Chapter 13
Industrial Maintenance Entering the Industry 4.0 Era: A Roadmap Proposal

Pedro Fernandes Anunciação
https://orcid.org/0000-0001-7116-5249
Polytechnic Institute of Setúbal, Portugal

Vitor Manuel Lemos Dinis
https://orcid.org/0000-0003-4016-3851
Cibersur, Portugal

Francisco Madeira Esteves
Polytechnic Institute of Setúbal, Portugal

ABSTRACT

Industry 4.0 marks the beginning of the so-called fourth industrial revolution. The new emerging information technologies, such as internet of things, cloud computing, machine learning, artificial intelligence, among others, have challenged the management and organization of industrial companies. They have now shorter market response times, higher quality requirements, and customization needs, which challenges many industrial areas from production to maintenance, from design to asset management. The maintenance and asset management condition and the reliability of production lines are closely linked and constitute key areas of good industrial operation. This work seeks to present a roadmap proposal for the management of industrial assets from maintenance management. In addition, it seeks to identify the key elements for a roadmap design and proposes a set of management questions to assess maintenance maturity.

DOI: 10.4018/978-1-7998-7452-2.ch013

INTRODUCTION

Industry 4.0 is a major milestone in today's industry. Industry 4.0 promise to be the era of artificial intelligence, where digital technologies will prosper (Horváth, 2018). Although it can be assumed as a natural evolution of previous industrial systems, this evolution represents new levels of knowledge and learning that, supporting the consolidation of the knowledge held and linking them to technological innovation, open new prospects for the economic and social development of humanity. Without ruptures and conflicts, the evolution has been carried out in a search of answers to the market, in the mechanization of work, and in the automation of production, among other aspects.

Industry 4.0 brings several opportunities and benefits, such as highly flexible mass production, real-time coordination of the production system, value chain optimization, cost savings derived from complexity, or the creation of new services and business models. These industry-wide innovations put pressure on all other related activities in a push-pull logic. For example, regarding logistics, some experts say that industry 4.0 can only exist if logistics is able to supply production systems at the right time, in the right quantity, with the right quality and in the right place. So, however promising the "fourth industrial revolution" maybe there are still several challenges, risks, and barriers to overcome for its implementation. It will be necessary to deconstruct traditional management approaches, reorganize value creation processes, make changes within and between enterprises, define appropriate infrastructure and standards, ensure data security and educate employees so that a positive outcome of this change can be achieved (Hofmann & Rüsch, 2017).

Industry 4.0 or 4th Industrial Revolution are some of the terms used to describe the implementation of "smart" devices that can communicate autonomously along the value chain. It is in this context that technologies such as Cyber-Physical systems (CPS) have emerged, which represent a significant leap in the dynamics of industrial operation, in that they facilitate the self-organization of systems, monitoring processes or creating a virtual copy of the real world; Internet of Things (IoT), which connects machines, objects and people in real time; Cloud Computing, which offers storage solutions, as well as enabling access to information and decision-making, allowing production processes and businesses to be combined creating value for organizations (Santos *et al.*, 2018).

In the field of industrial management, the current challenge is very different from previous times. Equipment currently incorporates systems with intelligence characteristics and industrial units have become organizations with sufficient flexibility to meet the specific needs of demand, according to the response times that the market requires. The equipment communicates with each other and the sharing of data in real time opens opportunities for an automotive monitoring of systems, products, and processes. The systems control themselves and allow higher degrees of reliability. Customers require increasingly customized products in small batches, which would be impossible and unsustainable under the previous traditional production paradigm (Alkaya et al., 2015).

This new era of industrial is thus marked by the fusion between the physical and digital world, providing a new context of action characterized by a communication between products and machines and a symbiosis between organization and dynamics. An unprecedented autonomy in production and a convergence between different «worlds» (physical, digital, and biological world) is expected in an action guided by multi-disciplinarity and complementarity of knowledge.

This will be a new industrial and, at the same time, economic universe, marked by new information and communication technologies such as cloud computing, horizontal and vertical integration of man-