Artículo de Investigación. Revista Ciencia e Ingeniería. Vol. 43, No. 3 pp. 335-342, agosto-noviembre, 2022.
ISSN 1316-7081. ISSN Elect. 2244-8780 Universidad de los Andes (ULA)

Mejores prácticas de la gestión integral de activos para transformar en un centro de rentabilidad como estrategia de negocios en la industria del gas natural

Best practices to transform comprehensive asset management in the natural gas industry as a business strategy into a profitability center

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DOI: https://doi.org/10.53766/CEI/2022.43.03.11

Abstract

This article describes the models and implementation strategies of the Assessment and Implementation of Asset Manage-ment with ISO 55000 to ensure that the natural gas industry operates aligned with business requirements to maintain its design capacity, eliminating waste and increasing efficiency operations, establishing a starting point for a scientific way to define strategies, tactics and operational actions which must be executed to achieve good practice in the management of physical assets will be. Applying the three 3P methodology that identifies and analyzes the opportunities for improvement in the 5 key areas of business: Resources for maintenance and operations, information technology, preventive maintenance and technology, planning and scheduling, and operations and maintenance support, under the requirements defined in the standard, making a quantitative and qualitative data analysis and identifying areas to enhance and good practice based on the 28 requirements of Standard.

Monitoring and control of the efficiency and effectiveness of maintenance (implementation of specific indicators), improving the efficiency of the maintenance function (implementation of predictive strategies) and cost reduction (plan: conclusion based on two objectives is proposed plan asset substitution).

Keywords: management, asset, evaluation, criticality, diagnosis, integrity

Resumen

Este artículo describe los modelos y estrategias de aplicación del Assessment e Implementación del Asset Management con ISO 55000 para conseguir que la industria del gas natural opere alineada con los requerimientos del negocio para mantener su capacidad productiva de diseño, eliminando las pérdidas y aumentando así la eficiencia en las operaciones, estableciendo un punto de partida de una forma científica para definir estrategias, tácticas y operativas cuáles serán las acciones que se deben ejecutar para alcanzar las buenas prácticas en la gestión de activos físicos. Aplicando la metodología de las tres 3P que identifica y analiza las oportunidades de mejora en las 5 áreas claves del negocio: Recursos del mantenimiento y operaciones, tecnología de la información, mantenimiento preventivo y tecnología, planificación y programación, y soporte al mantenimiento y operaciones, bajo los requerimientos definidos en la Norma, realizando un análisis cuantitativo y cualitativo de datos e identificando las áreas a potenciar y buenas prácticas basado en los 28 requerimientos de la Norma ISO 55000.

Como conclusión se plantea un plan basado en dos objetivos: seguimiento y control de la eficiencia y efectividad del mantenimiento (implementación de indicadores específicos), mejora de la eficiencia de la función del mantenimiento (implementación de estrategias predictivas) y reducción de costes (plan de sustitución de activos).

Palabras clave: gestión, activos, evaluación, criticidad, diagnóstico, integridad

1 Introduction

Asset Management corresponds to the comprehensive systematic and integrated planning and programming of physical resources throughout their useful life cycle. This includes the specification, design, requisition and manufacture of the asset, its operations and its modification during its useful life, as well as its disposal at the appropriate time.

Maintenance is sometimes undervalued and seen as something that interrupts production, affecting operating and product costs. They see the production and not the assets that produce it, the irony is that companies use quality management techniques such as "lean", "six sigma", rather than asset management and use cutting-edge technology not only to produce nuts but also to make each nut more profitably.

That is why lean principles have made progress in the industry, but there is still a weakness in organizations inside and outside of it, because they fail to define their value chain and how people and assets The physical ones are integrated to create value for the organization since this technique reflects eliminating corporate waste (or rather, waste), optimizing processes, increasing productivity and efficient use of assets and personnel in the search for improved profitability. Without this, the complexity of information management becomes stressful.

Taking Figure 1 as an example, an interpretation of the IEC 62264-1 Standard for the information flow of an oil installation, it is observed that once it flows and is clearly understood, it is easier to define what data and requirements are necessary to the management of information related to assets and how they create value for the business. Without this transparent link to the business, it is almost impossible for an organization to set up a system that manages the information to make asset management decisions in real time.

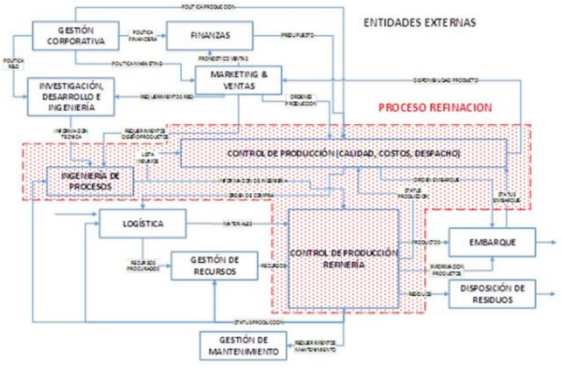

Fig. 1. Information flow for an oil installation, according to the IEC 62264-1:2003 Standard.

The basic principles for the management of the maintenance of industrial assets are similar to the alphabet, if the bases are not well understood and assimilated; it is difficult to ensure the reliability, performance and integrity of the productive equipment. However, we must begin by saying that a very important and often undervalued resource in this industrial process is the human resource, the people who carry out maintenance activities.

Assets are all the equipment, facilities and resources used in the production or transformation process within a company or plant. These assets must be in optimal conditions —be reliable— to fulfill the function for which they were acquired. In other words, the integrity of the assets is verified in their ability to fulfill their function in a reliable, optimal and risk-free manner beyond those used in operations or the production process; ideally, that integrity is maintained throughout the life cycle of the asset and throughout the entire process. To ensure it, the maintenance department plays a fundamental role, and it achieves this by applying the fundamentals and basic concepts of the relative management of the equipment and installations in question. We must understand that maintenance can only preserve and maintain equipment standards through systematic and coordinated activities.

Asset Management or in English, “Asset Manage-ment” corresponds to the systematic and integrated planning and programming of physical resources throughout their useful life cycle. This may include the specification, design and construction of the asset, its operations and its modification during use, as well as its timely retirement.

It is the management or management of tangible and intangible assets with a focus on "an integrated approach to operate, maintain, improve and adapt the plants and infrastructures of an organization in order to create an environment that strongly supports the primary objectives of the organization, Business. The correct application of asset management techniques will enable companies to provide the right environment to conduct their core business on a cost-effective and value-for-money basis. As well as other functional areas in process control, asset maintenance management has a direct impact on the execution of technical and financial strategies.

The objectives of comprehensive asset management in an organization are equivalent to a beacon that guides navigation at sea, as they force management to always maintain an attitude of alertness. That is why in the comprehensive management of assets, the objectives must be considered as something measurable and quantifiable, such that it clearly expresses the intention of the statement of a clear business strategy, giving way to a series of activities whose execution allows a greater degree of reliability in equipment and facilities. For this, the maintenance, its organization and computerization, must be aimed at the permanent achievement of the following objectives:

- Optimization of asset availability.
- Optimization of maintenance costs.
- Optimization of human resources.
- Maximizing the useful life of assets

Equipment Health is the percentage of these that are operating without defects, for this it is necessary to design a maintenance plan that focuses on the detection of defects through Predictive Maintenance and Inspections, said inspections and application of technology Predictive needs to be developed based on analysis of failures that equipment may incur and select the best activities to detect defects that can trigger a loss of function of the equipment. Equipment Health is not only a key indicator, but also has a direct correlation with "Maintenance Costs" and "Availability", for the former, as Asset Health increases, the costs associated with maintenance will decrease, this due to that there will be less equipment operating with defects and fewer activities to eliminate defects and corrective maintenance will be carried out. Availability will be increased by having fewer corrective maintenance interventions on the equipment and it will be possible to have more time with the capacity to produce.

Figure 2 shows the P-F Curve, which measures on the Y axis the condition of the equipment as a function of time as a piece of equipment decreases in its condition, giving signs or symptoms, which must be detected in a timely manner so that Proactively, the planning and programming of the maintenance task is carried out in order to eliminate the defect and keep the equipment as far away as possible from Point F or point of failure. Elimination of the defect is not only important for technical or equipment functionality reasons, but also from the point of view of costs associated with the elimination of the defect, it makes sense to be as far to the left as possible since the costs will be lower. With this said, it is clear that it is necessary to design a strategy that allows focusing on eliminating defects instead of repairing or returning the equipment to its operational condition after a failure, the next step is to know the stages that will allow the development of that strategy. as shown in Figure 3.

For this, it is necessary to have an updated and precise record of the equipment with its characteristics or technical attributes, as the appropriate information base from which a hierarchical structure is developed based on PAS55 (before) and ISO55000 (now), applying known concepts with pre-established limits and hierarchies through a structured and limited sequential process in the possibilities of qualification and weighting of events and maintenance experiences that allow Quantifying the Reliability of the Equipment and comparing it with that of others with similar characteristics.

Reliability parameters can be determined for use in the Design, Operation and Maintenance phases, dividing the physical asset from higher to lower hierarchy or degree of detail regarding to ISO 55000/ISO Guide 72/ISO 14224, as follows:

- Class
- System
- Sub System
- Active Maintainable
- Detail component (optional)

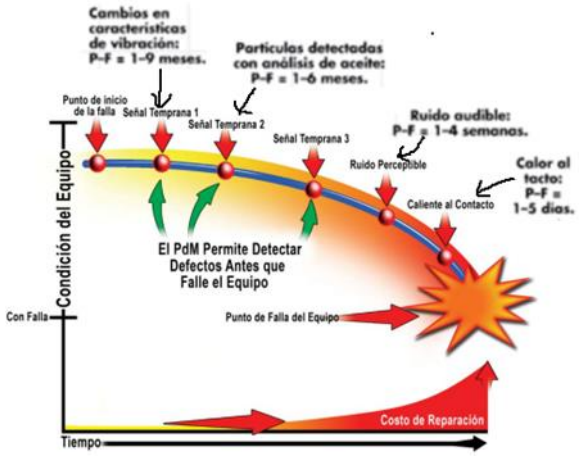

Fig. 2. P-F curve correlating Potential Failure and Functional Failure.

Fig. 3. Stages for the Development of an Asset Maintenance Strategy.

This division is essential since it allows defining how the equipment will be treated and then how the operation and maintenance records will be associated with their functions, each one in its operational context within the process.

The maintenance strategy requires parameters that give it support, said support is oriented to: the personnel that executes the maintenance and the execution of the tasks per se. For each discipline of predictive maintenance and inspection, it is necessary to have the competency model of the personnel that will execute said tasks, as well as the competencies to carry out the analysis and recommendations of the field data surveys. Additionally, it is necessary to define the correct way of executing the tasks, handling of collected data, parameterization of the analysis and equipment/tools to execute the tasks. The goal is to provide consistency to the maintenance strategy and ensure that knowledge is properly managed within the maintenance department.

For each discipline to be implemented, it must be measured how prepared the organization is to execute the changes and, through a formal change management structure, carry out the implementation of the designed maintenance plan or strategy. Once the strategy and the defined tasks inserted within the Computerized Maintenance Management System (CMMS) have been structured, the indicator measurement begins, as can be seen in Figure 4, if multiple tasks are executed at the same time. Team in order to detect defects and eliminate them proactively, each one must show a “healthy”

status generally indicated by the color green, "unhealthy" denoted by the color red. If a piece of equipment has at least one defect, it will be considered "unhealthy" and a defect elimination activity must be planned and scheduled for this purpose.

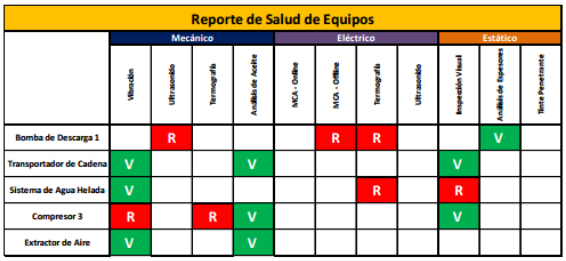

Fig.4. Equipments Health Log.

2 Methodology

2.1 Asset Management Model

It shows the component elements that must operate in the system: a diagnostic stage, another for operations and maintenance, another for technical-financial indicators and a final stage for operational reliability strategies. All this immersed in a skills development environment reinforced with essential training and specialization, followed by the corresponding certification of said skills.

Each element in turn complies with internal processes that must be executed or fed back to transform reality and achieve concrete results, as shown in Figure 5.

Fig. 5. Asset Maintenance Management Comprehensive System Model.

2.2 3.3 Physical Asset Management Comprehensive Methodology (IAM-AMC), Global Forum on Maintenance and Asset Management (GFMAM)

The Institute of Asset Management (IAM), "The EFNMS, the European Federation of National Maintenance Societies", (EFNMS) y The Asset Management Council Ltd lead the development of asset management, on behalf of the GFMAM "Global Forum for Maintenance and Asset Management".

The Asset Management Capability Assurance Model shown in Figure 6 is an example of a conceptual model for asset management. The Capacity Assurance Model describes the management of physical assets as a combination of principles, quality processes and people, emphasizing understanding and ensuring the capacity to manage assets and based on the four principles of Asset Management. Assets: Exit Approach, Capabilities, Assurance and Learning.

Fig. 6. Asset Management Capacity Assurance Conceptual Model.

2.3 Conceptual Model GFMAM "Global Forum for Maintenance and Asset Management"

Comprehensive Asset Management is being updated every day to provide a stable platform for companies, universities and society, which is why the IAM and its collaborators give priority in their work to the creation of knowledge in asset management. For this, it has made a proposal for an Asset Management methodology shown in Figure 7.

All maintenance strategies must have a vision of anticipating failures, since it is better to have a proactive culture —which anticipates failures— than to have a reactive culture, which is dedicated to repairing what is damaged once the failure appears. For this, there must be preventive maintenance tasks of scheduled restoration, scheduled replacement or based on condition and/or predictive. Proactive maintenance tasks are possible to plan, their cost is lower than reactive tasks (unscheduled corrective maintenance or unexpected failures), however there are so many corrective tasks that can be scheduled and optimize costs.

Fig.7. Integral Asset Management Methodology IAM-AMC/GFMAM.

Like a doctor with his patients, operational reliability personnel along with operations and maintenance personnel must know the functions of the equipment and how they can lose them. In the same way, you must know the antidotes and medicines. We can do this through the RCM process framed in the ISO 55000 Asset Management Standard, by means of which we identify how the equipment can lose its function and what are the strategies to ensure its operational continuity with the appropriate operating standards and their level of general reliability revolutionizing the industrial field in terms of financial results, risk management, better services and products and organizational sustainability, as shown in Figure 8.

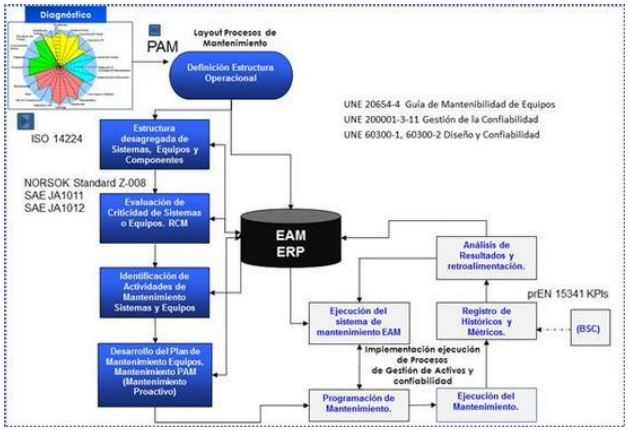

Fig.8. Methodology for the Effective Implementation of the Comprehensive Management of Physical Assets, according to ISO 55000 conforming guidelines of IAM.

3 5. Reasons why it is vital to adapt to an Asset Management Model

3.5.a) Companies based on cost leadership

The competitive advantage is the cost, they generally produce "commodities" and cannot define the price in the market, because it is imposed on them, so they have two ways to increase their income, increasing the volume of production or reducing their costs operational.

3.5.b) Asset-intensive companies

They use a large number of assets to produce, the value of their fixed assets is high, a large operating and maintenance force is required to ensure availability, and the failure of their assets directly impacts their financial results.

3.5.c) What can asset management do for you?

1) Board of Directors and CEO: Provides a better understanding of the needs and risks of investments, to ensure future profitability in a sustainable and competitive manner, increasing capital productivity.

2) Finance Manager: Reduce unforeseen capital needs, provide 10-year and beyond forecast capital, operations and maintenance needs.

3) Business Planning Manager: Incorporates infrastructure and asset needs into management and planning plans.

4) Engineering and Projects Manager: Offers a higher level of project acceptance, reduced scope change levels, design optimization through standardization and continuous improvement processes, ease of access to the platform of company information and support knowledge management.

5) Operations Manager: Offers the availability of assets, the information platform is available to review the operation and health of assets, focuses on achieving efficiency and effectiveness and operating results..

6) Maintenance Manager: Offers the reliability and maintainability offered by the assets, an information platform with data on the operation, health and history of the assets, a set of analysis, decision-making and monitoring tools for improving maintenance processes and practices.

7) Logistics and Contracts Manager: Offers early information about the requirements of components and spare parts, optimizes inventories by standardization, allows the development of differentiated strategies by defining the criticality of assets and spare parts.

8) Safety and Environment Manager: Offers an information platform that records the risks, probabilities of occurrence and impacts of the consequences, all decisions will be based on cost-risk-benefit, therefore the analysis and control of risks are embedded in the culture.

9) Information Technology Manager: Generates a greater awareness and understanding of the specific functions of the necessary systems and of integrating data and information to support asset management and knowledge management.

10) Human Resources Manager: Provides clear information on the human requirements and skills to support asset management.

3.5.d) Benefits of an asset management model

1) Improved customer satisfaction with better asset performance and control.

2) Delivery with quality under the required standards.

3) Improved health, safety and environmental performance.

4) Optimization of capital productivity and return on investment.

5) Optimized growth, possibility of producing more with fewer assets.

6) Long-term planning, trust, performance and sustainability.

7) Ability to demonstrate the best cost/risk/benefit ratio.

8) Improved compliance with regulations.

9) Controlled and systematic processes, evidence to demonstrate legal compliance.

10) Better management and handling of risks.

11) Clear audit processes for the adequacy of the decisions made.

12) Improved corporate reputation that can generate greater business value.

13) Greater staff satisfaction.

14) More efficient and effective contracting of the supply chain.

15) Ability to demonstrate that sustainable development is actively considered.

16) Most significant financial information.

17) Improvement of the reliability of systems and equipment.

18) Improve long-term systems integrity.

19) Improvement of capital financing.

20) Cost optimization and profitability improvement..

4 Conclusiones

A common mistake is to confuse physical asset management with maintenance management. Physical asset management goes much further than maintenance; It involves the entire cycle of the asset since its need is generated: select it, design it, develop it, buy it, commission it, operate it and maintain it until an economic point that indicates the moment to repair it, replace it or disincorporate it.

Asset management involves all departments (design, engineering, purchasing, installations, commissioning, operations and maintenance). If we design poorly, buy below specifications or exploit the asset above its capacity, it will have a detrimental effect on its maintenance and it will not be able to fulfill its task optimally because in the failure patterns that exist within the RCM, 68% of failures follow an 'infant mortality' rate, where the causes range from poor design, poor manufacturing quality, incorrect installation, poor staff delegation, incorrect operation and inadequate maintenance.

Ensuring asset integrity is not that difficult if the fundamentals and basic concepts of maintenance are applied.

Operational effectiveness is the goal of every organization, keeping costs low and a high capacity to generate value, otherwise it fails. Until now, asset management and sustainability were considered separately, but that is changing.

As the prices of raw materials increase, it is necessary to implement good practice strategies for their use. If we consider that the general operation of a company and all its facilities are powered by energy, a metric such as the Global Asset Sustainability Index must be incorporated to control spending during its life cycle.

In this sense, the approach must be to analyze the integration of sustainability aspects in the three phases of the active life cycle (Create-Acquire, use, Maintenance, Disincorporation), especially the scope pursued based on integration with the economy, society and environment, aligned to the model of sustainable management of physical assets.

It is important to consider as a lesson learned that the usefulness of assets not only seeks to exploit natural resources at the lowest possible cost, speaking in economic terms, but also to assess the cost to society and the environment; and thus prior to that, develop a truly sustainable strategy.

When the asset management system is aligned with the objectives of the organization and supported by senior management, internal conflicts are eliminated, silos are broken down and departments work aligned to a common goal.

Acknowledgments

The author wants to thank all the magazine staff, principally at Universidad de Los Andes, who contributed to the development of this research.

References

IEC62264-1(2003). *Enterprise-Control System Integration, Part 1: Models and Terminology*. Published by IEC

Amendola, L. (2012). *Libro de Gestión Integral de Activos Físicos*, Editorial (PMM). Institute for Learning. Valencia, España

BS ISO 55000 (2014). *Asset Management*. Published by BSI Standards Limited.

ISO Guide 72 (2001). *Guidelines for the justification and evaluation a proposed management system*. Published by ISO.

Recibido: *13 de octubre de 2021*

Aceptado: *24 de julio de 2022*

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