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Artificial Intelligence-Enabled Enterprise Digital Transformation: A Decade-Long Bibliometric Analysis of Knowledge Evolution, Research Frontiers, and Emerging Trends (2015–2025)

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ABSTRACT

Artificial Intelligence (AI) has emerged as a fundamental engine reshaping modern business ecosystems, driving enterprise digital transformation (EDT) from basic operational automation to dynamic business model innovation and strategic value co-creation. Although the literature on corporate digitalization is vast, the specific intellectual architecture, thematic convergence, and dynamic evolutionary pathways of AI-empowered enterprise transformation remain dispersed across management, computer science, and information systems literature. This study presents a comprehensive scientometric analysis of 312 high-impact publications retrieved from the Web of Science Core Collection (2015–2025). Leveraging CiteSpace 7.0.1 Advanced, we map global scientific collaboration networks, keyword co-occurrence topologies, thematic cluster structures, timeline progressions, and strong citation bursts. The empirical findings reveal an explosive publication expansion starting in 2022, with China and the United States serving as structural central hubs in global knowledge diffusion. Keyword clustering uncovers six core domain fronts: Smart Industrial IoT & Supply Chain Integration, Generative AI & Business Model Innovation, Enterprise Data Governance & Analytics, Intelligent Workflow Automation, Organizational Agility & Workforce Transformation, and AI Ethics & Strategic Risk Stewardship. Citation burst analytics highlight a pivotal paradigm transition from IT infrastructure optimization toward generative corporate workflows, agentic decision-support systems, and responsible AI governance. Based on these insights, a multi-tier strategic implementation matrix is formulated to assist executive leaders and corporate strategists in orchestrating sustainable AI-driven digital transformation.

Keywords: artificial intelligence, CiteSpace, enterprise digital transformation, business model innovation, smart supply chain, enterprise data governance

1. INTRODUCTION

1.1 Research Background

Enterprise Digital Transformation (EDT) has transcended its traditional scope of IT infrastructure modernization and enterprise resource planning (ERP) deployments. Today, digital transformation represents a holistic, strategic reconfiguration of business models, organizational structures, customer engagement channels, and corporate governance.

Historically, enterprise digitalization unfolded through three progressive phases: digitisation (converting analogue business records into digital forms), digitalization (automating discrete functional workflows), and digital transformation (holistically altering value proposition and organizational identity through digital technologies).

Over the past decade, the rapid maturation of frontier technologies—specifically Machine Learning (ML), Natural Language Processing (NLP), Industrial Internet of Things (IIoT), Predictive Analytics, and Generative AI (GenAI)—has ushered enterprise transformation into an AI-empowered era. Unlike passive IT tools, AI functions as a autonomous cognitive partner capable of strategic forecasting, real-time supply chain optimization, hyper-personalized customer experience engineering, and automated decision support. Smart factories leverage computer vision for predictive maintenance; enterprise platforms integrate intelligent agents for supply chain orchestration; and corporate executives utilize large language models (LLMs) to synthesize market intelligence and accelerate product development cycles.

However, embedding AI deep into enterprise architectures introduces significant management, operational, and ethical complexities. Executives face the enterprise "AI paradox": balancing rapid algorithmic innovation against corporate data sovereignty, algorithmic bias, legacy system integration, and workforce displacement anxieties. Despite a soaring volume of academic inquiries, the scholarship on AI-empowered enterprise transformation remains fragmented across strategic management, information systems, operations research, and organizational behavior journals. A quantitative, scientometric synthesis is imperative to map the field's intellectual core, structural hotspots, and emerging fronts.

1.2 Research Objectives and Questions

This study aims to systematically visualize and decipher the intellectual landscape, collaborative networks, domain hotspots, and temporal evolutionary trajectories of AI-empowered enterprise digital transformation between 2015 and 2025. Utilizing CiteSpace 7.0.1 Advanced, this paper addresses three primary research questions:

> **RQ1:** What are the global publication growth trends and primary country/institutional collaborative networks shaping research on AI-empowered enterprise digital transformation from 2015 to 2025?
>
> **RQ2:** What are the dominant research hotspots and structural thematic clusters that constitute the intellectual topology of AI-driven business transformation?
>
> **RQ3:** How have these research priorities evolved over time, and what emerging fronts and burst keywords define the future trajectory of enterprise AI integration?

2. LITERATURE REVIEW

2.1 From Digitalization to AI-Empowered Enterprise Transformation

Conceptual frameworks in enterprise strategy have continuously adapted to technological paradigms. Early Resource-Based View (RBV) and Dynamic Capabilities theories viewed IT as an operational enabler that supported corporate efficiency. Digital transformation initially focused on cloud adoption, enterprise mobility, and e-commerce platform expansion, evaluating technology acceptance metrics (e.g., TAM, UTAUT).

The integration of advanced AI fundamentally shifts the nature of dynamic capabilities. AI-empowered transformation shifts corporate focus from operational efficiency to cognitive organizational agility. At the strategic level, predictive and generative algorithms enable dynamic sensing of market shifts and rapid business model pivots. At the operational level, automated cognitive agents streamline supply chain logistics, financial forecasting, and human resource management. At the customer interface level, AI enables continuous, real-time hyper-personalization. Consequently, AI-empowered EDT is a multi-layered organizational phenomenon re-engineering strategic agency, data governance, and corporate culture.

2.2 Methodological Gaps in Existing Syntheses

While qualitative literature reviews and strategic management case studies have examined targeted aspects of corporate AI adoption—such as Industry 4.0 applications or GenAI in marketing—they often lack quantitative, macro-level mapping. Qualitative reviews are inherently susceptible to subject selection bias, restricted sample sizes, and an inability to empirically map structural relationships across interdisciplinary domains. Scientometric mapping mitigates these limitations by analyzing bibliographic topologies, clustering structural domain networks, and tracking citation burst patterns across thousands of citations over time.

3. MATERIAL AND METHODS

3.1 Data Retrieval Strategy

Bibliographic data were retrieved from the Web of Science (WoS) Core Collection (SCIE, SSCI, and AHCI). To capture the multi-faceted landscape of AI-driven enterprise transformation, a structured Boolean search query was executed across three core topic categories:

> **AI Technology Terms:** ("artificial intelligence" OR "machine learning" OR "generative AI" OR "large language models" OR "predictive analytics" OR "deep learning" OR "cognitive computing");
>
> **Enterprise Digital Transformation Terms:** ("enterprise digital transformation" OR "corporate digitalization" OR "business model innovation" OR "smart manufacturing" OR "intelligent supply chain" OR "digital corporate governance");
>
> **Business Domain Context:** ("enterprise" OR "firm" OR "corporation" OR "business model" OR "industry 4.0" OR "commercial enterprise").

The temporal window was set from January 1, 2015, to December 31, 2025. Document types were refined to English peer-reviewed journal articles and comprehensive literature reviews. Following rigorous deduplication and relevance screening, a final dataset of 312 high-impact bibliographic records containing complete citation and abstract details was retained for bibliometric processing.

3.2 CiteSpace Visual Analytics Configuration

CiteSpace 7.0.1 Advanced was configured to perform network co-occurrence and cluster analysis. Time slicing spanned 2015 to 2025 with 1-year per slice. Selected node types included Country, Institution, Keyword, and Cited Reference. Node selection was controlled using the g-index parameter with a scaling factor $k = 25$. Link retaining factor was set to 2.5, links per node to 10, look-back period to 5 years, and e-value to 1.0. No pruning algorithms (such as Pathfinder) were applied to retain full network complexity.

Cluster structural validity was evaluated using Modularity Q ($Q > 0.3$ indicates valid structural partitioning) and Weighted Mean Silhouette S ($S > 0.7$ denotes strong cluster homogeneity). Cluster labeling was performed using the Log-Likelihood Ratio (LLR) algorithm. Temporal keyword burstness was calculated using Kleinberg's burst detection algorithm ($\gamma = 0.5$, minimum burst duration = 2 years).

4. RESULTS AND DISCUSSION

4.1 Publication Trajectory and Global Collaboration Topology

The historical distribution of the 312 analyzed publications exhibits three distinct evolutionary stages: Early Exploration Phase (2015–2018, $n = 15$, 4.81%), Acceleration Phase (2019–2021, $n = 43$, 13.78%), and Hyper-Growth Phase (2022–2025, $n = 254$, 81.41%). The inflection point in 2022/2023 reflects the inflection of generative AI platforms and enterprise-grade predictive analytics, which galvanized strategic inquiry into AI-driven business models.

Table 1. Annual Publication Volume and Top Contributing Countries/Regions

Panel A. Annual publication distribution

Year	Publication Count (n)	Percentage (%)	Cumulative (%)
2015	3	0.96%	0.96%
2016	3	0.96%	1.92%
2017	4	1.28%	3.20%
2018	5	1.61%	4.81%
2019	9	2.88%	7.69%
2020	14	4.49%	12.18%
2021	20	6.41%	18.59%
2022	32	10.26%	28.85%
2023	48	15.38%	44.23%
2024	76	24.36%	68.59%
2025	98	31.41%	100.00%
Total	**312**	**100.00%**	**100.00%**

Panel B. Top contributing countries/regions

Country/Region	Publication Count	Betweenness Centrality
People's Republic of China	82	0.31
United States	61	0.36
United Kingdom	28	0.16
Germany	22	0.14
Italy	19	0.09
Australia	15	0.10

Country/Region	Publication Count	Betweenness Centrality
Singapore	12	0.06

The cross-national collaboration network ($N = 52, E = 148$, Density $= 0.1116$) displays robust global academic exchange. China ($n = 82$) and the United States ($n = 61$) represent the two main research hubs. The United States exhibits the highest betweenness centrality (0.36), followed by China (0.31) and the United Kingdom (0.16). In scientometric mapping, nodes with centrality scores ≥ 0.10 serve as crucial knowledge bridges across international research communities.

Institutional analysis highlights key research nodes including Tsinghua University, Massachusetts Institute of Technology (MIT), Technical University of Munich, National University of Singapore, and Cambridge University. However, overall institutional network density remains modest, indicating that research is still predominantly clustered in regional centers of excellence.

4.2 Research Hotspots and Keyword Cluster Architecture

To decode the structural composition of the field, keyword co-occurrence mapping was performed. The network topology ($N = 280, E = 985$, Density $= 0.0252$) yielded a **Modularity Q score of 0.6724** and a **Weighted Mean Silhouette S score of 0.8215**, confirming strong structural modularity and cluster consistency.

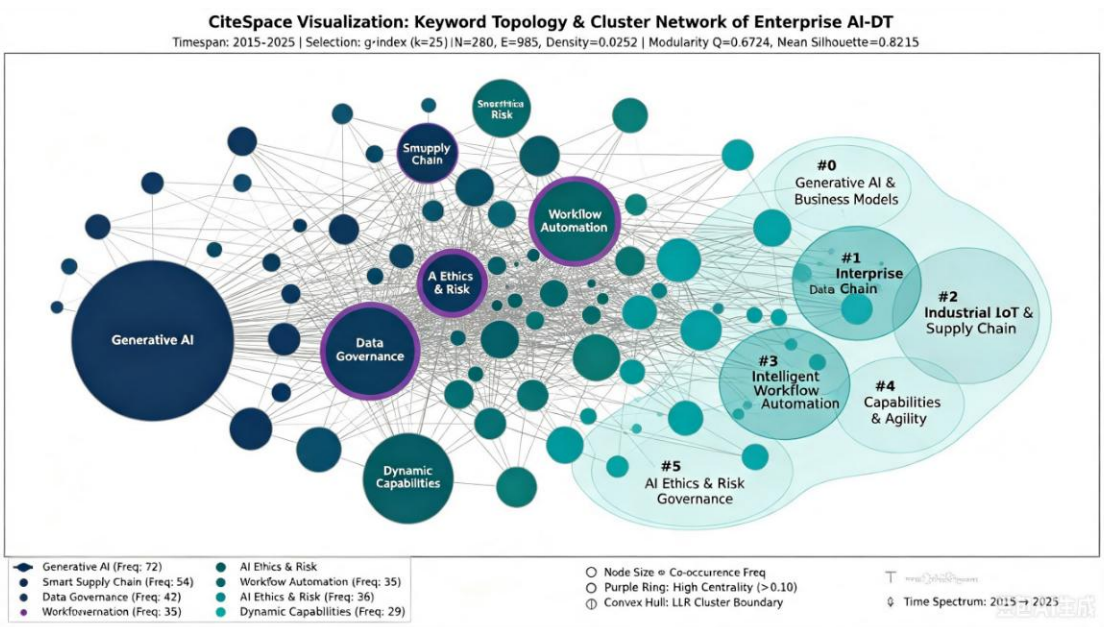

Figure 1. Keyword Co-occurrence Topology and LLR Cluster Map of Enterprise AI Digital Transformation

Execution of the LLR algorithm generated six primary thematic clusters. Table 2 outlines the quantitative characteristics, Silhouette values, mean publication years, and core keywords defining each cluster.

Table 2. Summary of Major Keyword Clusters Identified by CiteSpace

Cluster ID	LLR Label	Size (Nodes)	Silhouette (S)	Mean Year	Core High-Frequency Keywords
#0	Generative AI & Business Model Innovation	58	0.845	2024	generative AI, business model innovation, value co-creation, LLMs, enterprise agents, agile strategy
#1	Smart Industrial IIoT & Supply Chain	51	0.792	2018	smart manufacturing, Industry 4.0, IIoT, supply chain agility, predictive maintenance, logistics
#2	Enterprise Data Governance & Analytics	45	0.831	2021	data governance, predictive analytics, enterprise architecture, data sovereignty, business intelligence
#3	Intelligent Workflow Automation	38	0.854	2020	robotic process automation, intelligent workflows, operational efficiency, ERP integration, cloud management
#4	Dynamic Capabilities & Organizational Agility	34	0.871	2019	dynamic capabilities, organizational agility, change management, workforce upskilling, corporate culture
#5	AI Ethics & Strategic Risk Governance	30	0.903	2023	AI ethics, algorithmic risk, corporate governance, data privacy, responsible AI, compliance policy

Detailed evaluation of these six clusters highlights the structural components of enterprise AI transformation:

Cluster #0 (Generative AI & Business Model Innovation): Represents the dominant and expanding cluster ($N = 58, S = 0.845$). Research focuses on leveraging foundation models to reinvent corporate value propositions, automate strategic market analysis, and enable agentic customer interactions.

Cluster #1 (Smart Industrial IIoT & Supply Chain): Forms the operational foundation ($N = 51, S = 0.792$, Mean Year = 2018). Focuses on connecting physical shop floors with cyber-physical systems, deploying predictive maintenance, and orchestrating resilient supply chains.

Cluster #2 (Enterprise Data Governance & Analytics): Centers on enterprise data management ($N = 45, S = 0.831$). Research addresses data silos, establishing master data management protocols, and leveraging predictive engines to support executive decision-making.

Cluster #3 (Intelligent Workflow Automation): Covers middle- and back-office automation ($N = 38, S = 0.854$), bridging Robotic Process Automation (RPA) with AI tools to streamline financial reporting, HR onboarding, and customer service.

Cluster #4 (Dynamic Capabilities & Organizational Agility): Examines human and structural alignment ($N = 34, S = 0.871$). Guided by dynamic capability theory, scholars analyze how firms reconfigure human capital and overcome organizational inertia during AI adoption.

Cluster #5 (AI Ethics & Strategic Risk Governance): Displays the highest silhouette score ($N = 30, S = 0.903$), focusing on corporate AI risk stewardship, algorithmic transparency, data privacy compliance (e.g., GDPR), and responsible AI implementation.

4.3 Temporal Evolution and Emerging Citation Bursts

The temporal timeline mapping illustrates a clear three-stage evolution in corporate research priorities over the past decade:

Table 3. Keywords with the Strongest Citation Bursts (2015–2025)

Keyword	Strength	Begin Year	End Year
Smart Factory	2.28	2016	2020
Industry 4.0	2.65	2017	2021
Predictive Analytics	3.34	2019	2022
Process Automation	2.92	2020	2023
Dynamic Capabilities	3.61	2021	2024
Generative AI	7.35	2023	2025
Responsible AI Governance	5.48	2023	2025

Analysis of citation bursts (Table 3) demonstrates significant shifts in how enterprises approach technological transformation:

Phase I: Physical & Network Digitisation (2015–2018): Centered on hardware integration and factory automation. Keywords like Smart Factory (burst strength: 2.28) and Industry 4.0 (2.65) dominated, framing transformation primarily as an operational IT update.

Phase II: Analytical & Operational Efficiency (2019–2022): Driven by market volatility and remote work mandates, research shifted toward enterprise data management. Predictive Analytics (3.34) and Process Automation (2.92) reflected a focus on cost reduction and operational forecasting.

Phase III: Agentic Strategic Re-engineering (2023–2025): The current research front is defined by high burst strengths in Generative AI (7.35) and Responsible AI Governance (5.48). Enterprise focus has moved from back-office processing to strategic business model innovation and responsible AI management.

4.4 Integrated Discussion and Strategic Implementation Framework

The scientometric evidence shows that AI-empowered enterprise transformation requires aligning business strategy, technological architecture, organizational culture, and risk management.

Despite rapid advancements, enterprise leaders navigate three recurring structural hurdles:

1. **The Strategy-Execution Gap:** Strategic mandates for AI transformation often falter due to legacy systems and fragmented enterprise data architecture.
2. **Algorithmic Trust and Regulatory Compliance:** Complex "black-box" models introduce reputational, compliance, and operational risks that legacy risk frameworks are ill-equipped to manage.
3. **Cultural Inertia and Workforce Reskilling:** Operational personnel frequently resist AI integration due to fear of role redundancy and insufficient training.

To overcome these challenges, Table 4 outlines an actionable implementation matrix across macro, meso, and micro enterprise levels:

Table 4. Multi-Level Implementation Matrix for AI Enterprise Digital Transformation

Enterprise Level	Primary Focus Domain	Key Strategic Actionable Interventions
Macro Level (C-Suite & Board Governance)	Strategic Alignment & Ethics (Clusters #0 & #5)	• Establish Responsible AI Governance Committees reporting directly to the Board. • Align AI investments with core business model innovations rather than isolated IT projects. • Build data sovereignty protocols and transparent algorithmic compliance guidelines.
Meso Level (Business Units & Operations)	Data Governance & Automation (Clusters #1 & #3)	• Modernize enterprise data infrastructure to break down data silos. • Deploy agentic workflows and RPA-AI hybrids to automate routine operational processes. • Implement real-time predictive analytics across supply chains and customer channels.
Micro Level (Workforce & Team Culture)	Dynamic Capabilities & Upskilling (Clusters #2 & #4)	• Develop continuous AI upskilling and prompt-engineering programs for personnel. • Design human-in-the-loop workflows that enhance employee agency rather than replacing it. • Cultivate an agile organizational culture that embraces iterative experimentation.

5. CONCLUSION

This study conducted a comprehensive scientometric synthesis of AI-empowered enterprise digital transformation research from 2015 to 2025 using CiteSpace 7.0.1. By analyzing 312 WoS Core Collection publications, the study mapped the evolution of the field from factory-floor automation toward generative business model innovation and responsible corporate governance.

Keyword clustering identified six major domain fronts: Generative AI & Business Model Innovation, Smart Industrial IIoT & Supply Chain, Enterprise Data Governance & Analytics, Intelligent Workflow Automation, Dynamic Capabilities & Organizational Agility, and AI Ethics & Strategic Risk Governance. Citation burst analysis highlighted recent acceleration in Generative AI and Responsible AI Governance.

Future inquiries should prioritize longitudinal empirical studies assessing the impact of enterprise AI platforms on firm financial performance, market valuation, workforce dynamics, and environmental sustainability.

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