Editorial — New technology in industrial maintenance and asset management

Editorial — As novas tecnologias na manutenção industrial e na gestão de ativos

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This edition of RAE is entirely composed of full-length manuscripts selected amongst works presented at Congrega'24, the 1st Ibero-American Congress on Engineering Asset Management & 2nd Portuguese Congress on Engineering Asset Management, which took place from 3-5 July 2024 in Lisbon with the theme "Sustainable and Digital Innovation in Engineering Asset Management". One of the recurrent debates in Congrega'24 was about digitalization and the use of new technologies in industrial maintenance and asset management. This topic has been attracting much attention globally (GFMAM, 2024; Crespo, 2024), and this editorial provides a commentary of this specific issue.

The adoption of new technologies in industrial environments not only raises operational performance to higher levels but also generates a significant impact on business sustainability. With advanced capabilities that enable more accurate, predictive and efficient maintenance, companies are able to reduce material waste, minimize energy consumption and extend the life of assets (de Almeida Pais et al., 2021). This positive impact translates into lower operating costs and a significant reduction in environmental impact, aligning operations with more responsible and sustainable standards.

The impact of technological innovation in business practices of major industry players goes beyond operational efficiency: it redefines the strategy of organizations in the contemporary market. Companies that adopt these technologies not only achieve greater profitability but can also use these technologies to demonstrate more clearly a commitment to social and environmental responsibility, reinforcing their image before consumers, investors and regulators (Kok et al., 2024; Zhang et al., 2019). This reputational impact is crucial in a scenario where sustainability is increasingly valued as a competitive advantage.

New technologies applied to maintenance and physical asset management are profoundly transforming the impact of business operations. The incorporation of artificial intelligence, Internet of Things (IoT) and real-time data analytics creates a virtuous cycle of positive impact: improved efficiency, reduced costs and increased reliability (Gbadamosi et al., 2021). Furthermore, by reducing the environmental and social impact of their activities, companies position themselves as innovative leaders in a competitive and constantly evolving market.

By adopting these innovations, organizations not only ensure an immediate impact on the performance of their assets but also a lasting impact on their competitiveness and sustainability. This is a strategic investment that combines profitability, innovation and responsibility, preparing companies for a future with a positive impact on a global scale.

With the advancement of digitalization, tools such as the Internet of Things (IoT), artificial intelligence (AI), big data and predictive analytics have gained increasing relevance, allowing organizations to adopt more efficient, proactive and strategic approaches in managing their assets (Teoh et al., 2023).

The ISO/IEC 23053:2022 provides a framework for Artificial Intelligence (AI) and Machine Learning (ML) that defines a generic AI system utilizing ML technologies. It outlines the system's components and their roles within the AI ecosystem. The framework is designed to be applicable to organizations of all types and sizes, including private and public companies, government agencies, and non-profit organizations that develop or deploy AI systems.

Maintenance, previously characterized by preventive and corrective approaches, now benefits from a predictive model, which uses real-time data to anticipate failures and optimize processes. IoT sensors, installed in equipment, collect constant information about its performance, such as temperature, vibration, pressure and wear (M. Liu et al., 2024). This data is then analyzed by AI algorithms, which are able to identify patterns and predict when a failure might occur. This allows intervention only when really necessary, avoiding unexpected shutdowns and increasing the useful life of assets (Resende et al., 2021).

Furthermore, IoT is not just limited to maintenance but plays a crucial role in other asset management functions. By connecting devices and machines to centralized monitoring systems, companies can gain a more holistic and real-time view of the status of their assets, making it easier to continuously monitor their performance. With this connectivity, it is also possible to make adjustments and optimizations during operation, ensuring that assets are being used efficiently and effectively (Gbadamosi et al., 2021; Syafar et al., 2018).

Another major advance has been the use of big data. With the gigantic volume of data generated by sensors, maintenance histories and other collection points, big data allows companies to carry out in-depth analyses, identifying trends and patterns that, at first glance, could go unnoticed. This analysis process not only improves maintenance planning, but also provides valuable insights for resource allocation, cost management and better asset utilization. The combination of historical data and real-time information helps to create a continuous cycle of improvement and optimization in the operation (Mitra & Munir, 2019).

The use of increasingly sophisticated integrated enterprise resource planning (ERP) systems has also facilitated asset and maintenance management. By integrating ERP with technologies such as IoT and AI, companies can centralize all information about their assets in a single system, making the decision-making process more agile and accurate. This allows maintenance teams to access detailed data on the performance of each asset, perform quick diagnostics and plan actions efficiently (Wijesinghe et al., 2024).

But using connectivity and new technologies also exposes assets and asset systems to cybercrime, with the constant evolution of new threats, making it increasingly important to manage cyber risks, becoming more risk-aware and proactively identifying and addressing vulnerabilities.

There is a global trend in the commitment towards digitalization. To this end, there is a need to introduce new models and frameworks to implement good practices in the digitalization of assets, their business and asset management. In this way, we will have an industry with more sustainable operations and that takes advantage of value-based and digitalized asset management. This is expected to boost the integration of asset data applications for visual inspection, remote asset monitoring and predictive maintenance towards optimum physical asset management. Tools such as robotics, artificial intelligence (AI) and machine learning are expected to provide insights into how assets are performing, and how more value can be created, including more efficient operations and meeting business and overall societal goals.

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Declaração Ética

Conflito de Interesse: Nada a declarar. **Financiamento:** Nada a declarar.