational structure, gauging its impact on organizational productivity, quality, time, and service level performance indicators.

b) Continuous Improvement Culture: Strategic Application of Kaizen

The formation of a continuous improvement culture that centers on systematic problem-solving was made possible because of the implementation of Kaizen. Initial steps comprised training sessions with all logistics personnel to highlight the identification of waste and inefficiencies within organizational processes. This cultivated positive participation of employees in capturing operational activities and pinpointing constraints.

Using control sheets and visual display tracking boards, workers designed simple yet highly effective process improvement strategies. Reorganization of product-zones with high turnover, for instance, lessened walking distance during picking. Operational recommendations also included some shelving rearrangements coupled with improved equipment positioning leading to a 10% reduction in handling errors. Performance further improved with the use of visual monitoring boards

which made real-time performance deviations evident and rational, non-emotional, performance-based choices possible.

c) In the Context of Order and Efficiency: 5S Methodology Applied to the Warehouse

In this case, the 5S methodology was the first tool to be applied because it sets the stage for all the other actions to come. In the "sort" phase, freeing up to 12% of the warehouse's usable space was achieved by removing obsolete or unused products. Materials were rearranged strategically based on usage frequency, which was categorized with red and green tags at a rotational mark. From the total allocation of the inventory, 15% was identified as expired or defective; this figure dropped to 5.5% after implementation, a 63.3% improvement overall.

In "set in order," walking paths and standardized pathways were documented for internal navigational procedures, further delineating movement by category. The average search duration fell to 35 minutes from 52 minutes with these alterations, resulting in an efficiency gain of 32.7%. Within the remaining 5S phases—shine, standardize, and sustain—operational institutionalization was achieved through monthly audits alongside employee-driven checklists. In addition to operational effectiveness, these changes increased safety, reduced workplace stress, and promoted a sense of ownership among employees.

Figure 2 shows a radar chart comparing five key indicators before and after the implementation of the 5S methodology, alongside the defined target values. The significant improvements observed highlight the positive effects of 5S

on warehouse order, organization, and visual management, contributing to enhanced operational efficiency.

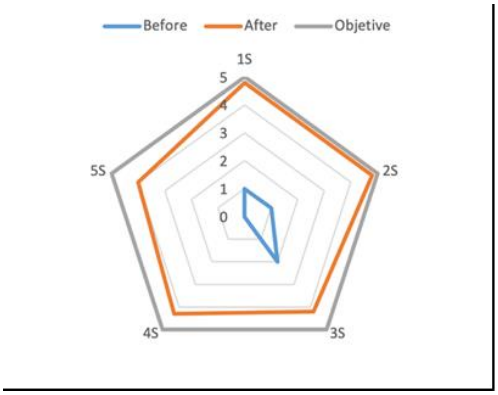

Figure 2 : 5S Audit Results Before and After Implementation

d) Clarity in Execution:

Visual Management in the Picking Process In the picking stage, Visual Management was employed to address delays as well as eliminate existing identification definitional problems associated with products. Signage, maps of the warehouse, and even major scale directional labels helped increase the speed and accuracy of navigation. Before the Visual Management reorganized the system, workers had to place so much effort in trying to locate items, especially during peak demand.

Improvement in shelf marking and picking pathways led to a reduction of 60 minutes material loading time to 38.5 minutes (decrease of 35.8%) as well as a decrease of unloading time from 70 minutes to 46 minutes (improvement of 34.3%). The reduction of training new employees using Visual Management was also significant at 40% because new employees could be onboarded through Management Information Systems that relied on Visually Managed processes. Supervisors were equipped with real-time visual dashboards placed in dispatch areas to allow them oversee order completion stream and order completion flow control to streamline order fulfilment as well as disruption detection for fast corrective measures. Enhanced supervision made possible through visibility significantly improved operational coordination and performance.

In Figure 3, a four-step process is illustrated to guide continuous improvement actions. It begins with identifying delays, followed by defining optimization measures, assigning responsibilities with task monitoring, and concludes with evaluating progress and detecting new improvement opportunities. This sequence fosters structured decision-making and enhances operational efficiency across processes.

Figure 3 : Steps in the Implementation of Visual Dashboards

e) Stable Processes: Work Standardization in the Packing Area

The area of packing was approached with Work Standardization aimed at minimization of variability and consistent presentation of the product. Operating Procedures (SOPs) were crafted based on the type of products, volume, degree of fragility, as well as the destination of the shipment. These SOPs were later subjected to validation through pilot runs supported by warehouse workers feedback to ensure their adherence to practical work constraints.

Prior to the intervention, the packing activities exhibited variation for each shift, thereby causing delays and repeat packaging mistakes. After standardization, all employees adhered to the same packing cycle and verification step, leading to much more predictable timeframes for packing as well as reduced damage to goods. Also, enhanced packing consistency

improved the quality of the complete deliveries and made the processes easier to control because it became possible to measure the standards and, if there were any deviations, correct them immediately.

This component strengthened process variability but at the same time, improved the number of customer complaints the company received, and at the same time, improved the reliability of service provided by the organization.

Figure 4 illustrates a six-stage work standardization cycle. It begins with analyzing processes and identifying variables, continues with defining handling methods, formalizing procedures, and training involved personnel, and concludes with publishing instructions. This structured flow fosters clarity, consistency, and operational discipline within work areas.

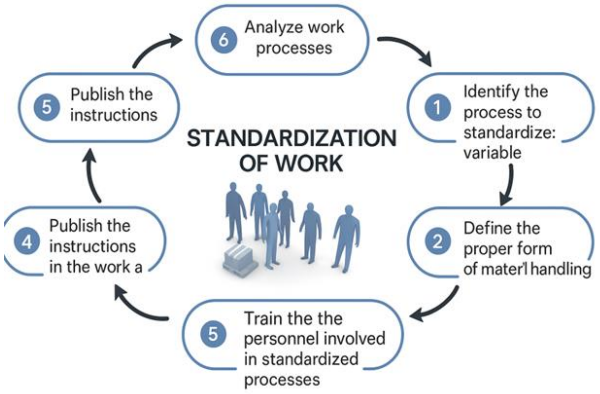

Figure 4 : Work Standardization Implementation Workflow

In Figure 5, the method of material loading is compared before and after the implementation of improvement tools in the construction materials and hardware SME. Previously, manual loading generated inefficiencies, physical strain, and product losses. After applying 5S, visual management, and standardized work, the process became mechanized, safer, and significantly more efficient.

Figure 5 : Method of Material Loading Before and After

f) Global Results: Improvements in Service Level and Operational Efficiency

The combined application of the Lean and Kaizen tools brought about radical changes in the most crucial measure of company performance—the OTIF. This figure rose from 69.3% to 87% within just 4 months and remarkably outperformed the set target of 85% under OTIF. The improvement was a direct result of diminished times spent for searching, loading, and unloading, as well as a decrease in the delivery of defective goods.

The economic benefits were also very apparent. The company did not incur an estimated opportunity cost of PEN 1,248 a month in wasted time from inefficient searches. The auxiliary services within the company yielded an increase of PEN 4,600 in sales daily. The increase in labor productivity was 59% with the average daily sales value per worker increasing to PEN 263.54 from PEN. 165.73. In addition, all key warehouse processes have been documented as 100% standard operated and internal 5S audits revealed an average of 55% improvement from the initial towards the final assessment. Employees expressed enhanced satisfaction with their jobs because the clear structure and order eliminated stress associated with repetitive tasks and automates highly repetitive tasks, which improved their morale.

D. Results

Table 1 presents the performance of the main indicators following the implementation of the Lean-Kaizen operations management model in the case study. The fill rate showed a notable improvement, increasing from 69.30% to 87%,

representing a 26% gain and approaching the proposed benchmark. Likewise, the percentage of defective materials was significantly reduced, dropping from 15.00% to 5.50%, which reflects a favorable variation of -63%. The time spent searching for materials and tools decreased from 52 to 35 minutes, a 33% reduction. Material loading time was shortened from 60 to 38.5 minutes, while unloading time improved from 70 to 46 minutes, yielding reductions of 36% and 34%, respectively. These results demonstrated the positive impact of the proposed model on the efficiency and quality of internal logistics processes.

Table 1 : Indicators After Model Implementation

Indicator	Unit	As-Is	To-Be	Results	Variation (%)
Fill rate	%	69.30%	90%	87%	26%
% of defective materials	%	15.00%	5%	5.50%	-63%
Time spent searching for materials and tools	minute	52	30	35	-33%
Material loading time	minute	60	35	38.5	-36%
Material unloading time	minute	70	41	46	-34%

V. DISCUSSION

The outcomes realized from executing Lean-Kaizen practices demonstrate a strong correlation to those documented in other studies. As noted in [14], "the use of Lean tools facilitates the improvement of logistics processes in SMEs by increasing the efficiency of the order preparation process and reducing the idle time." In this instance, the OTIF indicator increased from 69.3% to 87%, showing the model's ability to improve service levels. In the same way, studies such as [15] have shown that the Lean philosophy enables faster supply retrieval in warehouses, evidenced in this study by a 36% reduction in loading times and 34% in unloading times. As emphasized in [16], Enhanced warehouse productivity and the reduced rate of defective items are typical results of 5S and standard work models, which in this study are expressed by a 63% reduction in the rate of defective material processed. Furthermore, the enhancement of logistics indicators in SMEs was attributed to the use of visual management and standardized procedures [18], which validates the approach used in this study.

Even with the achievements reached, this study has some limitations that need to be borne in mind while interpreting the findings. First, the research focus was narrowed down to a single microenterprise based in Lima, which does not allow the outcomes to be extrapolated to other locations or types of businesses. In addition, the duration of the pilot implementation was four months, which is too short to determine the longitudinal sustainability of the improvements made. Furthermore, there were constraints regarding the available trained manpower as well as technological resources which conditioned the scope of the application of some of the Lean tools. Moreover, some qualitative variables such as organizational climate or perception by the customers were not analyzed in detail, which might have helped in better understanding the model's impact.

This study has valuable practical implications for the operational management of SMEs that focus on the marketed construction and hardware materials. For instance, it shows that the service level and logistics efficiency can be improved dramatically using low-cost tools like 5S, visual management, and standardized work. These improvements can be made without capital expenditure. This is a tangible possibility for micro and small enterprises functioning under resource constraints. In addition, the modular form of the model makes it easy to adapt to other similar environments, thus enabling every firm to tailor its implementation in accordance with priorities at best. Also, other actors in the sector can adopt the model to increase their competitiveness and market influence because it has a systemic approach to picking, internal order, and packing as well as to the order and systematic management of the warehouse.

Taking into consideration the results achieved, and the constraints considered, many areas of further research can be suggested. An example is the longitudinal assessment of the model to determine its impact in the medium and long term, incorporating periodic audits and satisfaction surveys from internal and external customers. Moreover, it would be relevant to examine the provision of real-time control through the integration of some digital technologies, mobile applications for visual management, or inventory sensors for more accessible controls. The model could also be applied to larger or different regional firms within the country to analyze the results and test its validity in multiple contexts. Lastly, those studies could include multicriteria analyses with financial, environmental, and social metrics that assess the model's impacts not just in operational value but also in its comprehensive sustainability impact on SMEs.

VI. CONCLUSION

The study performed illustrates the operational enhancements that could be realized from implementing Lean-Kaizen operations management model in small enterprises which focus on trading in construction materials and hand tools. Major outcomes include an improvement of 26% in OTIF, 63% decline in the defective materials, and marked reductions in the searching and loading/unloading times which pointed towards better operational throughput. The use of visual management together with 5s techniques and Standard operating procedures allowed the company to reorganize its internal logistics to achieve better defined standards which enhanced efficiency, order, and service dependability.

This research is particularly relevant because it sheds light on the realities of a microenterprise in Peru. By employing inexpensive yet effective methods for continuous incremental improvements, the research proves that even resource-constrained ecosystems can undergo radical operational changes. This underscores the flexible applicability of Lean-Kaizen approaches on the growth paradigm of organizations of all sizes and the adaptations necessary to implement them are not limited to large scale structures.

Enhanced Lean and Kaizen integration within warehouse operations is framed and empirically tested, thus contributing to the body of knowledge in industrial engineering. This study addresses a gap in the scientific literature on applications for small and medium-sized enterprises (SMEs) in the construction materials and hardware industry, showcasing the results of an actual implementation.

The model proposed in this study offers a straightforward and easily replicable strategy for improving logistics efficiency for other SMEs. Assessment of the sustainability of the improvements made over time, the addition of digital technologies for real-time monitoring, and testing the model in varied business contexts should be prioritized for further research. These actions will help strengthen the approach and expand its applicability, fostering sustained sector competitiveness.

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