# Proposal for Implementation of a Kanban System in the Auxiliary Inventory Sector in an Auto Parts Company

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## Abstract

*The article presents a proposal for the implementation of a kanban system in an auxiliary inventory sector in an auto parts company. The overall objective of the research was to propose a methodology that seeks to efficiently and cost-effectively control inventory for the company in order to avoid wastage of resources and to foster more adequate planning of resource reallocation by avoiding unnecessary inventory spending through of the kanban system. The study methodology was applied based on a bibliographic research and an action research, in which data were collected on site and the results of the research substantiated the proposal of the kanban system in the company's auxiliary stock sector. The results showed that the kanban system will bring an adequate organization of work in order to enable the operation in inventory control, replenishment and calculation of material demand to be performed more effectively, generating greater financial profitability through the company. a leaner inventory management system.*

**Keywords:** Kanban system; Inventory management; Efficiency;

## 1. Introduction

Currently, market competitiveness has required companies to invest heavily in strategies and actions that optimize their management and, consequently, boost results to ensure greater profitability. Faced with this

scenario, companies are investing in tools that seek to optimize their production x waste ratio, so that the elimination of failures is a crucial factor to ensure a greater return on production effectiveness and, thus, ensuring increased competitiveness. Market

This quest for equilibrium in the production system is critical for lean production, thus avoiding material obsolescence, misuse of resources and unnecessary spending on raw materials. This lean production control system is a philosophy widely practiced by organizations that systematize their production in a logical way, without overloading the stock with excessive demands.

Another crucial aspect of lean inventory control is ensuring a truly productive production chain. There is a difference between an efficient supply chain and an inefficient and costly overproduction chain. It is observed that an efficient production chain refers to a chain that produces cohesively, balancing resources with production demand, without overloading the production system. However, an overproduction chain, if not properly managed, tends to overwhelm the entire production system.

In Brazil, the Just in Time philosophy has been adopted by major automotive manufacturers and also by corporations that have invested in production improvements on the shop floor. This production management system was adopted mainly by the search for efficient inventory management as a differential factor of other competitors. [1] states that investments in lean production systems, still in the mid-80s, began to be adopted as market differentiation strategies.

The research had as object of study the choice of an auto parts company, located in the industrial sector of the city of Manaus-AM, which has a great deficit in the organization and logistic planning of clutch parts control and other types for stock replacement and shipping to sales. The research problem starts from the following analysis: How can a system of improvements in production flow contribute to optimizing the workflow in an inventory sector and generate greater profitability for the company? The proposal presented aims to improve the production flow and contribute to a reduction in idle inventory expenses.

The article is justified in its contribution to the company based on a proposal of improvement of the inventory management and the logistic planning of the company, helping the inventory management in the decision making and promoting a better economic planning of the company, thus avoiding unnecessary expenses with spare parts in stock.

Thus, the study of a proposal for the implementation of the kanban system in a company has as its contribution to offer to the company's managers, as well as to the technical staff responsible for the administration and planning of the resource management, to offer, through a systematic study of the control. stock, an overview of the waste of investment and the calculations of demands needed for work to flow efficiently in the inventory sector.

The overall objective of the research was to propose a methodology that seeks to efficiently and cost-effectively control inventory for the company in order to avoid wastage of resources and to foster more adequate planning of resource reallocation by avoiding unnecessary inventory spending through of the kanban system. The specific objectives of the study were: to propose the improvement in the company's auxiliary inventory sector; ensure cost-effectiveness with the proposal for more efficient inventory management control; and submit a kanban proposal to facilitate the logistics performance of inventory in the company.

## 2. Theoretical Foundation

### *2.1. The Toyota Production System*

The Toyota Production System has as its central idea the promotion of a harmonic flow of materials between workstations, in order to provide a work philosophy that allows a more efficient communication in a productive environment [1]. This conception of a more objective mode of production and work, with the lowest possible incidence of external actions, brought to the Toyota Production System the name Lean Manufactring, according to the approach of [2].

The entire process of globalization and the need for companies to be aligned with the required competitiveness in the market demands an efficient inventory and production control system. Since the 1970s, with the emergence of the philosophy developed by the Toyota Motors Company, which sought a lean system with the purpose of minimizing costs and prioritizing efficiency, the market has been adopting the quality model in the effectiveness of systems that aim to optimize production.

Just in time, or more popularly known as the kanban system, is one of the most widely used models in production systems that seek efficiency in the management of the production process, so as to focus on the alignment of the operation with a methodology called “system of production”. pull". The philosophy adopted by the Just in Time methodology aims to optimize the production system by adopting a sequential control of the production system [3].

In the period of World War II, in Japan, there was a latent need to resume investment in industrial production in order to rebuild the economy of the country. In this scenario, it is important to know the role of Toyota Motor Company as a company that came up with a work philosophy proposal that aimed to seek a better quality, efficient and in line with market demand [2].

[4] analyzes that the production performed at Toyota was characterized by the production performed by demand method, that is, the production of small volumes of a certain product assembly part, in the same assembly line, based on a demand. specific. This modus operandi impacted the production area at the time, as most companies still operated according to general demand, regardless of efficient inventory control.

In the mid-1950s there was marked competitiveness between Japanese and American industry. The focus of American industry was based on large-scale mass production, such as Ford, which was a major benchmark of American production at the time. However, the Japanese industry, based on a rational process philosophy and focusing on waste elimination, has managed to align manufacturing production with the most cost-effective on the market [4].

With the development of the Toyota Production System, production tools emerged to facilitate operation in this work model. Among them, the main one was Just in Time (JIT), which means a tool with the purpose of producing in a timely manner. The idea of JIT arose to optimize the Toyotist philosophy of ensuring efficient production based on the proposal to eliminate waste [5].

Another tool in the Toyotist philosophy of work, which together with JIT, work as waste reduction and production optimization tools is Jidoka. [4] says that the term Jidoka human touch automation, that is, in Lean philosophy the application of Jidoka aims to provide machine operation with the ability to detect abnormal working conditions.

The JIT method has the function of reducing manufacturing time in order to make inventory control more

efficient, seeking to work only with the necessary material, ie, according to market demand [5]. The JIT methodology with the application of Jidoka allows, in general, to prevent the emergence of defects and process failures to ensure that the company has a better use of its resources.

The concept of pull production is based on the perception of Japanese production to develop its production based on specific demands. This concept is applied in JIT and has as main features: predefined replacement, continuous flow and the talk time method. [1] conceptualizes talk time as the time required for the complete production of a product according to demand, ie, it is a method directly linked to lean production methodology.

In Toyotism, the rationalization of the work process is the main focus on the division of work and the execution of tasks. The leadership aspect and the distribution of tasks are principles of the systematization of the work form, since lean production starts from the distribution of tasks in a coordinated, systemic and synchronous way [2].

[1] discusses that the lean philosophy of the Toyota Production System is JIT's production planning so that the continuous flow of activities is not overloaded by excessive workload. There is then a production control schedule that uses the transmission of information through letters, then called kanban.

### *2.2. Kanban system*

The concept of kanban can be presented as a signaling card that controls production or transport flows in an industrial sector based on visual and informational communication [6]. This concept addresses one of the tools that emerged in the Toyota Production System in the post-World War II period, within the philosophy of lean production control.

[6] says that the kanban system aims to control production rationally and logically by programming the production system through information flows. This conception of the system seeks not to produce beyond what is required (specific demand) based on lean production and waste disposal.

One of the guiding aspects of the kanban system is its mode of production, which is considered a pulled mode of production, ie it only produces it as per the customer's request. [7] state that this type of production is essential for organizations to develop actions aimed at eliminating waste of raw materials and that it is able to speed up the production system based on drastically reduced inventory controls.

The kanban system is developed from the use of cards, which are called kanbans or signaling cards, whose function is to signal during the production process the operating status in the system (current situation) to operate logically [7].

The structures of the kanban card typologies are presented according to [6] for card types I and III; [8] for card type II and IV and [9] type V, VI and VII card.

I. Kanban Production Card

II. Kanban Internal Requisition Card

III. Supplier Kanban Card

IV. Kanban Container: Kanban Square

V. Electronic Panel

SAW. Computerized Kanban

The kanban system has a methodology that values efficiency in stock control and production based on

rationalizing the use of raw materials to avoid waste in stock. [10] presents the kanban system calculation based on: demand forecast determination (N), product processing time (t) and time between processes (tp).

[6] presents the main prerequisites for deploying a kanban system: level production, reduced setup time, machine layout, job standardization, activity improvement, and automation. Production must be in line with the objective of the kanban system, which is to reduce inventories based on minimizing production stock cycles and intermediate stocks.

### *2.3. Inventory Management*

Stocks are, according to [11] piles of raw materials, inputs, components and finished products that are available at points in the logistics channels of a particular company. Therefore, it can be considered that inventories should not only be termed as inputs or materials that are in process, but also the finished product that is on the shelf or in the sales sector.

[11] states that stocks can be presented in two forms: physical or potential. The most common form of inventory in companies is those that are in physical format (physical goods) and that require companies to have a more rational and objective control of these components. Accumulation of inventory can lead to a chain of logistical and administrative barriers and thus need to be managed.

Inventory management is the management process responsible for controlling, managing, rationally storing and supporting decision-making throughout the process of managing inventory flows [12]. The need for inventory management is in line with the importance of developing rational control in a company's logistics system, as controlled inventory ensures a much more efficient process.

Inventory control is one of the most important areas within the structure of a company, as it is responsible for controlling the entry and exit of all material received and supplied by the company for production. Therefore, the concern with resource management is fundamental to ensure that the company has an efficient use of its production stocks.

[12] states that inventory control is critical to efficiently managing inventories in order to allow a balance in consumption and the production system not to be overloaded. This type of management is ideal for having a holistic view of the entire production process, from its inventory phase to raw material supply and auxiliary inventory control. [13] complements the concept of inventory control by addressing that inventory, given its primary purpose in the business (supply of materials) ensures that flexibility in production processes is practiced.

[13] defines that inventory management is an integrated management process, in accordance with company management policies, whose objective is to optimize the inventory chain in production. The idea of inventory management is to develop integrated supply chain control in line with customer demand and to distribute through distribution channels.

[14] says that inventory management arose from the need to address companies' lack of inventory and production chain control. One of the major problems of inventory management in the early twentieth century, for example, was the methodology of controlling its warehouses, as there was no methodology of supply demand in sync with the production process.

[12] say that the integration of inventory management is directly linked with the general administration,

information technology, control and automation sectors and the planning sector. This systematic feature of inventory management allows us to understand that inventory control is global, that is, it is present from the organization of the raw material in the warehouse to the finishing of the finished product and the shipment for sale.

For [15] inventory management is critical for any company that seeks to ensure the best use of its financial resources by avoiding unnecessary spending on inventories and unwanted supplies. Thus, it is understood that managing inventory means ensuring information subsidies for the company's management, as well as for the financial sector, aiming to avoid accumulation in the production process and avoid overloading the production axes.

[16] states that inventory management cannot be developed in isolation; on the contrary, it needs to be integrated and systematized with the entire productive, administrative and financial process of the company. This feature of inventory management demonstrates that it is a management model that directly influences the mode of production and the delivery of the product to the customer.

[17] address the cost of inventory management and classify this process into four types: acquisition cost, storage cost, order cost, and shortage cost. This breakdown is intended to assist in the determination of inventory levels in order to more accurately (but undefined) project inventory expenditures so that there is no problem with storage.

This relation of stock cost with stock levels is pointed out by [18] as a major factor for the financial control of stock and aid in projecting the company's strategic planning. This information assists in making decisions for the acquisition of the most cost-effective raw materials, the best market turnover and the highest return on profitability for the company.

## 3. Methodology

The research process took place, a priori, by the bibliographic survey of the most recent studies on Quality Management and the application cases of kanban in companies in the logistics sector.

Subsequently, an initial diagnosis stage was carried out at the company to survey the problems and barriers regarding parts organization and distribution of functions in the production process and meeting the demand for the sales sector.

## 4. Results and Discussions

The proposal was linked in the following actions (Figure 1):

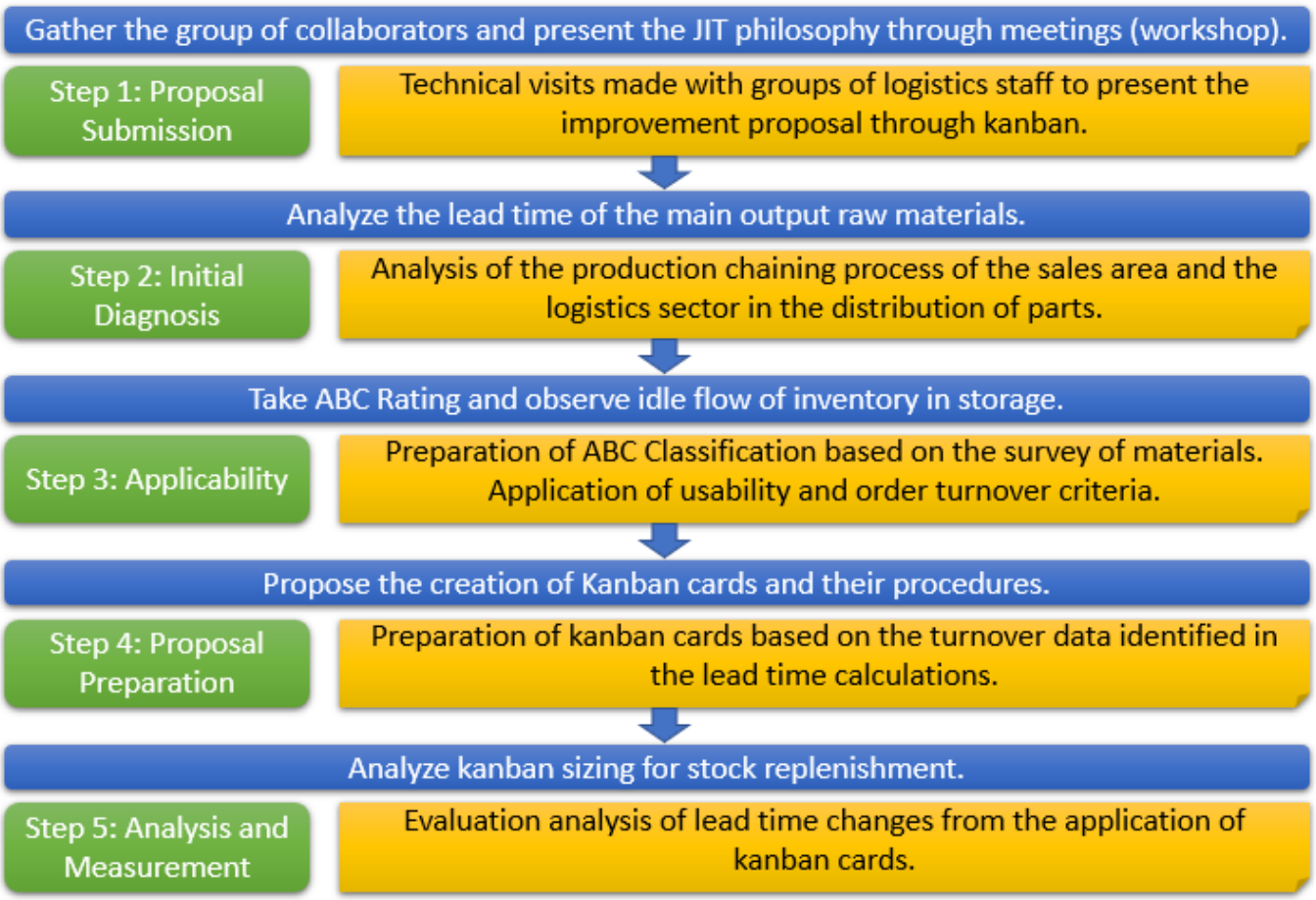


Figure 1 - Flowchart of the study steps
Source: Prepared by the author (2019)

Tucumã Peças, the object of study of this research, is an auto parts company with the main activity the production of motorcycle clutch assembly. It is located in the Industrial District, in the city of Manaus - AM and mainly serves the assembling companies such as Moto Honda da Amazônia and Yamaha Motor Company.

Since 2015 she has entered the 4-wheel business, developing clutches for the Ford company. Its current market segment is considered mixed, because in addition to the manufacture of parts, it also acts in project preparation and technical consulting activities.

The auxiliary stock sector is responsible for storing part of the materials that are required for clutch production. One of the industry's primary functions is to work on the material receipt and storage flow, as well as to make material payments through requisitions through the Production Order (O.P).

Due to the major problem faced by the company when the reallocation of resources for the purchase of materials and the increase of re-supply barriers due to the purchase of materials that are not used and become obsolete in stock, management has been analyzing in its strategic planning. a methodology that makes inventory control effective in the auxiliary inventory sector, given that it is a strategic sector for the flow of production and sales in the enterprise.

Initially, together with the company's employees (auxiliary inventory sector), the managers responsible for logistics and one (01) representative of the company's management, a series of technical meetings

(workshops) were presented for the presentation of JIT's philosophy. and the kanban system proposal.
The workshop was called the company's "I JIT Philosophy Workshop". The schedule was defined in three (03) technical meetings, which were held within the company's internal meeting space. The time set for the meetings was during breaks, in the morning, with the presence of invited collaborators.
The JIT Philosophy was explained and the Kanban system proposal for the employees and management was presented. A preview of the article was presented, as well as other cases implemented in companies that were successful in controlling inventory management and logistics planning.
After the workshop phase, the study surveyed the inventory management process of the company's ancillary inventory sector and analyzed the current process lead time to look at the inventory and logistics management situation (Figure 2). :

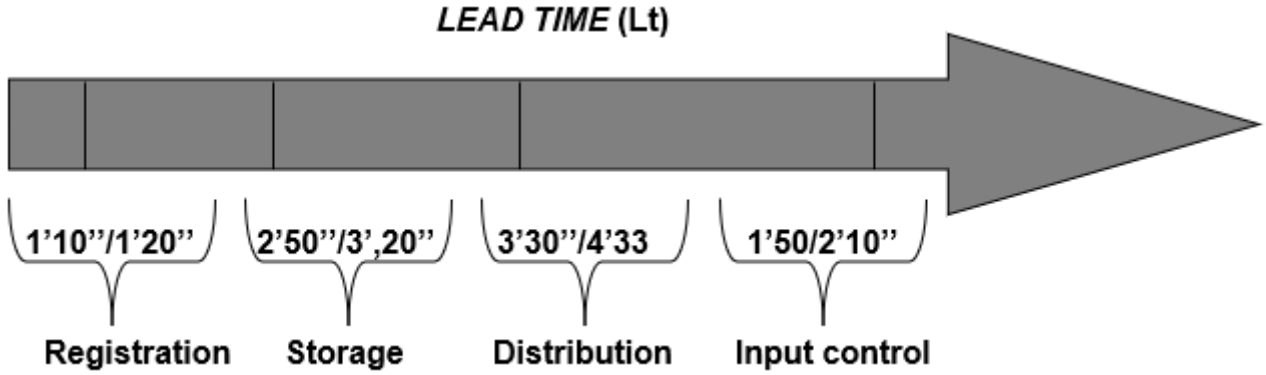


Figure 2 - Auxiliary Inventory Lead Time
Source: Prepared by the author (2019)

After calculating the lead time, the parts with the highest inventory output and those with the least inventory output (idle) were surveyed for the ABC classification. [19] state that this type of method is fundamental for carrying out a stock examination in order to assess the consumption of stock values and thus identify stock items according to their degree of usability (A - most important; B - intermediate and C - less important).
Following is Table 1 with the ABC classification performed in the company's auxiliary inventory sector:

Table 1 - ABC Classification

| ITEM DESCRIPTION | CODE | DEMAND 2017 | COST | VALUED DEMAND (DV) | % | ABC |
|---|---|---|---|---|---|---|
| STEEL COIL | 04G1312C0119AC | 253409 | 0,0693512 | R$ 5.213,35 | 59,69 | A |
| FRICTION DISC | 22201MJ80000 | 87591 | 0,459311 | R4 9,70 | 13,22 | A |
| FRICTION BOARD | 22201MS66201 | 43983 | 0,789122 | R$ 7,98 | 9,90 | A |
| CLUTCH SPRING | 22401KVSJ010M1 | 20982 | 0,509210 | R$ 0,90 | 4,12 | A |
| SCREW | 90050KFL8500 | 19864 | 0,789911 | R$ 0,18 | 3,00 | A |
| WELDING RETAIL | PR107 | 19456 | 0,090912 | R$ 27,35 | 1,12 | A |
| FIXING PLATE | 22105KCY9000H1 | 19340 | 0,045321 | R$ 5,70 | 0,96 | A |
| CUSHION | 11904G7200 | 17800 | 0,056123 | R$ 2,98 | 0,94 | A |

| | | | | | | |
|---|---|---|---|---|---|---|
| KVS Cushion | 22106KRM8400H1 | 15634 | 0,067540 | R$ 3,12 | 0,88 | A |
| YOSHIRO OIL | MA17745 | 12098 | 0,213849 | R$ 5.780,00 | 0,87 | A |
| STEEL WASHER | 17504G4300 | 10900 | 0,119408 | R$ 0,20 | 0,81 | B |
| MUCAMBO GLOVE | MA34221 | 10235 | 0,459690 | R$ 13,70 | 0,71 | B |
| CIRCLIP | MA63625 | 10100 | 0,983890 | R$ 0,10 | 0,69 | B |
| KPS BUSHING | 22126KBB9000BR | 9988 | 0,230298 | R$ 9,85 | 0,66 | B |
| PRINTED DISC RING | 22203KWSA9010R | 9542 | 0,450989 | R$ 17,90 | 0,55 | B |
| WOOD PALETTE | 3020371 | 9109 | 0,230494 | R$ 70,00 | 0,47 | B |
| 5RM GEAR | 11004G1303 | 872 | 0,192010 | R$ 13,70 | 0,35 | C |
| KPS Rivet | 231151073101R | 732 | 0,103829 | R$ 0,20 | 0,41 | C |
| ANALOG WATCH | MA15331 | 540 | 0,129280 | R$ 17,00 | 0,44 | C |
| CNC BREAKER | PR15069 | 234 | 0,201932 | R$ 27,70 | 0,21 | C |
| TOTAL | xxxxxxxxxxxxxxxxx | xxxxxxxxxx | xxxxxxxxx | R$ 11.227,31 | 100% | xxxxxx |

Source: Prepared by the author (2019)

After the ABC classification based on stock circulation products was developed, it was defined which type of kanban to use. For the study, it is proposed to use the card, aimed at the circulation of stock based on the stock flow of the sector. For the determination of kanban cards it will be necessary to choose the colors of the cards based on the degree of need for stock replenishment, also called kanban sizing.
Below is in Table 2:

Table 2 - Kanban Sizing

| ITEM DESCRIPTION | ***DARK BLUE KANBAN*** | ***KANBAN LIGHT BLUE*** | ***KANBAN YELLOW GRAY*** |
|---|---|---|---|
| STEEL COIL | 19000 | 1000 | 5000 |
| FRICTION DISC | 5500 | 3000 | 1500 |
| FRICTION BOARD | 5000 | 2500 | 1000 |
| CLUTCH SPRING | 4500 | 2000 | 1000 |
| SCREW | 4200 | 1800 | 800 |
| WELDING RETAIL | 4000 | 1200 | 700 |
| FIXING PLATE | 3500 | 1000 | 600 |
| CUSHION | 3200 | 800 | 550 |
| KVS Cushion | 2500 | 650 | 460 |
| YOSHIRO OIL | 2200 | 620 | 400 |

Source: Prepared by the author (2019)

The methodology in the JIT calculation process corresponded to cash flow control based on the replacement of products. It has been noted that there is a waste in the procurement industry when

purchasing low-turnover parts, as shown in classification C. Kanban cards will help to reduce inventory through more effective control of procurement and turnover to meet the demand of the sales sector.

## 5. Final Considerations

The objectives of the study were achieved in the following proportions: Regarding the general objective of the study, the proposal was able to build a methodology to optimize the workflow in inventory control through kanban cards based on the elaboration of the ABC classification and through the identification of idle stocks.

From this identification it was observed that the products at level C are those that have low turnover and do not offer a profitable cost-benefit to the company, and the reallocation of expenses for the acquisition of other products may be suggested. Improved production efficiency was observed through the adoption of a leaner system aimed at reducing process waste.

As for the specific objectives of the study, the kanban methodology will be able to improve the flow of inventory control by targeting cards and reducing idle inventories. This will improve the company's cost-effectiveness in purchasing products that have a higher inventory turnover (A-rated products) and thus reallocate investments from other acquisitions. The proposal of a kanban system will thus facilitate, through inventory control, the logistics performance of the company, since the use of cards should help in the process of inventory flow in the sector.

The contribution of the JIT methodology through the kanban system will bring greater efficiency in inventory control and logistics of the company's auxiliary inventory sector. Implementing this tool will improve workflow, drive greater profitability by reallocating product acquisition costs in idle inventory, and streamline workflow to more effectively serve the company's sales industry.

JIT can be pointed out as a philosophy that stands out for a vision that proposes quality with greater efficiency and the reduction of waste in a production process. As such, companies are seeking to tailor their strategies around a more profitable work philosophy that focuses on increasing productivity without generating idle inventory losses and pent-up demand.

The results showed that the kanban system will bring an adequate organization of work in order to enable the operation in inventory control, replenishment and calculation of material demand to be performed more effectively, generating greater financial profitability through the company. a leaner inventory management system.

It is concluded that companies need to adapt to management models that bring greater efficiency to the production process and bring greater potentiality in logistics management and inventory management. As Liker (2005) points out, it is of paramount importance that a company's production system be sound in its logistics process so that it eliminates downtime and streamlines workflow.

The purpose of this study arose precisely from the need to contribute for Tucumã Peças to optimize its inventory control and, thus, readjust its financial planning for the acquisition and reallocation of products.

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