

Artificial Intelligence Adoption in SMEs: Survey Based on TOE–DOI Framework, Primary Methodology and Challenges

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Abstract-

Despite the transformative potential of artificial intelligence (AI), small and medium-sized enterprises (SMEs) continue to face significant challenges in its effective adoption. While prior studies have emphasized strategic benefits and readiness models, there remains a lack of operational guidance tailored to SME realities—particularly regarding implementation barriers, resource constraints, and emerging demands for responsible AI use. This study presents an analysis of AI adoption in SMEs by integrating the technology–organization–environment (TOE) framework with selected attributes from the diffusion of innovations (DOI) theory to examine adoption dynamics through a dual structural and perceptual lens. Empirical insights from sectoral and regional contexts are also incorporated. Ten critical challenges are identified and analyzed across the TOE dimensions, ranging from data access and skill shortages to cultural resistance, infrastructure limitations, and weak governance practices. Notably, the framework is expanded to incorporate responsible AI governance and democratized access to generative AI—particularly open-weight large language models (LLMs) such as LLaMA, DeepSeek-R1, Mistral, and FALCON—as emerging technological and ethical imperatives. Each challenge is paired with actionable, context-sensitive solutions. The paper is a structured, literature-based conceptual analysis enriched by empirical case study insights. As a key contribution, it introduces a structured, six-phase roadmap methodology to guide SMEs through AI adoption—offering step-by-step recommendations aligned with technological, organizational, and strategic readiness. While this roadmap is conceptual and has yet to be validated through field data, it sets a foundation for future diagnostic tools and practical assessments. The resulting study bridges theoretical insight and implementation strategy—empowering inclusive, responsible, and scalable AI transformation in SMEs. By offering both analytical clarity and practical relevance, this study contributes to a more grounded understanding of AI integration and calls for policies, ecosystems, and leadership models that support SMEs in adopting AI not merely as a tool, but as a strategic enabler of sustainable and inclusive innovation.

Index Terms- artificial intelligence (AI); small and medium-sized enterprises (SMEs); technology–organization–environment (TOE) framework; diffusion of innovations (DOI); digital transformation; AI adoption challenges; innovation management

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