

Value Transmission Pathways of AI-Driven Cross-Domain Innovation: A Literature Review (2022-2026)

Abstract

Artificial intelligence (AI) has become a pivotal driver of cross-domain value creation, with its innovative potential transmitting across healthcare, quantum science, digital commerce, cybersecurity, and finance through distinct pathways. This review synthesizes 10 recent studies (2022-2026) to identify three core value transmission mechanisms: technical empowerment (transfer of AI algorithms and architectures to solve domain-specific problems), data circulation (privacy-protected data flow enabling cross-sector insight sharing), and ecosystem radiation (inclusive frameworks extending AI benefits to diverse stakeholders). By analyzing how value propagates from AI innovation hubs to peripheral sectors, the paper reveals that effective transmission relies on algorithmic adaptability, data trustworthiness, and stakeholder inclusivity. The findings provide a novel framework for understanding how AI innovation generates spillover effects across domains, offering guidance for researchers optimizing value transmission efficiency and practitioners leveraging cross-domain AI dividends.

1 Introduction

The transformative impact of AI is no longer confined to individual domains but spreads across sectors through interconnected value transmission pathways [1][10]. For instance, AI advancements in computer vision (healthcare) have enhanced risk detection in cybersecurity [5], while privacy-preserving techniques (digital commerce) have improved data sharing in medical research [9]. However, the mechanisms through which AI value transmits across domains remain underexplored—existing research focuses on innovation within sectors rather than how value spills over between them [3][7]. This review addresses this gap by synthesizing recent literature (2022-2026) to map the value transmission pathways of cross-domain AI innovation. By integrating findings from five diverse fields, this paper aims to unpack how AI-driven value flows, adapts, and amplifies across sectors, providing a holistic understanding of cross-domain AI's transformative potential.

2 Core Value Transmission Pathways of Cross-Domain AI Innovation

2.1 Technical Empowerment: Algorithmic Adaptation and Reconfiguration

Technical empowerment represents the most direct value transmission pathway, where AI algorithms, architectures, and methodologies developed for one domain are adapted or reconfigured to address challenges in another. This pathway relies on the inherent flexibility

of AI technologies to be tailored to domain-specific needs while retaining core functional strengths. In healthcare, Chang et al. [1] reconfigured path aggregation (a computer vision technique) and dual attention mechanisms (originally for sequential data analysis) to develop the PDU-Net algorithm, transmitting computer vision's precision value to lung nodule segmentation—a critical medical imaging task. In finance, Li and Liu [10] adapted LSTM models (designed for natural language processing) to time-series financial data, transmitting the algorithm's sequential prediction value to portfolio optimization, significantly improving market trend forecasting accuracy. In cybersecurity, Zhou [5] reconfigured static (SAST) and dynamic (DAST) testing techniques (from software engineering) into a hybrid SCA-IAST framework, transmitting software testing's risk identification value to microservice vulnerability prioritization. This pathway demonstrates how AI's technical core can be repurposed, enabling value to flow directly across domain boundaries.

2.2 Data Circulation: Privacy-Protected Insight Sharing

Data circulation is a foundational value transmission pathway, where cross-domain data—processed and shared via privacy-enhancing technologies (PETs)—transmits actionable insights between sectors. This pathway resolves the "data island" problem, allowing domains to leverage each other's data assets without compromising privacy or compliance. In digital commerce, Yi [3][8] developed federated learning frameworks integrated with differential privacy and zero-knowledge verification, enabling cross-channel data circulation between retailers, platforms, and advertisers. This transmits consumer behavior insights across channels, optimizing marketing strategies while protecting user privacy. In healthcare, Yue et al. [9] used EHR phenotyping with de-identification techniques to facilitate cross-institutional data circulation for HIV treatment adherence research, transmitting patient care insights across medical facilities to develop more effective intervention strategies. Even in quantum physics, Wu et al. [2] noted that privacy-preserving data circulation could transmit quantum system insights between research teams, accelerating the refinement of unsupervised learning models for quantum geometry modeling. PETs act as enablers for this pathway, ensuring that data-driven value can flow securely across domains.

2.3 Ecosystem Radiation: Inclusive Frameworks Extending Value Reach

Ecosystem radiation is a scalable value transmission pathway, where inclusive AI frameworks extend the benefits of cross-domain innovation to diverse stakeholders—including SMEs, marginalized sectors, and non-technical users. This pathway ensures that AI value is not concentrated in resource-rich organizations but radiates outward to create systemic impact. In digital commerce, Yi [7] developed a multi-tenant trusted AI infrastructure, integrating standardized APIs and incentive systems to enable SMEs to access cross-sector AI capabilities. This radiates the value of advanced AI marketing and recommendation systems from large corporations to small businesses, leveling the competitive playing field. In cybersecurity, Zhou [4] proposed the M-VP2 method, which uses multi-agent reinforcement learning to align the interests of IT teams, security vendors, and business units. This framework radiates cybersecurity value across organizational departments, ensuring that vulnerability patch planning balances technical security needs

with operational efficiency and cost constraints. In financial ESG governance, Liu [6] highlighted the need for inclusive AI tools that transmit ESG optimization value to cash-constrained SMEs, enabling them to improve their ratings and participate in sustainable finance ecosystems. This pathway demonstrates how inclusive design ensures that cross-domain AI value reaches diverse stakeholders, maximizing societal and economic impact.

3 Factors Shaping Value Transmission Efficiency

3.1 Enablers of Efficient Transmission

Three key factors enhance the efficiency of cross-domain AI value transmission: first, **algorithmic modularity**—AI systems designed with reusable components that can be easily adapted to different domains [1][5]; second, **data standardization**—consistent data formats and governance frameworks that facilitate cross-sector data circulation [3][9]; and third, **stakeholder co-creation**—involving diverse users in AI design to ensure frameworks are inclusive and domain-relevant [7][4]. These enablers reduce friction in value transmission, ensuring that AI innovation can flow seamlessly across sectors.

3.2 Barriers to Effective Transmission

Several barriers hinder cross-domain value transmission: **technical lock-in**—AI systems over-specialized for a single domain, making adaptation difficult [2][10]; **regulatory inconsistency**—varying privacy and compliance rules across sectors that disrupt data circulation [3][8]; and **value misalignment**—AI innovation focused on narrow domain needs rather than cross-sector benefits [6][9]. For example, quantum physics AI models often use specialized data formats that are incompatible with financial systems, creating technical lock-in that blocks value transmission [2]. Similarly, conflicting privacy regulations between healthcare (HIPAA) and digital commerce (GDPR) complicate data circulation, limiting insight sharing [8]. Addressing these barriers is critical for maximizing cross-domain AI value.

4 Discussion and Strategic Implications

The literature synthesis reveals that AI-driven cross-domain value transmission is a multi-faceted process, with technical empowerment, data circulation, and ecosystem radiation acting as interconnected pathways. Technical empowerment provides the foundational tools, data circulation supplies the insights, and ecosystem radiation ensures widespread impact—together, these pathways create a value transmission loop that amplifies AI's transformative potential. For researchers, the findings highlight the need to design AI systems with modularity and adaptability in mind, prioritizing reusable components and standardized data interfaces to facilitate cross-domain transmission. For practitioners, the pathways offer actionable strategies: leveraging technical empowerment by adapting proven AI algorithms to new domains, using PETs to unlock data circulation, and adopting inclusive frameworks to extend value to diverse stakeholders. Policymakers can support efficient transmission by promoting data standardization and regulatory harmonization, reducing barriers to cross-sector collaboration.

Future research should focus on quantifying the impact of each transmission pathway, exploring how value amplifies as it moves across multiple domains. Additionally, case studies of successful cross-domain value transmission (e.g., healthcare AI empowering cybersecurity, digital commerce PETs enabling medical research) could provide practical insights into overcoming barriers. Developing metrics to measure value transmission efficiency—such as adaptation cost, data circulation speed, and stakeholder reach—would also help researchers and practitioners optimize cross-domain AI initiatives.

5 Conclusion

This review synthesizes recent literature to identify the core value transmission pathways of cross-domain AI innovation: technical empowerment, data circulation, and ecosystem radiation. These pathways enable AI value to flow across healthcare, quantum science, digital commerce, cybersecurity, and finance, adapting to domain-specific needs and creating systemic impact. While algorithmic modularity, data standardization, and stakeholder co-creation enhance transmission efficiency, technical lock-in, regulatory inconsistency, and value misalignment pose significant barriers. By understanding these pathways and factors, researchers, practitioners, and policymakers can optimize cross-domain AI value transmission, unlocking transformative benefits that no single domain could achieve alone. As AI continues to evolve, prioritizing efficient value transmission will be critical for realizing its full potential as a cross-sector innovation driver.

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