

AI-Enabled Market Intelligence for Strategic Management of Sustainable Technology Development Bottlenecks

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Abstract

Effective enterprise development in technology-intensive industries requires structured approaches for managing uncertainty, aligning R&D investments with market realities, and accelerating the deployment of sustainable technologies. This study examines how artificial intelligence (AI) can support organizations in systematically identifying and managing technology development bottlenecks that hinder sustainable innovation and strategic progress. Focusing on complex energy technologies within the energy transition, the paper develops and tests a bottleneck identification framework that integrates market intelligence (MI) and generative AI to enhance managerial decision-making.

Sustainable technology development is frequently constrained by a dynamic combination of internal (technical readiness, cost structures, scalability) and external (regulation, carbon pricing, infrastructure, public acceptance) bottlenecks. These evolving constraints can delay commercialization and slow progress toward climate and sustainability targets. Using Carbon Capture and Storage (CCS) as a longitudinal case, the study demonstrates how AI-supported analysis can identify, classify, and monitor bottlenecks across development phases, enabling more adaptive and evidence-based technology strategies that support sustainable transition.

The proposed framework introduces a structured bottleneck matrix for continuous monitoring of both controllable and non-controllable constraints. By linking bottleneck

assessment with MI functions, enterprises can improve strategic agility, reduce sunk development costs, and accelerate the commercialization of sustainable technologies. The framework is applicable beyond energy technologies to other long-term R&D-intensive contexts contributing to sustainable development.

The contribution lies in offering a dynamic, AI-enabled management tool that enhances organizational effectiveness, supports technology commercialization, and improves enterprise capability to respond to shifting market environments.

Keywords: Enterprise development, Bottleneck identification, Market intelligence, Artificial intelligence, Sustainable development, Energy transition, Technology commercialisation