An Improvement Framework for Maintenance Management

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EXECUTIVE SUMMARY

Maintenance is one of the main stages to deliver business outcomes from physical assets over their life cycles. However, as unexpected events and performance may occur in maintenance management, organizations shall be aware of how to address them as well as other opportunities for improvement. Accordingly, this chapter intends to present an improvement framework for maintenance management. The first two sections provide an introduction to maintenance management improvement and its interface with the ISO 55000 series for asset management and the maintenance management model (MMM). Then, the proposed framework and its activities for improvement in maintenance management are discussed in the third section. The fourth section addresses an overview of the main RCA techniques to support the framework implementation. Finally, a hydroelectric power plant case study is discussed to demonstrate the framework in a real operational context.

INTRODUCTION TO IMPROVEMENT IN MAINTENANCE MANAGEMENT

The current paradigm of industrial maintenance management is quite different from a few decades ago. After years of evolution of maintenance practices and the rise of physical asset management, it is no longer seen as just an operational expense, but a strategic process in the organizations. Its results can contribute to the achievement of asset management and, consequently, of the organizational objectives. Therefore, it is appropriate that organizations have a systematic framework in order to seek improvements and learn from unwanted incidents in maintenance management.

Facilities and equipment do not remain safe or reliable if there is no maintenance, even when well designed (Arunraj & Maiti, 2007). Evidence shows that well-management and well-performed main-

tenance can be utilized to contribute to business strategy (Holgado et al., 2020). Besides, maintenance is essential to address and treat risks regarding physical assets in organizations. Therefore, managing maintenance is not just about the restoration of physical assets to their operational state after a failure. It comprises the planning, organizing, implementing, and controlling of all maintenance activities supported by maintenance leaders (Haroun & Duffuaa, 2009).

As maintenance management aligns maintenance delivery activities with organizational objectives and strategies (GFMAN, 2016), it can directly contribute to the success of organizations. Nevertheless, organizations should be aware that unexpected events and performance can occur in or as a result of maintenance. Evidence shows that poor maintenance can result in process failures that can expose people to hazards, cause loss of revenue, and impact operational feasibility (Ihemegbulem & Baglee, 2017). This corroborates the importance of seeking improvements in the performance from unwanted incidents in maintenance activities.

The origin of interest in seeking improvement in organizations is directly associated with the evolution of quality management. According to ISO 9000, quality management is the coordinated activities to direct and control an organization with regard to quality (ISO, 2015). Quality is a competitive aspect in industries since customers only buy goods with accepted quality (Yang, 2012). As consequence, organizations have developed different approaches to address the subject over time, as presented by Yang (2012) and summarized in Table 1.

Table 1. Milestones in the quality management evolution

Approach	Origin	Characteristics
Inspection Quality Control (IQC)	Around 1910	The inspections activities were applied as control of product quality in assembly lines
Statistical Process Control (SPC)	Around 1930	Introduction of statistical tools for process control and sampling inspections as a quality control method
Total Quality Control (TQC)	Around 1950	The concept that quality assurance cannot be achieved by the control just on the production process was established. As consequence, all the functions were included in the quality control
Company-Wide Quality Control (CWQC)	Around 1970	Japanese industries emphasized the education and training for all employees and the cultivation of quality culture intensively in addition to the TQC concepts of quality control, costs of quality, and statistical methods. Moreover, continuous improvement was promoted through the quality control circles
Total Quality Management (TQM)	Around 1985	This approach was derived from Japanese CWQC and widely adopted around the world. TQM is an integrated model of management philosophy, quality concept, and set of practices. It comprises a hard side with technical aspects of quality control and a soft side with quality concepts, culture, training, and people factors
Quality Management System (QMS)	Around 1990	An international and standardized approach that focuses on consistently meeting customer requirements and enhancing their satisfaction through a continuous improvement cycle. As a reference, it was introduced the ISO 9000 series

Although all these approaches in Table 1 intended to contribute to better results regarding the quality of the products in the organizations, the concept of continuous improvement has introduced in the 70s. By definition, continuous improvement is a management approach that focus on enhancement of manufacturing processes through incremental changes (Singh & Singh, 2019). For Yang (2012), this was the biggest contribution of Kaoru Ishikawa as well as the seven quality control tools to support it (Yang,

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