Articles

Asset management system according to ISO 55000 standard in the production process

Sistema de gestión de activos según norma ISO 55000 en el proceso de producción

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ABSTRACT

The undocumented processes, the lack of a record with specifications of machinery, procedures, operational use; causes the maintenance to be developed in an empirical way. The objective of this research is to develop an asset management model using ISO 55000 standards, focused on improving the production processes of balsa blocks in the company Tecnoblock S.A. The analytical, deductive and inductive methods were used to diagnose the production process. As a result, the maturity level analysis was obtained, which consists of; diagnosis of the current situation of the production system, SWOT analysis, verification of compliance with the parameters of the standard, requirements in the context of planning, operation, evaluation, performance and improvement. It was concluded that the development of an asset management model applying ISO 55000 standards, it is necessary to

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specify in detail each of the requirements described by the standard.

Keywords: Asset Management System, ISO 55000 Standard, SWOT analysis, maturity level.

RESUMEN

Los procesos no documentados, la falta de un registro con especificaciones de maquinarias, procedimientos, uso operativo; ocasiona que el mantenimiento se desarrolle de forma empírica. El objetivo de esta investigación es desarrollar un modelo de gestión de activos mediante las normas ISO 55000, enfocado al mejoramiento de los procesos de producción de bloques de balsa en la empresa Tecnoblock S.A. Se utilizó los métodos; analítico, deductivo, inductivo, permitió realizar el diagnóstico del proceso de producción. Como resultado se obtuvo el análisis de nivel de madurez que consiste en; diagnóstico de la situación actual del sistema de producción, análisis FODA, verificación del cumplimiento de los parámetros de la norma, requerimientos en el contexto de planificación, operación, evaluación, desempeño y mejora. Se concluyó que el desarrollo de un modelo de gestión de activos aplicando Normas ISO 55000, es necesario especificar de manera minuciosa cada uno de los requerimientos descritos por la norma.

Palabras clave: Sistema de Gestión de Activos, Norma ISO 55000, análisis FODA, nivel de madurez.

INTRODUCTION

The management of physical assets arises from the need of many industries to improve their processes in order to maximize their competitiveness, increasing the useful life of the assets by improving their quality and the service it provides, depending on the nature of the organization in which it operates oriented to increase its life cycle (International Organization for Standardization, 2014), (Parra, , et al., 2021), (ROSIQUE, A. S., & Márquez, A. C., 2016).

In most industries the main problem corresponds to undocumented or incomplete guidelines, processes and procedures, which omit both the correct planning and execution of work methods and techniques, leading to non-compliance with activities and planning.

The concept of life cycle can be applicable to a system or process of a certain service and/or product being indispensable for the sustainability of the business, the due technical and economic follow-up depend largely on the performance and cost of the life cycle of its physical assets. This in turn implies the availability and reliability of its assets

with efficiency, preserving the environment and safety (International Organization for Standardization, 2014), (Castañeda, 2014).

It is common to find in the industries equipment maintenance processes poorly defined and structured, presenting errors or omissions that form conflicts in the different areas of the company, due to the lack of documentation in their guidelines, generating mostly by the staff the non-compliance of the planned activities.

Will the implementation of the ISO 55000 standard improve asset management?

Asset Management deals with the activities coordinated by an organization to obtain value from its assets. The International Organization for Standardization, through the ISO 55000, ISO 55001 and ISO 55002:2014 family of standards, establishes the concepts, requirements, and criteria to fulfill such objective, where the management of assets in the company is optimized.

The purpose of this article is to provide the necessary guidelines for asset management, which will be based on the ISO 55000 family of standards, linking the industry, executing the different activities in the appropriate time, providing value to the asset and prolonging its useful life, which avoids unnecessary stoppages in production, facilitating decision making.

The descriptive, non-experimental, analytical, deductive, deductive, inductive and descriptive method was used to analyze the information of the articles in reference.

The result is an asset management model applying the ISO 55000 Standard, which refers to measuring the level of maturity.

It is concluded that in order to apply the asset management model according to ISO 55000, it is necessary to specify in detail each of the requirements described by the standard.

MATERIALS AND METHODS

The non-experimental descriptive method was used, through on-site observation and the collection of information during visits to the company, in order to know the state of the company, its strengths, opportunities, weaknesses and threats, in order to establish a management model for physical assets aimed at improving processes.

The deductive method was used to perform the analysis of information gathering, digesting from the general to the particular, it was known the restrictions regarding the implementation of an asset management system. In conjunction with the previous method, the inductive method was used to obtain conclusions in a general way starting from assumptions, to the formulation of the facts until arriving at the descriptions of the results.

The analytical method allowed the diagnosis of the different industrial processes of the company Tecnoblock S.A. in relation to the operation of physical assets such as

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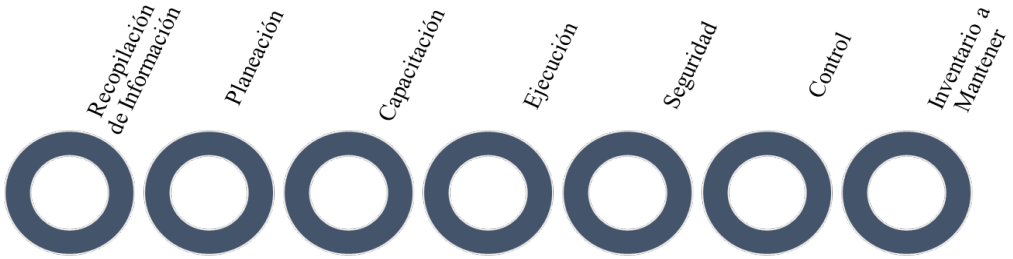
machinery and through the information provided and the technique of interviewing the production manager.

Figure 1 Maintenance management components.



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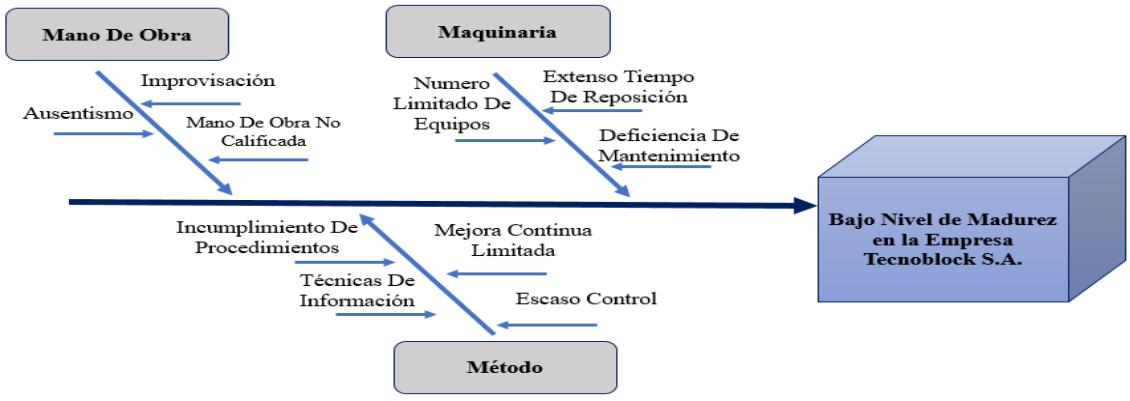
RESULTS

By means of the Ishikawa cause-effect diagram, those circumstances to be taken into consideration of the company's reality are specified, thus allowing to give due importance to the planning of activities and procedures in the production process when developing an asset management system (Parra, et al., 2021), (Carrosco, 2016). The following is shown below:

Figure 2. Cause - Effect Diagram



The development of the SWOT analysis reflects the current situation of the organization, the strengths and weaknesses that occur most frequently, and thus can help in decision making, so it is taken into consideration for the study and development

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of strategies to reduce or mitigate the weaknesses through an asset management system, whose main function is to give value to the asset and increase its useful life.

Figure 3. SWOT matrix of the current situation of the company TECNOBLOCK S.A.

This study mythology allows knowing the current situation of the organization, since in every economic activity they experience changes in internal as well as external situations (Rosique, & Márquez, 2016), (Servicio Ecuatoriano de Normalización, 2016), (Baque, Mera & Vera 2020).

The company TECNOBLOCK S.A. is not apart from this reality, therefore, in order to have complete knowledge of the organization, as well as its machinery and to be able to establish strategies in relation to the problems studied, we start from the diagnosis of the organization, identifying through a modal analysis of failures and effects, which is determined by the effect or severity of the failures in the process. The criteria used for

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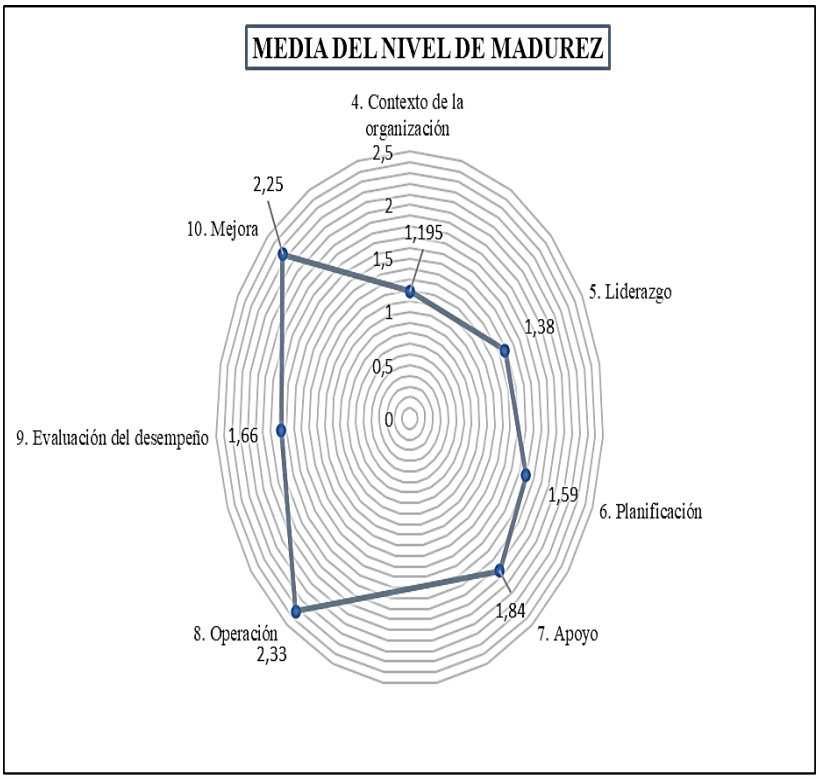
the verification of the maturity levels are provided by Fidel Márquez Artola in his degree project Evaluation of Asset Management based on ISO 55000.

Verification of compliance with ISO 55000 standard parameters at Tecnoblock S.A.

From the point of view the industrial maintenance management its main function is the conservation of the service ensuring that the function it plays in the productive system is fulfilled in its entirety in economic terms a correct maintenance means the protection and conservation of investments, the guarantee of productivity and security of its services (PARRA, et al. , 2021), (DEVIA, Santana, , & Mora, 2017).

Figure 4. Average Maturity Level.



Based on the above elements, the organization's compliance with ISO 55000 asset management is verified. This verification contains two tools: the evaluation to the top management and the detailed evaluation, which produces that both are complementary, having as purpose the understanding in the top management those requirements of the asset management for the sustainable success in the organization, as well as in the application of the sections of the standard in detail (Rosique, & Márquez 2016), (Flintsch 2019).

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The analysis of the maturity level in Tecnoblock S.A. showed that 71% of the requirements set forth in the standard do not exceed Level 1, with only two requirements at Level 2, therefore, the company is at the lowest level of management, which is Level 1.

Development of the physical asset management model focused on improving the processes of the company Tecnoblock S.A.

The physical asset management model is focused on compliance with the requirements established in the ISO 55001 standard, for this the degree of compliance that the company has in relation to what is described by the standard is taken as a reference, this is known as the level of maturity (Rosique, & Márquez, 2016), (PLATFOOT, 2017), (Quilumbaquí, 2019).

For the development of the asset management model, the standard establishes the implementation of several requirements, starting with the context of the organization where it is composed of four points, which refers to the situation in which the company is currently located, as well as the understanding of its needs and expectations of stakeholders and determine its scope according to external and internal issues relevant to its purpose and affecting the ability to achieve the proposed results, aligned and consistent with the objectives of the organization, as well as its policies (Cárcel, 2016), (Artola, 2015), (Heredia 2017).

Table 1. *Requirements to follow in the process of implementing the asset management model.*

Requirements	Detail
Contexts of the organization	It refers to the situation in which the company currently finds itself, as well as the understanding of its needs and expectations of interested parties and determine its scope according to external and internal issues relevant to its purpose and affecting the ability to achieve the proposed results, aligned and consistent with the objectives of the organization, as well as its policies.
Leadership	It is related to the conformation of the company, as well as its departments and responsibilities, also taking much into consideration the leadership and policies, therefore, the organization chart of the company was structured to further define the roles and responsibilities of each department integrating as a fundamental factor the top management, being essential at the time of the implementation of a management system.

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Planning.	The organization as such must determine the internal and external issues that affect its ability to achieve these results, Identify, control and record the assets involved in production processes and configuration equipment. Protect the integrity of assets operating in the production process and configuration equipment. Preserve the confidentiality of the company's documented information records.
Support	The necessary competencies of those persons under your control who affect the performance of the assets, asset management, and the asset management system must be determined, looking at it from the macro to the individual point of view. Use formats that allow monitoring the status of assets, as well as the collection of information that will support decision making.
Operation	It is recommended to plan actions to address risks and opportunities, considering that these may change over time. SWOT format is a type of diagram used to study the strengths, weaknesses, opportunities and threats in a given situation. Analytical flowchart format shows the trajectory of a product or process, indicating all the facts subject to analysis, using the symbol that corresponds to each process. Failure Mode and Effects Analysis (FMEA) format is a methodology that aims to study the possible failures in the future "Failure modes". ISHIKAWA's format helps to raise the causes and effects of a problem.
Performance evaluation	In order to assess the organization's performance with respect to asset management, the organization should determine what needs to be monitored and the methods of monitoring, measurement, analysis and evaluation, bearing in mind asset performance and asset management, keeping documented information as evidence of the monitoring results.
Improvement	Take preventive actions by establishing processes to identify potential failures in asset performance and assess the need for preventive actions. Above all, it is important to continuously improve the relevance, adequacy and effectiveness of asset management.

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Once the current situation of the company Tecnoblock S.A. is known, the factors that prevent an effective execution of maintenance work are visualized, so a Physical Asset Management System is designed to control, measure and evaluate the performance of processes and seek corrective actions for critical equipment (Servicio Ecuatoriano de Normalización, 2016). The maturity table is shown where it takes into account all the criteria of the standard corresponding to ISO 55000, evidencing the degree of compliance that the organization has with the standard, allowing the opportunity for improvement in each of the requirements, taking criteria from 1 to 5, with 1 being the lowest level of management or applicability with the standard and 5 being the maximum level of management.

Table 2. *Maturity Level Assessment Format.*

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		MATURITY LEVEL	
AMBITO	**PERFORMANCE**	**1**	**5**
4. Context of the organization	4.1 Understanding the organization and its context		
	4.2 Understanding stakeholder needs and expectations		
	4.3 Determining the scope of the asset management system		
	4.4 Asset management system		
5. Leadership	5.1 Leadership and commitment		
	5.2 Policy		
	5.3 Organizational roles, responsibilities and authorities		
6. Planning	6.1 Actions to address risks and opportunities to the asset management system		
	6.2 Asset management objectives and the planning to achieve them		
7. Support	7.1 Resources		
	7.2. Competence		
	7.3 Awareness		
	7.4 Communications		
	7.5 Documented information		
8. Operation	8.1 Operational planning and control		
	8.2 Change management		
	8.3 Third-party contracts		
9. Performance evaluation	9.1 Monitoring, measurement, analysis and evaluation		
	9.2 Internal authorship		
	9.3 Management review		
10. Improve	10.1 Nonconformities and corrective actions		
	10.2 Preventive actions		
	10.3 Continuous improvement		

In the development of this research project an asset management model is proposed according to the ISO 55000 standard where the diagnosis of the current situation of the organization and the internal and external situations are analyzed, so it is taken as a reference to the publication, "Propuesta para la Gestión Integral de Activos Físicos dentro del Área de Mantenimiento Vehicular Dirigido a Benemérito Cuerpo de Bomberos Voluntarios de Cuenca," Cuenca, 2018, where they state in their project that through the SWOT analysis major weaknesses are detected in the organization, this being essential to identify those controllable factors such as strengths and weaknesses of the organization, as well as opportunities and threats, so it is taken into consideration for the study and proceed to the development of strategies to reduce or mitigate the

weaknesses through SWOT and FA-DA plans (BASTIDAS, Suarez and Hernandez, 2019), (GUTIÉRREZ, et al. 2019), (. LEÓN Ganchozo, Valero, and Vera, 2020).

To support the technical study of maturity verification, F. M. Artola, "Evaluation of Asset Management based on ISO 55 000. Theoretical considerations," Santa Clara, 2015, who indicates that the activities can be assessed within the five possible maturity levels with each of the requirements of the standard, therefore based on the above, we proceed to the verification of the organization's compliance with respect to the standard, to situate the level of strategy, vision and management by top management and operability. Aiming to determine the opportunities for improvement with respect to the organization and its understanding of those requirements by asset management (Flintsch, Gerardo 2019), (PEREZ, 2020).

CONCLUSIONS

To determine the current situation as an object of study, we start from a diagnosis of the organization through the modal analysis of failures and effects, identifying through those elements, the equipment with major defects: the boiler, molding machine, planer and press. In this way the familiarization of its processes, activities and distribution of the company Tecnoblock S.A. that together with the SWOT analysis allowed to identify those internal and external factors, inquiring the strengths and weaknesses, as well as the opportunities and threats that are considered for the development of strategies to mitigate them through the SWOT-DO and FA-DA analysis.

In the verification of the organization's compliance with the standard, we proceed to the evaluation of the maturity of the management level and strategies by the top management and operability, in relation to the above in more detail, we obtained as a result a poor level of management according to the compliance, 71% of the requirements do not exceed Level 1 and only two requirements are at Level 2, having the lowest level of management, which identifies opportunities for improvement with respect to the organization and the understanding of what is set forth in the standard for the application of asset management.

For the development of the proposed asset management model, each of the requirements described in the standard are thoroughly described, establishing policies, roles and methods for collecting information and following up on each activity to be carried out, highlighting the need to improve the organizational culture, emphasizing collaborative work for the development and fulfillment of the objectives set forth in the management model.

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