

# Peering Through AI's Veil: Task-Technology Fit and Its Impact on AI Adoption in Data Centers

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## ABSTRACT

This study examines how artificial intelligence (AI) generates operational value in data centers through the Task–Technology Fit (TTF) framework. Using survey data from data center professionals, the study applies covariance-based structural equation modeling (CB-SEM) to test relationships among task characteristics, technology characteristics, managerial competence, organizational support, TTF, AI adoption, and operational efficiency. The findings indicate that task, technology, and managerial factors strengthen TTF, which serves as the key mechanism driving AI adoption. Organizational support also facilitates adoption by creating conditions that enable effective technology integration. AI adoption, in turn, enhances operational efficiency. The study contributes to AI adoption research by showing that AI value depends not only on technological capability but also on alignment with task demands, managerial expertise, and supportive organizational contexts. It offers practical insights for improving AI implementation in complex data center environments.

## KEYWORDS

Artificial intelligence (AI), Task-Technology Fit (TTF), Data Center, AI Adoption, Operational Efficiency

## INTRODUCTION

Artificial intelligence (AI) is transforming the technological landscape, particularly within data center management, which forms the backbone of the digital economy by hosting critical infrastructure for cloud computing, big data analytics, and machine learning (Nash, 2024). As the complexity and scale of data centers increase, the demand for efficient, automated systems becomes paramount. AI offers promising solutions, enabling optimization of energy consumption, prediction of hardware failures, enhancement of cybersecurity, and automation of routine tasks (Brynjolfsson et al., 2011; Wamba et al., 2020). However, the effectiveness of AI in these applications depends significantly on how well the technology fits the specific tasks that data center managers need to accomplish.

One of the primary challenges in AI adoption (AIA) is ensuring that these technologies align with the existing workflows and responsibilities of data center managers. Inadequate fit between AI systems and managerial tasks can lead to inefficiencies, underutilization, or even resistance to technology adoption (Tarafdar et al., 2019). Managers often face barriers in adapting AI to their specific needs due to integration complexities, lack of appropriate training, or organizational resistance to automation (P. Stone et al., 2022; Wessel et al., 2021). These issues highlight the importance of

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tailoring AI technologies to the unique requirements of the data center environment to achieve an effective task–technology fit (TTF).

The TTF provides a valuable framework for analyzing this relationship. TTF posits that technology will have a positive impact on performance only if it aligns with the tasks it is intended to support (Goodhue & Thompson, 1995). In data centers, AI tools must be designed to match the specific operational requirements, such as system monitoring, workload distribution, and resource management. When this fit is achieved, AI can enhance the efficiency and effectiveness of data center management by enabling managers to make more informed decisions and streamline processes (Gregor, 2006; Rai et al., 2019).

This study seeks to explore how AI aligns with the specific tasks performed by data center managers in high-tech companies. By focusing on TTF, the research aims to identify the factors that influence the successful adoption of AI, and the challenges associated with integrating AI into data center operations. Specifically, the study is guided by three research questions. First, it examines how familiar data center managers are with AI technologies and how confident they feel in utilizing AI tools for decision-making, thereby assessing the degree to which AI tools are understood and effectively integrated into management tasks (Walsham, 1995; Wamba et al., 2020). Second, it investigates the main barriers to adopting AI in data centers, with particular attention to the technical, organizational, and human factors that hinder effective TTF, including integration challenges and resistance to adoption (Urquhart et al., 2010; Wessel et al., 2021). Third, it evaluates how AI utilization affects operational efficiency (OE) and decision-making, focusing on tangible benefits, such as performance improvement, cost reduction, and risk mitigation (Brynjolfsson & McAfee, 2017; Rai et al., 2019).

Despite the promise of AI, much of the existing literature has concentrated on general user perceptions, such as usefulness and ease of use, rather than examining the alignment between AI capabilities and the specific operational tasks of managers. In data centers, adoption success hinges on whether AI tools fit the task demands and organizational conditions in which they are applied. Without this fit, adoption risks inefficiencies, resistance, or underutilization. To address this gap, the present study develops a conceptual model grounded in TTF that links task characteristics, technology characteristics, managerial competence, and organizational support to AIA and OE. It validates these constructs through survey measurement, analyzes the relationships using descriptive, correlational, and regression analyses, and visualizes the findings to enhance interpretability. By bridging the gap between AI's theoretical capabilities and its practical implementation in data centers, this study contributes both to academic understanding and to industry practice, offering actionable insights for managers, vendors, and policymakers while also highlighting directions for future research (M. Stone et al., 2020; Venkatesh et al., 2013).

## **LITERATURE REVIEW**

### **AI in Data Center Management**

The application of AI in data centers has emerged as a critical research area in the information systems (IS) literature, driven by the need to optimize operations in increasingly complex and data-intensive environments. AI technologies, including machine learning algorithms, natural language processing, and predictive analytics, are being leveraged to enhance various operational aspects of data center management, such as predictive maintenance, energy efficiency, cybersecurity, and resource allocation (Muhammed et al., 2024; Ucar et al., 2024). According to recent studies, AI's ability to predict equipment failures, optimize energy use, and improve security protocols has significantly reduced operational costs while enhancing the reliability of data center operations (Sarker et al., 2019; Wamba et al., 2020). In line with the growing importance of AI, the IS field has explored the transformative potential of AI in information technology (IT)-enabled environments, where AI's role is evolving from a support tool to a strategic asset that enhances decision-making and automation (Benbya et al., 2020; Rai et al., 2019).

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