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Determinants of Artificial Intelligence Adoption in Facilities Management: A Second-Order Systematic Review Integrated with R-SWARA

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Introdução

Artificial Intelligence (AI) is transforming Facilities Management (FM) by enabling real-time data use, machine learning, and predictive analytics to optimize operations and enhance decision-making. Technologies like Digital Twins support continuous monitoring and resource efficiency. However, challenges such as data fragmentation, lack of interoperability, and limited digital maturity hinder broader AI adoption. Identifying and prioritizing Critical Success Factors (CSFs) is crucial. This study applies a Second-Order Systematic Review (SOSR) and the R-SWARA method to address this gap.

Problema de Pesquisa e Objetivo

RQ1: Which Critical Success Factors (CSFs) should be prioritized for the effective adoption of AI in FM?
RQ2: How can the R-SWARA method contribute to more consistent decisions in complex organizational environments?

Fundamentação Teórica

AI in Facilities Management (FM) has evolved beyond earlier technologies by enabling machine learning and real-time processing. Adoption advanced in three phases: early fragmented efforts, integration with IoT and BIM, and the rise of generative AI. Applications like predictive maintenance, energy management, and Digital Twins have improved accuracy and efficiency. Challenges remain, including interoperability, skills gaps, and regulatory issues. This study consolidates 14 Critical Success Factors (CSFs) within the TOEH framework to guide strategic AI adoption in FM.

Metodologia

This study employs a quantitative, exploratory approach structured in three stages: (i) a Second-Order Systematic Review (SOSR) compared with a first-order Literature Review (LR) to identify Critical Success Factors (CSFs); (ii) application of the R-SWARA multicriteria technique; and (iii) complementary statistical analysis of expert agreement. The SOSR, comprising 13 articles, served as a conceptual validation of 14 CSFs, operating at a meta-analytical level by synthesizing only Systematic Literature Reviews (SLRs) (Grant and Booth, 2009; Cronin and George, 2020).

Análise dos Resultados

The analysis revealed three behaviors: (i) Organizational factors like Culture, Strategic Alignment, and IT Integration rose in ranking as the Organizational dimension was prioritized, reflecting sensitivity to institutional changes; (ii) Structural and human factors such as Data Availability, Training, and Governance remained robust in top positions, showing transversal importance; and (iii) Building Infrastructure, Investments, and External Factors consistently ranked lower, suggesting a secondary role in AI adoption decisions.

Conclusão

AI integration in FM represents a transformative shift in building operations, offering cost reductions, enhanced energy performance, and improved maintenance predictability. However, adoption remains hindered by organizational and regulatory barriers. This study, based on a Second-Order Systematic Review (SOSR) and R-SWARA application, proposed a 14-CSF model structured by the TOEH framework, identifying organizational culture, data availability, strategic alignment, workforce training, and governance as key enablers.

Contribuição / Impacto

Theoretically, it operationalizes a hierarchical model linking theory and empirical validation; practically, it offers managers a structured agenda for AI adoption. The heterogeneity in expert perceptions (Kendall’s W = 0.0504; p = 0.1205) justifies the use of multicriteria methods, such as R-SWARA, for decision support.

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