

UNDERSTANDING THE EVOLVING LANDSCAPE OF EMERGENT TECHNOLOGIES IN PRODUCT DEVELOPMENT FOR INDUSTRIAL EQUIPMENT SMES

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Summary: The rapid advancement of emergent technologies is transforming product development, particularly for small and medium-sized enterprises (SMEs) that manufacture industrial equipment and machinery. Innovations such as artificial intelligence (AI), additive manufacturing, the Internet of Things (IoT), and digital twins are revolutionizing machine design, engineering, and production processes. This paper explores how these technologies are reshaping industrial equipment development and aims to identify specific trends that directly impact machine design. Additionally, it analyzes the challenges and opportunities these changes present for Portuguese SMEs operating in this sector.

Through a literature review, this study examines technological trends that influence industrial machine design, focusing on how they enhance efficiency, functionality, and sustainability. Key trends include the integration of smart sensors for predictive maintenance, the use of generative design algorithms to optimize structures, and the application of advanced simulation techniques to improve performance and durability. Additive manufacturing is also playing a critical role in enabling rapid prototyping and lightweight component production, while digital twins are transforming product lifecycle management by enabling real-time monitoring and virtual testing.

A core aspect of this research is the analysis of change management strategies that help industrial equipment SMEs adapt to these innovations. Unlike large corporations with extensive resources, SMEs face unique challenges such as limited investment capacity, the need for specialized workforce training, and difficulties in integrating new technologies with existing systems. However, embracing these advancements also presents significant opportunities, including increased design flexibility, reduced development cycles, enhanced machine performance, and access to new markets through innovative solutions.

The findings highlight that SMEs in the industrial equipment sector must strategically plan their technological transition to remain competitive. While challenges such as high implementation costs and adaptation to digital workflows persist, those who successfully integrate emergent technologies into machine design can achieve significant advantages in efficiency, product differentiation, and sustainability.

Ultimately, this study underscores the need for proactive change management in ensuring a smooth technological transition for industrial equipment SMEs. By identifying trends that directly impact machine design and preparing for these shifts, businesses can leverage emergent technologies to enhance innovation, optimize production, and maintain long-term competitiveness in an increasingly digitalized industrial landscape.