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DEVELOPMENT OF AN INVENTORY CONTROL SYSTEM IN A CONSTRUCTION MATERIALS COMPANY

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ABSTRACT

Inventory control has become a key factor in the operational efficiency of manufacturing companies. This article presents the implementation of an inventory control system based on ABC analysis, withdrawal Kanban cards, visual management, and a single-entry digital recording platform. The proposal was applied in a company located in the Bajío region of Mexico, achieving improvements in inventory accuracy, a reduction in inconsistencies, and optimization of inventory turnover indicators. The results show that integrating visual and digital tools strengthens operational discipline and offers a replicable model for companies seeking to increase their competitiveness in the construction materials industry.

Keywords: Inventory control, ABC analysis, Kanban system, Visual management, Warehouse organization, Construction materials manufacturing.

1 INTRODUCTION

The need to introduce changes in storage and inventory control processes has forced local companies to adopt new work schemes that allow them to remain competitive in today's market. One methodology that has proven useful in logistics management is the ABC analysis, which facilitates the classification of materials according to their importance and frequency of use, allowing for more efficient control of resources.

This article presents the implementation of a comprehensive inventory control system in a manufacturing company of construction materials, through the integration of the ABC analysis, the Kanban system, visual management, and a digital monitoring platform. The purpose is to improve warehouse organization, strengthen the accuracy of records, and facilitate the operational management of materials.

The methodology developed was structured into four sequential stages: product classification using the ABC analysis, determination of control levels through Kanban, implementation of visual management for the physical organization of the warehouse, and development of a digitized system for stock monitoring. Figure 1 presents a general overview of the stages considered for the design and implementation of the proposal.

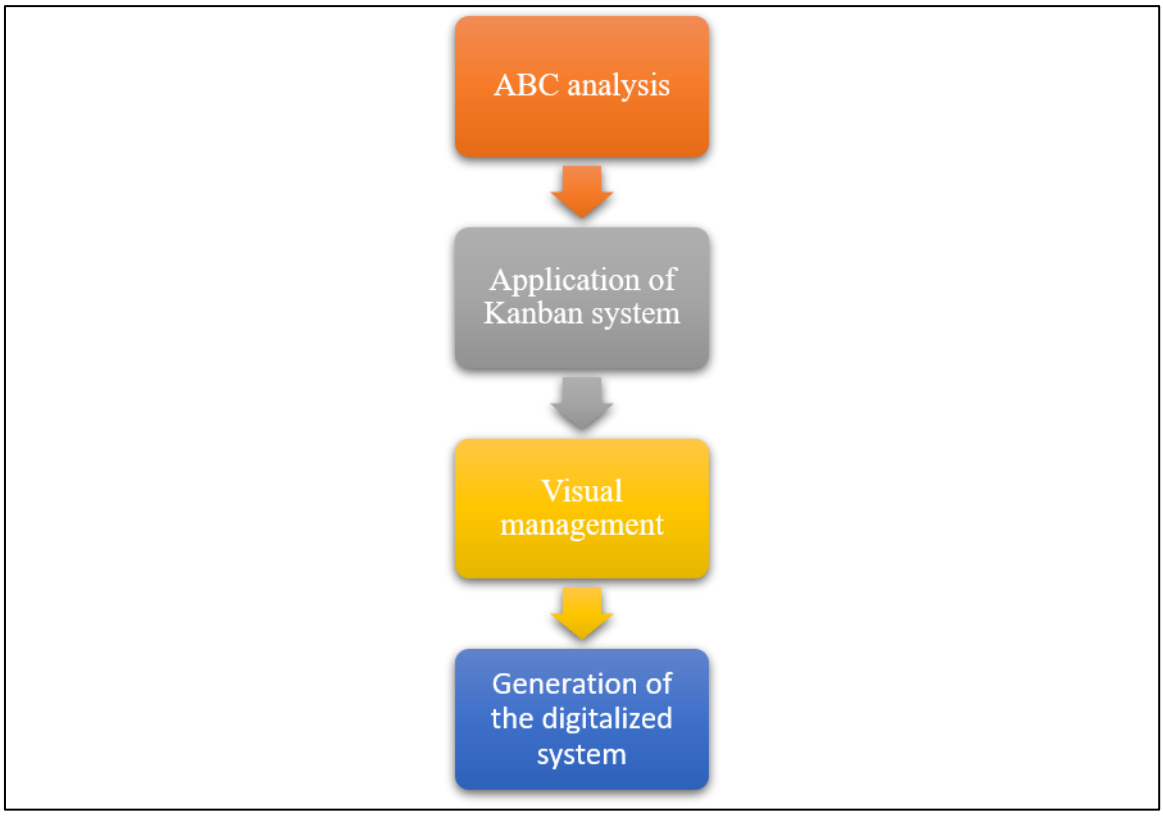


Figure 1: Methodology used for the design and implementation of the inventory control system

2 METHODOLOGY

2.1 ABC analysis

ABC analysis is an inventory classification technique that organizes products according to their level of turnover and value, in order to optimize their location in the warehouse (Macías et al., 2019). It is based on the Pareto principle, which states that a small number of items concentrate most of the sales and movements.

Likewise, the application of ABC analysis makes it possible to establish different levels of supervision and monitoring for each group of materials, concentrating administrative efforts on the most relevant products (Amer and Jawad, 2023).

The items are divided into three groups:

- Group A: around 20% of the references generate nearly 80% of sales. They are critical and must be located in immediate access areas.
- Group B: approximately 30% of the items contribute about 15% of sales. They require intermediate control and high accessibility.
- Group C: they make up about 50% of the stock, but account for only 5% of turnover. They are located in standard storage areas.

The classification procedure made it possible to identify the following product groups according to their contribution to the total inventory value (See Table 1).

Table 1: ABC analysis for the products

Product	Percentage of total sales	Cumulative percentage	Category
EST40	33%	33%	A
CERGR	21%	54%	A
ESTRE	8%	62%	B
PSP	8%	70%	B
PCL	7%	77%	B
EST20	6%	83%	B
PPYM	6%	89%	B
PPDR	5%	94%	C
CERBL	4%	98%	C
PGPEM	1%	99%	C
PGZEM	1%	100%	C

The analysis shows that two items concentrate 54% of total sales, which is consistent with the concentration characteristic of the Pareto principle.

2.2 Application of Kanban system

The Kanban system is a visual management tool used to regulate the flow of materials and control inventory levels through previously defined replenishment mechanisms. It makes it possible to establish clear replenishment points, improve material availability, and reduce excess inventory, favoring a more efficient operation within logistics and production processes (Herawan and Setiafindari, 2024).

This approach is consistent with Kanban applications reported in warehousing environments in the construction sector, where its use has contributed to improving productivity and reducing operational waste (De la Cruz et al., 2020).

Demand, replenishment times, and the operational conditions of the warehouse were considered to define the control and replenishment levels for each product (See Table 2).

Table 2: Quantity per Kanban piece

Product	Category	Weekly demand	Lead time (weeks)	Packaging unit	Demand variability	Pieces per Kanban
EST40	A	2,297	0.86	40 kg bag	30%	2,565
CERGR	A	1,458	0.86	20 kg bag	30%	1,629
ESTRE	B	649	0.86	20 kg bag	30%	724
EST20	B	514	0.86	20 kg bag	30%	576
PPYM	B	406	0.86	20 kg bag	30%	455
PCL	B	321	0.86	20 kg bag	30%	358
PSP	B	306	0.86	20 kg bag	30%	342
PGPEM	C	282	0.86	20 kg bag	30%	227
CERBL	C	259	0.86	20 kg bag	30%	201
PPDR	C	243	0.86	20 kg bag	30%	172
PGZEM	C	43	0.86	20 kg bag	30%	48

Based on the calculated inventory levels, the number of Kanban containers required for each product was subsequently determined, and the results are presented in Table 3.

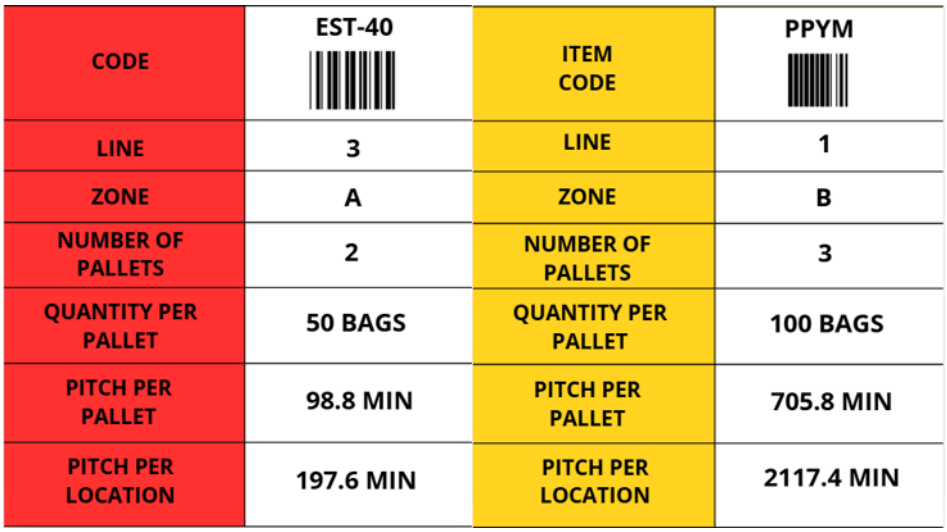
Table 3: Number of Kanban containers

Product	Category	Pieces per Kanban	Container capacity	Number of containers
EST40	A	2,565	100	20
CERGR	A	1,629	300	10
ESTRE	B	724	300	5
EST20	B	576	300	3
PPYM	B	455	300	2
PCL	B	358	300	2
PSP	B	342	300	2
PGPEM	C	227	300	2
CERBL	C	201	300	2
PPDR	C	172	300	1
PGZEM	C	48	300	1

The determination of the number of containers made it possible to establish the physical visual control levels required for each product within the warehouse. This information served as the basis for the design of the Kanban cards and for the physical organization of the materials during the subsequent implementation stages.

Kanban cards function as visual signals that authorize the movement or replenishment of materials, making it possible to synchronize operational needs with the required inventory levels (Al Robaaiy et al., 2023).

As part of the implementation of the Kanban system, visual control cards were designed for each product category. These cards incorporate information related to material identification, storage location, and operational parameters associated with replenishment, making it possible to standardize the replenishment process and facilitate the visual management of inventory. Figure 2 shows examples of the cards developed for the different product categories.



CODE	CER-BL
LINE	2
ZONE	C
NUMBER OF PALLETS	3
QUANTITY PER PALLET	100 BAGS
PITCH PER PALLET	800 MIN
PITCH PER LOCATION	2400 MIN

Figure 2: Kanban cards implemented for visual inventory control

The implementation of the Kanban cards made it possible to link the calculated inventory levels with visual control mechanisms within the warehouse. This information was the basis for the subsequent physical organization of the materials through visual management.

2.3 Visual Management

ABC analysis and the implementation of Kanban provided the foundations for structuring visual control mechanisms within the warehouse. In this sense, visual management is a tool that facilitates the communication of operational information and strengthens process efficiency through the rapid identification of relevant conditions and indicators (Navarro et al., 2023). Based on these principles, various visual management tools were implemented, aimed at reinforcing the physical organization of materials and compliance with storage rules (See Figure 3).

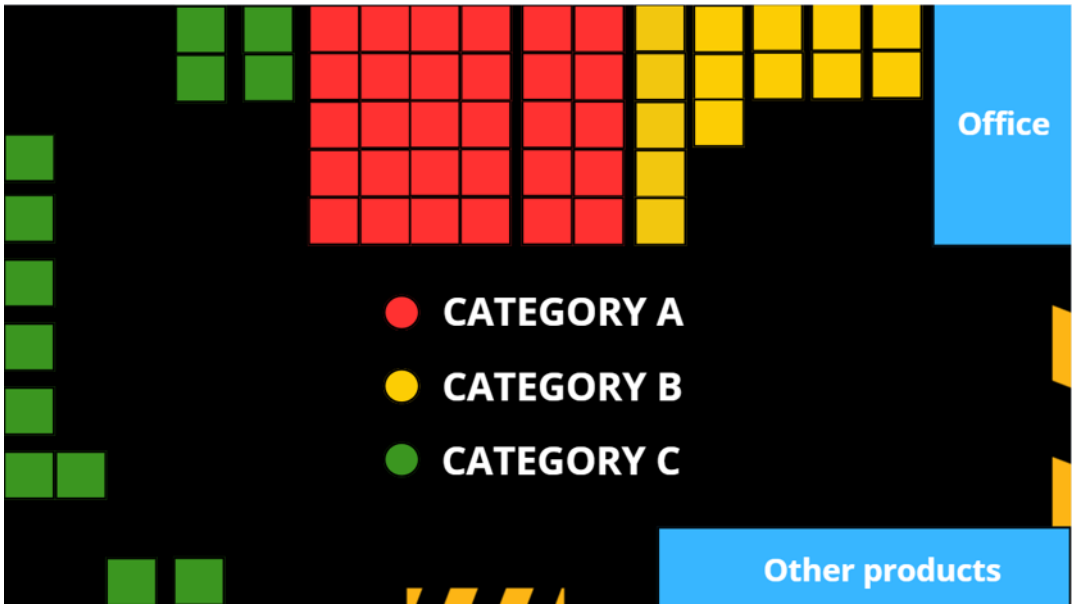


Figure 3: Warehouse reorganization based on ABC analysis and kanban system

With the new physical layout established, visual management tools were implemented to strengthen the identification and control of locations within the warehouse. These consisted of delimiting spaces with traffic paint, assigning colors associated with each ABC category, and installing hanging signs to identify each storage row.

Additionally, the locations were coded using an alphanumeric nomenclature such as A1, A2, B1, B2, C1, allowing quick and standardized identification of storage positions (See Figures 4-6).

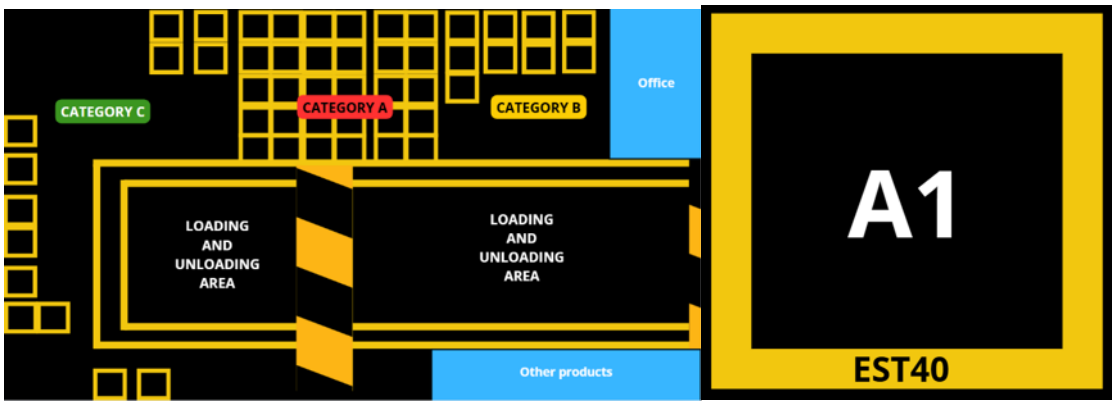


Figure 4: Warehouse area demarcation map based on ABC analysis and Kanban inventory parameters



Figure 5: Implementation of physical area demarcation through visual signage



Figure 6: Visual identification system for storage locations by ABC category

The hanging signs were designed based on the colors assigned to each ABC category and the nomenclature defined for the storage locations. These elements made it possible to establish a uniform visual system that facilitated the identification of the different zones within the warehouse.

2.4 Generation of the digitalized system

The evolution of visual management has incorporated digital tools that make it possible to centralize operational information and facilitate its consultation in real time. In this sense, Haartman et al. (2023) point out that digital visual systems are an alternative to support continuous improvement activities and strengthen communication within production processes.

Based on these principles, a digital system for inventory control was developed that integrated ABC analysis, the inventory levels defined through Kanban, and the location coding implemented in the warehouse (See Figure 7).

STOCK

ITEM CODE	CATEGORY	BAR CODE	RECEIPTS	ISSUES	CURRENT STOCK	UNIT COST	INVENTORY VALUE
PPYM	B		100	300	200	$ 56.03	$ 11,206.00
CERGR	A		150	100	50	$ 47.57	$ 2,378.50
CERBL	C		500	0	500	$ 55.31	$ 27,655.00
PGPEM	C		350	24	326	$ 43.64	$ 14,226.64
PGZEM	C		500	342	158	$ 50.01	$ 7,901.58
PSP	B		0	0	0	$ 97.09	$ -
PCL	B		250	214	36	$ 75.03	$ 2,701.08
EST20	B		631	31	600	$ 47.03	$ 28,218.00
EST40	A		6000	738	5262	$ 89.35	$ 470,159.70
ESTRE	B		800	14	786	$ 47.03	$ 36,965.58
PPDR	C		521	0	521	$ 89.40	$ 46,577.40
TOTAL					**8439**		**$ 647,989.48**

Figure 7: Digitalized inventory monitoring system incorporating visual indicators

The implementation of the digital system made it possible to integrate into a single tool the information on ABC analysis, storage locations, and the inventory levels established through Kanban. This approach is consistent with what Trubetskaya et al. (2024) point out, who indicate that the digitalization of visual management improves information availability and supports the monitoring of operational indicators.

Likewise, digital visualization facilitates communication and decision-making within continuous improvement processes (Haartman et al., 2023).

3 RESULTS AND DISCUSSION

3.1 ABC analysis

The application of ABC analysis made it possible to identify that a small group of products concentrates the largest proportion of movements and economic value within the warehouse. The materials EST40 and CERGR were classified as category A items due to their high share (54%) of supply operations. These results are consistent with the Pareto principle, which states that a small fraction of items usually accounts for most of the economic and operational impact of inventory (Moncayo et al., 2026).

3.2 Application of Kanban

The application of Kanban made it possible to establish inventory levels in line with the consumption patterns observed for each product. The Kanban containers defined for each product established stock levels in line with demand and

provided a standardized criterion for the replenishment of critical materials. The integration of Kanban with ABC analysis made it possible to prioritize the monitoring of those products with the greatest impact on the operation.

3.3 Visual Management

The visual management tools implemented made it possible to link ABC analysis with the physical arrangement of raw materials within the warehouse. The delimitation of spaces, color codes, and alphanumeric nomenclature facilitated the quick identification of materials and locations, supporting the standardization of storage activities. These results agree with the approaches of Navarro et al. (2023), who point out that visual management facilitates the communication of operational information and strengthens process efficiency.

3.4 Generation of the digitalized system

The digitalized system made it possible to integrate information on ABC analysis, inventory movements, Kanban levels, and physical locations into a single platform. The incorporation of visual alerts facilitated the monitoring of stock and the identification of materials that required replenishment. These findings agree with those reported by Haartman et al. (2023), who emphasize that digital visual management tools improve the availability of operational information and support continuous improvement processes.

The joint implementation of ABC analysis, the Kanban system, visual management, and the digitalized platform generated significant improvements in inventory control indicators. Inventory accuracy increased from 65% to 96%, which reflects a greater correspondence between physical stock and control records. Likewise, the inventory stockout rate decreased from 25% to 10%, showing a reduction in shortage events associated with critical products. These results suggest that the prioritization of materials through ABC analysis, complemented by visual and digital monitoring mechanisms, contributed to strengthening the inventory management system in the construction materials manufacturing industry.

4 CONCLUSIONS

The implementation of a comprehensive inventory control system based on ABC analysis, the Kanban system, visual management, and a digital platform made it possible to significantly improve materials management within the company analyzed.

ABC analysis facilitated the identification of the products with the greatest operational impact, making it possible to concentrate control efforts on those items that account for the largest proportion of warehouse movements.

The application of the Kanban system contributed to establishing appropriate inventory levels for each product, reducing the likelihood of shortages and providing standardized criteria for the replenishment of materials. Likewise, the incorporation of visual management improved the physical organization of the warehouse and facilitated the quick identification of products and locations, strengthening operational discipline.

On the other hand, the digital system developed made it possible to centralize information related to stock, inventory movements, and the defined control parameters, facilitating decision-making and the monitoring of operational indicators. The results show an improvement in inventory accuracy and a reduction in stockouts, demonstrating the effectiveness of the proposal implemented.

It is concluded that the integration of ABC analysis, the Kanban system, visual management, and digital monitoring tools constitutes an effective strategy for strengthening inventory control in companies engaged in the manufacture and sale of construction materials. It is demonstrated that the combination of these industrial engineering tools makes it possible to solve problems related to warehouse organization, record accuracy, and the timely supply of materials. Likewise, the methodology developed has a high potential for replicability, as it can be adapted to other organizations in the sector with similar operational characteristics, contributing to improving their logistics performance and competitiveness. In this way, the study provides practical evidence of how the integrated application of industrial management tools generates effective and transferable solutions for inventory control in the construction industry.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Disclosure of conflict of interest

The authors declare no conflicts of interest regarding this manuscript.

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