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Article

Implementing Warehouse Management to Improve Inventory productivity in the execution of projects in a Construction Company, Lima 2025

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Abstract: Warehouse management plays a decisive role in the competitiveness of construction companies, where the timely availability of materials and equipment conditions project progress. Aligned with Sustainable Development Goal 9, this research aimed to determine how the implementation of warehouse management improves productivity in project execution at a construction company in Lima, 2025. The study was applied, quantitative, explanatory and used a pre-experimental design. The population and sample consisted of 50 warehouse dispatch order records, assessed in the pre-test (September–October 2025) and post-test (March–April 2026); the techniques used were document analysis and observation, with record and observation forms as instruments. The implementation was structured according to the continuous improvement cycle (PDCA) and included ABC classification, material coding, 5S application, a digital Kardex and indicator control. After the intervention, productivity increased by 25.33 % (from 46.55 % to 58.34 %), efficiency by 10.74 % (from 65.10 % to 72.10 %) and effectiveness by 14.23 % (from 70.60 % to 80.65 %). The Wilcoxon test yielded a significance of 0.000 (< 0.05) for all three variables; it is therefore concluded that warehouse management significantly increases productivity.
Keywords: warehouse management, productivity, efficiency, effectiveness, continuous improvement.

1. Introduction

In today's globalized environment, warehouse management is an essential logistics process for the fulfillment of productivity in industrial organizations. This research aligns with Sustainable Development Goal (SDG) 9, which promotes innovation and resilient infrastructure that avoids disruptions and cost overruns in asset clearances, as well as SDG 12, aimed at fostering efficient and sustainable logistics practices. In the construction sector, companies that execute projects face the permanent challenge of guaranteeing the availability of materials and equipment at the right time, avoiding stoppages that compromise the success of their operations.

Internationally, many warehouses of industrial companies have an inadequate distribution and design, which causes unnecessary travel, longer search and picking times, and risks to occupational safety due to poorly structured spaces with little signage. In contrast, companies in countries such as Spain, Mexico and Chile show that the adoption of warehouse management systems and technologies such as WMS and ERP contributes to improving the traceability of materials, reducing replenishment times and optimizing the use of resources. In the United States, nearly 80% of warehouses have some level of automation, using artificial intelligence for predictive maintenance, digital twins to simulate processes, and autonomous robots for transporting goods, radically transforming warehouse management in companies such as Amazon (Statista, 2025).

In Peru, the logistics sector is based on three main axes—planning, supply, and distribution—with the retail and mass consumption sectors being the most mature, while manufacturing, energy, and hydrocarbons concentrate the greatest opportunities for consolidation (El Comercio, 2021). However, deficiencies persist in the implementation of good logistics practices due to the lack of standardization of processes and the limited training of personnel in charge of warehouses (Vargas & Chávez, 2021).

The company under study provides solutions for the design, development and execution of construction projects and has experienced sustained growth with services in Cusco, Huancavelica and Ica, which has increased the volume of supply of materials, tools and equipment. However, the warehouse area does not have the necessary conditions to adequately fulfill its role, generating delays in the delivery of shipments and, consequently, in the progress of projects. To identify the root causes, the Ishikawa diagram was applied—organizing the causes into the categories of machinery, methods, raw materials, labor, measurement, and environment—, the Vester matrix, and the Pareto diagram, tools that allowed prioritizing the problems with the greatest impact: inadequate classification and coding of products, insufficient storage, and inadequate training.

Consequently, the general problem of the research was formulated as: how does the implementation of warehouse management improve productivity in the execution of projects in a construction company, Lima 2025? The specific problems addressed, respectively, the improvement of efficiency and effectiveness in the same context. The social justification is based on the ordering and classification of the products in the warehouse to reduce the probability of accidents; economic justification, in the search for an optimal stock that reduces costs due to expired, obsolete or spoiled products; and practical justification, in the application of tools such as the EOQ model, inventory controls, procedure manuals, checklists and the 3S.

The general objective was to determine how the implementation of warehouse management improves productivity in the execution of projects in a construction company, Lima 2025; specific objectives, determine how such implementation improves efficiency and effectiveness. The general hypothesis was that the implementation of warehouse management improves productivity, with analogous specific assumptions for efficiency and effectiveness.

1.1 Background

At the international level, Suhaimi et al. (2025), in a study published in the International Journal of Business and Technology Management, demonstrated that warehouse management can be a source of competitive advantage and that a critical focus on available space generates productivity increases; Using a mixed and experimental methodology, they reported a productivity improvement of 68% to 75%, optimizing data management, costs, and demand forecasting. Arakaza and Dushimimana (2024), in an analysis of Cimerwa Limited (Rwanda) with a sample of 166 workers, showed that inventory, material handling, and automation explain 79.2% of the variation in organizational performance, incorporating EOQ and JIT techniques. Rebelo et al. (2021), in Procedia Manufacturing, showed that a critical analysis of storage space allows capacity to be increased by up to 9.77% with low investment, reducing dispatch times and inventory costs through ABC classification by rotation.

Likewise, Faisal and Patil (2023) evaluated the effect of a warehouse management system on the storage of goods, raising productivity from 40.1% to 59.9% based on the improvement of entry and exit records and inventory analysis; and Muhammad and Nurul (2024) reported improvements in efficiency (15%) and effectiveness (11%) by strengthening the management of tasks and responsibilities of warehouse personnel.

At the national level, Cruz et al. (2023) established the relationship between warehouse management and company productivity, achieving an increase of 39.13% in productivity, 28.3% in efficiency, and 25% in effectiveness through the management of stock levels and the optimal order batch. Álvarez and Ramírez (2022) increased productivity by 19.7% by applying inventory accuracy, ABC classification, and EOQ. Garavito et al. (2023) achieved an improvement of 11.76% complementing warehouse management with 5S, standardization, Poka Yoke, and TPM. Arellano and Calderón (2022) improved efficiency by 6% and reduced supply times by 11% through a layout redesign, while Francois (2021) increased productivity from 50% to 74% with input and output controls and storage according to rotation.

1.2 Theoretical framework

Warehouse management is an essential logistics process that involves managing, coordinating, and supervising the actions that take place in a storage facility, from the receipt of goods to their dispatch (Roux, 2009). Serrano (2019) defines it as the procedure of monitoring the daily activities of the warehouse, including the planning, implementation and optimization of information and material flows; and Flamarique (2022) conceives it as the set of practices that ensure effective management of storage areas, improving the availability and transit of products and guaranteeing inventory control.

Warehouse management is divided into five stages: reception (checking that the products received correspond to the order in quality and quantity), storage (design of the physical distribution and assignment of optimal locations according to criteria such as ABC rotation), inventory (accurate records that avoid stockouts or overstocks), preparation (picking, verification, packaging and labeling or packing) and dispatch (consolidation of orders and loading for delivery). Its fundamental principles are to maximize space, minimize handling, facilitate access and rotation, coordinate and integrate operations, minimize risks, and maintain flexibility (Roux, 2009; Serrano, 2019). Among the classification models, the ABC method – based on the Pareto principle (80/20) – the inventory rotation strategies (FIFO, LIFO, FEFO) and the WMS model, which enables the transition from manual and reactive management to intelligent, automated and predictive management, stand out.

With respect to the dependent variable, productivity is an economic indicator that measures the efficiency of a system or process, understood as the relationship between the goods and services produced and the resources used to obtain them (Ramírez et al., 2022). Álvarez (2013) defines partial productivity as the relationship between the quantity produced (outputs) and the use of a single type of resource (input), such as labor, time, space, or costs. Efficiency refers to the optimal use of resources to obtain the expected results with the lowest possible consumption, while effectiveness refers to the ability to achieve the established goals and objectives (Arellano, 2021).

2. Method

2.1 Research Type and Design

The research was applied, as it used existing knowledge to provide solutions to the problem of low productivity through quality tools and corrective measures focused on warehouse management (Bernal, 2010). The approach was quantitative, since the indicators (KPIs) of each dimension were measured from the company's database, quantifying the results in percentage and applying descriptive and inferential statistical techniques. The level was explanatory, aimed at identifying the causes of the problem and establishing how the manipulation of the independent variable causes changes in the dependent variable. The design was experimental of a pre-experimental type, working with a single group to which an initial measurement (pretest), the intervention based on the Deming cycle (PHVA) and a final measurement (posttest) were applied.

2.2 Variables and operationalization

The independent variable, warehouse management, was operationalized through five dimensions – reception, storage, inventory, preparation and dispatch – measured with percentages of compliance on a ratio scale. The dependent variable, partial productivity, was operationalized using the dimensions efficiency (percentage resulting from the relationship between the time used and the time scheduled for dispatch) and effectiveness (percentage of orders delivered on time and complete with respect to the total number of orders). Productivity was calculated as the product of efficiency times effectiveness.

2.3 Population, sample and sampling

The unit of analysis was a warehouse dispatch order record. The population was made up of all the records of dispatch orders; Dispatches made from Monday to Saturday were included and those corresponding to non-working days (holidays and Sundays) were excluded. The sample was composed of 50 records of dispatch orders, evaluated during the months of September to October 2025 for the pre-test and from March to April 2026 for the post-test. Since the sample was equal to the population and less than 100 units, sampling was not applied (Bernal, 2010).

2.4 Techniques and instruments

The information collection techniques were documentary analysis and observation. Record sheets were used as instruments—for the five dimensions of warehouse management and for efficiency and effectiveness—and a time observation sheet. Validity was content, evaluated by judgment of three experts (master's degrees from the César

Vallejo University), and reliability was determined by Cronbach's alpha coefficient. Table 1 summarizes the techniques and instruments by dimension.

Table 1. Data collection techniques and instruments

Variable / Dimension	Technique	Instrument
Warehouse Management: Reception	Document analysis	Reception Registration Form
Storage	Document analysis	Storage Log Tab
Inventory	Document analysis	Inventory Record Sheet
Preparation	Document analysis	Preparation Record Form
Dispatch	Document analysis	Registration form of the office
Productivity: Efficiency	Documentary analysis / observation	Record form and time observation form
Effectiveness	Document analysis	Effectiveness Record Sheet

Note. Own elaboration.

2.5 Procedure

The implementation of warehouse management was developed in four phases structured according to the continuous improvement cycle (PHVA), over a ten-week schedule. In Phase I (plan), personnel were trained, the current receiving and dispatch process was mapped, the 5S were applied, the initial physical inventory was carried out, materials were classified by value and turnover (ABC method), the minimum safety stock was defined and a coding system (SKU) was designed. In Phase II (do), the entry record validated with the purchase order was standardized, the work requisition format for the outputs was implemented, precise physical locations were assigned, and the stock card (Kardex) was created in Excel using pivot tables. Phase III (verify) incorporated cyclical inventory, monthly calculation of key indicators (KPIs), standard operating procedures (SOPs), labeling and coding of materials, and layout design. Finally, Phase IV (act) consolidated warehouse KPIs (dispatch time, accuracy, and turnover), cyclical inventory control, and internal audits.

2.6 Data analysis and ethical aspects

The data analysis included descriptive statistics (measures of central tendency, dispersion, asymmetry and kurtosis) and inferential statistics using the SPSS version 25 software. To evaluate normality, the Shapiro-Wilk test was used, suitable for samples less than or equal to 50, and for hypothesis testing, the non-parametric Wilcoxon sign range test was applied. The research respected the ethical principles of confidentiality, respect, scientific integrity, transparency and academic use of information, verifying originality with anti-plagiarism software and citing sources in accordance with ISO 690.

3. Results

3.1 Diagnosis of the dispatch process

The study of times of the material dispatch process, composed of 16 activities, determined a standard time of 29.43 minutes per dispatch in the pretest, considering an evaluation factor of 93% due to the inadequate conditions of the work area. The process activities diagram (DAP) showed that, of the total activities, only 82.14% added value. After the implementation of warehouse management, the time of the dispatch process was reduced from 28:00 to 17:00 minutes, by eliminating non-productive times – mainly those associated with product search – through labeling and location according to ABC rotation (Table 2).

Table 2. Comparison of the clearance process (DAP) — pre-test and post-test

Dispatch Process Indicator	Pre-test	Posttest

Process Time (min/dispatch)	28.00	17.00
Standard Time (min/dispatch)	29.43	18.50
Value-adding activities (%)	82.14 %	82.14 %

Note. Own elaboration based on the study of times.

3.2 Descriptive analysis

The descriptive results of the three variables show a consistent improvement after the intervention. Productivity increased from an average of 46.55 % to 58.34 % (increase of 25.33 %), efficiency from 65.10 % to 72.10 % (10.74 %) and efficiency from 70.60 % to 80.65 % (14.23 %). In addition, a reduction in dispersion was observed in all variables: the standard deviation of productivity decreased from 10.76 to 7.59, that of efficiency from 7.21 to 4.63 and that of efficiency from 9.19 to 6.49, which reflects a more homogeneous and stable behavior of warehouse performance (Table 3).

Table 3. Descriptive statistics of productivity, efficiency and effectiveness (mean and standard deviation)

Variable	Media Pre	Media Post	OF Pre	THE POST
Productivity	46.55	58.34	10.76	7.59
Efficiency	65.10	72.10	7.21	4.63
Effectiveness	70.60	80.65	9.19	6.49

Note. Prepared by the author with SPSS v.25. SD = standard deviation.

Table 4. Percentage comparison pre-test-post-test and percentage increase

Variable	Pretest	Posttest	Increase
Productivity	46.55 %	58.34 %	**25.33 %**
Efficiency	65.10 %	72.10 %	**10.74 %**
Effectiveness	70.60 %	80.65 %	**14.23 %**

Note. Own elaboration. The percentage increase was calculated as (Posttest − Pretest) / Pretest × 100.

3.3 Inferential Analysis

To determine the appropriate statistical test, normality was assessed with Shapiro-Wilk (n = 50). In productivity, the pretest presented a significance of 0.003 (non-normal distribution) and the post-test of 0.180 (normal); in efficiency, both moments were not normal (0.000); and in terms of efficacy, the pre-test was normal (0.076) and the post-test was not normal (0.015). Since at least one of the moments of each variable did not meet the assumption of normality, Wilcoxon's nonparametric test was chosen (Table 5).

Table 5. Shapiro-Wilk normality test

Variable	Timing	gl	Say.	Distribution
Productivity	Pretest	50	0.003	No normal
	Posttest	50	0.180	Normal
Efficiency	Pretest	50	0.000	No normal
	Posttest	50	0.000	No normal
Effectiveness	Pretest	50	0.076	Normal

	Posttest	50	0.015	No normal

Note. Prepared by the author with SPSS v.25.

The Wilcoxon test confirmed statistically significant differences in the three variables between the pretest and the posttest. Productivity obtained a Z-value of −4.754, efficiency of −4.555 and effectiveness of −4.710, all with a bilateral asymptotic significance of 0.000, below the critical level of 0.05 (Table 6). Consequently, the null hypothesis is rejected and the researcher's hypothesis is accepted in all three cases, confirming that the implementation of warehouse management significantly increases productivity, efficiency and effectiveness.

Table 6. Wilcoxon Sign Range Test

Variable (Posttest − Pretest)	**Z**	**Asymptotic sig. (bilateral)**	**Decision**
Productivity	−4,754	0.000	H_1 accepted
Efficiency	−4,555	0.000	H_1 accepted
Effectiveness	−4,710	0.000	H_1 accepted

Note. Prepared by the author with SPSS v.25.

4. Discussion

The general objective was to determine how the implementation of warehouse management improves productivity in the execution of projects in a construction company in Lima, 2025. The findings showed an increase in productivity of 25.33 % (from 46.55 % to 58.34 %), with a Wilcoxon significance of 0.000 (< 0.05), which allowed the null hypothesis to be rejected. This result is theoretically supported by Álvarez (2013), who defines partial productivity as the relationship between outputs and a single input resource, and is explained by the establishment of compliance with dispatch activities, labeling, ABC location according to rotation and the consequent improvement in the organization and control of materials.

These results are consistent with those reported by Suhaimi et al. (2025), who raised productivity from 68% to 75%, demonstrating that a critical focus on available space is a source of competitive advantage; and with Arakaza and Dushimimana (2024), who attributed 79.2% of the variation in organizational performance to inventory, material handling, and automation, applying EOQ and JIT techniques. In contrast to these antecedents, the present research structured the improvement in the four stages of the Deming cycle, directly addressing the prioritized causes of the problem. Likewise, the findings are in line with Faisal and Patil (2023), who increased productivity from 40.1% to 59.9% by eliminating unnecessary search times and improving entry and exit records, and with Garavito et al. (2023), who achieved an improvement of 11.76% by complementing warehouse management with 5S, standardization, Poka Yoke, and TPM.

Regarding the first specific objective, efficiency increased by 10.74 % (from 65.10 % to 72.10 %), with a significance of 0.000. This result, supported by Arellano (2021) —who conceives efficiency as the optimal use of resources with the lowest possible consumption—, is explained by the reduction of non-productive time spent searching for products through labeling and the application of the layout according to ABC rotation. The findings coincide with Cruz et al. (2023), who improved efficiency by 28.3% by managing stock levels and the optimal order batch; with Arellano and Calderón (2022), who developed a layout model that streamlined shipments; and with Rebelo et al. (2021), who reduced dispatch times and inventory costs by selecting materials with the ABC method by rotation.

Regarding the second specific objective, efficacy increased by 14.23 % (from 70.60 % to 80.65 %), with a significance of 0.000. Based on Arellano (2021) —for whom effectiveness is the ability to achieve the established goals—, this improvement was achieved through the database of inflows and outflows, which made it possible to manage a real stock of each item and make compliant shipments in quantity and condition of the products. The results are consistent with Cruz et al. (2023), who improved efficiency by 25%, and Muhammad and Nurul (2024), who reported an 11% improvement in effectiveness from correct task management and standardization of dispatch activities.

Overall, the empirical evidence and the contrast with the literature confirm that warehouse management, approached as a comprehensive system of reception, storage, inventory, preparation and dispatch and deployed under a continuous improvement approach, constitutes an effective intervention to increase productivity in warehouses in the construction sector. Among the limitations of the study are the pre-experimental design with a single group – without a control group – and the sample size of 50 records, which restricts the generalization of the results; however, the magnitude and significance of the changes support the practical usefulness of the proposal.

5. Conclusions

It is concluded that the implementation of warehouse management improves productivity in the execution of projects in the construction company studied. Productivity increased by 25.33 % (from 46.55 % to 58.34 %), with a Wilcoxon significance of 0.000 (< 0.05), which allowed the null hypothesis to be rejected. This achievement is due to the standardized compliance with dispatch activities, labeling and ABC location according to rotation, which improved organization, control of materials and availability of resources.

Regarding the first specific objective, it is concluded that warehouse management improves efficiency, which increased by 10.74 % (from 65.10 % to 72.10 %), with a significance of 0.000. This is explained by the reduction in order handling time, by reducing the non-productive time associated with product search through labeling and layout based on ABC rotation.

In relation to the second specific objective, it is concluded that warehouse management improves efficiency, which increased by 14.23 % (from 70.60 % to 80.65 %), with a significance of 0.000. This result was achieved through the database of inflows and outflows, which made it possible to maintain a real stock of each item and execute shipments in accordance with the quantity and condition of the products.

Recommendations

It is recommended that the company maintain and strengthen warehouse management as a permanent practice, optimizing physical organization, labeling, ABC location and systematic control of resources, in order to sustain and increase productivity over time.

For efficiency, it is suggested to carry out periodic evaluations of order handling times, reinforce the maintenance of the layout based on the ABC rotation, update the signage of the storage areas and continuously train the dispatch staff.

For efficiency, it is recommended to consolidate the use of the inflows and exits database as the main tool for controlling the actual stock, permanently updating the records and carrying out cyclical inventories that ensure compliant shipments and avoid differences between the physical and registered stock.

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