

# Analysis of the Kanban system in the warehouse of a maritime engine maintenance company

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## Abstract

*The machine control has always been a task, carried out exclusively by people who do not work directly on the production lines, so people directly involved in production do not need to worry about the materials needed for their work, and with this model there was difficulty when product supply. Therefore, the objective of this research was to identify benefits and results in the application of the Kanban system in a marine engine maintenance company, in the warehouse sector, added to the selection of literature that conceptualized the mechanism of the system; the identification of the process, from the organization of maintenance parts, as a way to facilitate the maintenance of marine engines. The company studied, founded in 2014, headquartered in the city of Manaus/AM, specializes in marine engine maintenance, with machinery as its main sector. The company has vacancies ranging from 11 to 50 employees annually, according to demands and times of the year. The methodology addressed is of a mixed nature, being part bibliographical in order to select works for the basis and better understanding of the subject, and part case study, since the maritime maintenance company will be the focus of this article. The kanban system determines the quantity of supply so that bottlenecks do not occur with regard to the company's production. Regarding the updating of the table, every day you should check which are the stocks with the highest degree of demand, indicated by the color red, being possible and necessary to pass on to the replacement sector, the missing products. the control system was installed by means of plates that indicated the quantity of parts they had and with that, it could be predicted which parts were priorities in reallocation in the stock, replacing mainly products and fundamental parts for the continuity of the maintenance. After applying this process, it was possible to easily identify the needs and speed up the notes of the company's technical staff with the supply sector (purchases), as well as to avoid the constant lack of "priority" parts in the maintenance process. The performance of the kanban production system applied to the marine engine company was concluded, since the nameplates of the missing parts became much more visible, optimizing the replacement process of pending parts. This production technique presented in the study is of great importance in today's world, as it focuses on the quality of the production process and the quality of finished products offered to the market, making the company that has*

*this system solidify and can remain competitive.*

**Keywords:** Kanban; Operating System; Management.

## **1. Introduction**

Machine control always was a task carried out solely by people who do not work directly on the production lines, so the operators in charge of production line do not need to worry about the materials needed for their work, on this method there was difficulty in supply of products in order to schedule the entire production process. The Kanban system emerged to act directly with the most urgent demand, whether for products or parts.

The Kanban system was created around of 1960s by Toyota Motors, with the aim of make easier and faster the activities of control and monitoring of batch production system. In addition [1], this production system does not produce anything until the customer (internal or external) of their process requests the production of certain items.

The authors also point out that Kanban is a method used to start the production, movement and control of materials in a process, and is commonly used to allow the production order of a stage, manufacturing process or organization.

So, this research is justified as a way to contribute to the actual literature providing material to turn easier the understanding of those who also wish to contribute or use this line of research. Another point that justifies the development of this research, is the improvement of skills in the field of scientific research, since others can be developed from this work that follow the same theme, besides allowing a continued study and professional training.

[2] point out that the Kanban system is a subsystem of the Toyota production system used to control work-in-process stocktaking, production and supply of components, in some cases raw materials. The researchers point that there are a certain number of parts in the warehouses (stocks) between the workstations, proving that it is essential to ensure the availability of sufficient parts for the building final products in a given period of time work in which the process sequence is seen in a more widely way, allowing you to get necessary parts for flawless execution.

[3] states that the kanban system works using two flags, a production order flag and a requisition flag. The production order flag authorizes the production of parts to replace those required for use in subsequent stations, being used only in the processing center which produces the parts, it is a control mechanism within the process. The request flag, on the other hand, is a mechanism of parts from the power stations, the use stations, working as a kind of passport, showing what must be done.

The Production, known as pull production, occurs by the level control of final stocks or by scheduling the last production stage, in which the operating routine is ensured in a decentralized way through visual control carried out by the process workers themselves in each productive stage.

Stocktaking is limited at each workstation, that is, they have a finite capacity, determined by the number of flags. Thus, [3] cite that like many others, stocktaking must be generated in a given time in order to meet the

specific needs of a particular company.

[4] point out that there is a huge need for organizations to become competitive in the globalized market, making the manufacturing process the main target to achieve in the organization's strategic objectives. This great need in the quest to improvement of productivity becomes one of the most important points, which is to see the flow of the organization's value map. With this vision, it is possible to identify the improvement needs mainly in the production sector and to obtain a significant cost reduction, making it necessary to eliminate all waste during the process.

For companies that aim for great competitiveness in the market, it is not enough to just create an improvement strategy plan, it is necessary to involve managers to take care of the demand rate, as it is unacceptable for a production to stop due to lack of material in stock [4].

In this context, the kanban system aims to improve production through the visual control criteria, making it possible to identify the real demands and failures of the system. As every implementation of improvement in the quality system requires a change in the organization's culture, priority must be given to the form of application to obtain satisfactory results due to the optimization of production, focusing on training, awareness and self-discipline.

In view of this, the objective of this research was to identify benefits and results in the application of the Kanban system in a marine engine maintenance company, in the warehouse sector, added to the selection of manuals that conceptualized the mechanism of the system; the identification of the process, from the organization of maintenance parts, as a way to facilitate the maintenance of marine engines.

## **2. Materials and Methods**

The company studied, was founded in 2014 in the city of Manaus/AM, they are specialists in marine engine maintenance, which machinery is the main sector. The company has vacancies ranging from 11 to 50 employees annually, according to demands and times of the year.

The methodology used was a mixed source, being bibliographical in order to select studies for the basis and better understanding of the subject, and another part was a case study, being the maritime maintenance company the main focus of this article. The selection of articles was made from the relevant database: Google Scholar, Scielo (Scientific Electronic Library) and Capes periodical.

One of the aspects for the construction of this work was initially to understand in which methodological categories this research was applied previously, and fit the work into the methodological standards. Initially, the research was classified as being of a qualitative structure, and reinforcing this framework, [5] describes that qualitative research is not concerned with numerical representation, but rather with how deep will be the understand of the social group, qualitative research is concerned with aspects of reality that cannot be quantified, focusing on understanding and explaining the dynamics of social relations.

Another aspect applied to the methodological procedures of this research is to say that it fits into the format of exploratory research, [5] states that this type of research aims to provide greater familiarity with the problem in order to make them more explicit or to build hypotheses. The vast majority of this research involves some aspects such as bibliographical survey, analysis of examples that stimulate understanding, and others.

According to the type of this work, it is possible to fit it as an explanatory and exploratory research, which the explanatory research is concerned with to identify the factors that sets or contributes to the occurrence of some phenomenon, that is, this type of research explains the things through the results offered.

Finally, it is worth to note that the applied procedure is of a bibliographical way, [6] mention that bibliographical research by definition is carried out from bibliographical surveys of theoretical references already analyzed and published by authors using electronic means such as books, scientific articles, websites, periodicals and others. The most common examples of these types of approach are about ideological investigation or those that propose a brief analysis of the various prepositions about a problem.

As the purpose of this research is to be as up-to-date as possible, it was found necessary to filter the surveys that was produced between 2015 to 2022, for specific literature, fundamental for the construction of the literary collection of the study, with the chronology criterion being the first to be considered.

The second filter to be analyzed was in relation to the relevance of the addressed topic, where a previous reading of the abstracts and introduction was done, being selected 12 works of the academic Google; 3 from Capes periodical and 8 works from Scielo, initially totaling 23 works among them are articles, monographs and publications in periodicals, excluding websites, magazines, blogs and others.

### **3. Results and Discussion**

Assessing the maritime company's warehouse, it was observed that the kanban system define the quantity of supply to avoid the bottlenecks on the company's production. About the updating of the table, daily it is checked which are the stocks with the highest demand, indicated by the color red, being possible and necessary to pass on to the replacement sector, the missing products.

The operation of the kanban system in the warehouse, applied in the company, aimed to measure the optimization of stocks analyzing the different phases. Thus, it was verified at first moment that, in its initial phase of operation, there was no stocktaking control, presenting an obstacle to team work, because there was stagnation of maintenance processes due to lack of parts, indicating from this observation, where major interventions would be needed.

From this vision, the control system was installed using plates, with different colors, which was indicated the quantity of parts, and with that, it was easier to predict which parts were the priority in stock reallocation, replacing mainly the products and fundamental pieces for the maintenance continuity and after do a verification if the system would be able to reach the pre-established goals.

After applying this process, it was possible to easily identify the needs and speed up the notes of the company's technical staff with the supply sector (purchases), as well as to avoid the constant lack of “priority” parts in the maintenance process.

In addition to the Kanban system in the company's warehouse, the same process was installed in the control of services, divided as follows: pending, in execution and executed, was to knowledge of everyone of what was being executed, in the different sectors, including analyzing, the different productive stages, providing the achievement of the goals by the company very close to those was previous determined on the

implementation of the system.

Reinforcing this study, the application of the kanban system was done in civil construction and observed that [3] started with a search for tools that would help production to be more "lean". In this analysis, the creation of production cells on the floors was the starting point for the beginning of the transformation of the construction site into a factory, where the entire vertical flow of materials, which is very intense in the winch, of workload, was organized by kanban cards, both in the production sector and in the transportation sector.

Furthermore, this same study has inserted the kanban system in the grout sector, which the final cards were made with multilayer paper. Each type of grout received a color to ensure durability and the correct information to every part involved in this system. All the plates were laminated with transparent adhesive paper, the size of the plates was determined according to the panel and was organized in the order of production. Another survey was the kanban system application in the agribusiness industry, according to [7] his research obtained great advantages, also aiming the cost reduction, the companies will have only the necessary quantity in stock, that is to supply the demand, including additional safety stocks. This system increases the flexibility of customer response allowing greater production closer to real demand

Another area to be highlighted is the health area, where the same system applied to emergencies could be evidenced by [8] showing that the system is usually used in visual charts and cards that help with production planning and control stocktaking or production flows. According to the number of cards available on the boards, prioritized decisions are made in the hospital emergency room for better visualization of patients in different care sites, proposing some adjustments.

#### **4. Conclusions**

Was concluded that the performance of the kanban production system applied to the marine engine company, the identification plates of the missing parts became much more visible, optimizing the replacement process of pending parts. This production technique showed on this study has great value in today's world, and it aims on the quality of the production process and the quality of finished products offered to the market, making the company more robust and competitive.

Another consideration is that there was no resistance from the collaborators, in addition they present the creation of the head of control, to manage the kanban. Therefore, it is important to highlight that the kanban system, works in different types of companies, being marine engine maintenance or another area, always it has positive points in the organization and stocktaking, when it is implemented.

The startup of this system proved to be effective on prevention of lack of parts and components used in the production process avoiding the occurrence of unexpected stops in production.

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