Article

Research on the Connotation Evolution and Key Issues of the "Domain" in Data Circulation and Utilization Under the Background of Artificial Intelligence

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Abstract: The rapid development of artificial intelligence has highlighted data as a core production factor in the digital economy, while privacy protection, security risks, and compliance constraints continue to restrict the potential of data circulation and utilization. In this context, the concept of the "domain" provides a new analytical perspective for defining the boundaries, responsibilities, and conditions of lawful and efficient data use. This paper systematically examines the connotation evolution of the "domain" in data circulation, tracing its transformation from a purely technical or physical scope to a comprehensive socio-technical governance space that integrates legal, organizational, and technological dimensions. It analyzes key issues including legal frameworks for data privacy, security and encryption measures, standardization of data classification and access rules, differences between domestic and foreign regulatory practices, and the innovation of multi-stakeholder governance models. The study argues that clarifying domain boundaries can standardize data circulation processes, reduce risks of leakage, abuse, and unauthorized cross-border transfer, and support the construction of transparent and auditable data flow mechanisms. Furthermore, driven by blockchain, the Internet of Things, and other emerging technologies, the design of dynamic, scenario-based domains tailored to industry characteristics will become a central topic in the marketization of data elements. Finally, the paper emphasizes that a sound policy, regulatory, and governance framework is essential to safeguard healthy data circulation and promote sustainable, innovation-driven digital economic development.

Keywords: artificial intelligence; data circulation; data governance; privacy protection; data security

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1. Introduction

1.1. Research Background and Significance

With the rapid advancement of artificial intelligence, data has emerged as a fundamental element driving the digital economy. The processes of algorithm training and system operation are increasingly dependent on vast amounts of data [1, 2]. However, challenges such as privacy protection, security vulnerabilities, and compliance concerns in data circulation have become significant obstacles that hinder the full realization of its potential value. As a governance framework extending beyond technical considerations, the concept of "domain" emphasizes the establishment of clear boundaries for data circulation and its efficient utilization. The absence of unified global rules for data circulation has resulted in widespread data silos and regulatory gaps, creating challenges for effective governance. Exploring the connotation of the "domain" concept and addressing its key issues can help standardize data circulation practices, foster a trusted ecosystem for artificial intelligence, and facilitate mechanisms for cross-border data flow [3]. This approach provides essential theoretical foundations for policymakers and practical guidance for enterprises, contributing valuable insights to the development of international data governance frameworks.

1.2. Research Objectives and Methodology

This study investigates the evolving concept and critical challenges associated with the term "domain" in the context of AI-driven data circulation, aiming to provide a robust theoretical foundation for policy development and technical implementation. The research seeks to elucidate the role of "domain" in facilitating data circulation, examining its implications for data privacy, security, and standardization. Furthermore, it explores how the concept of "domain" has expanded beyond traditional boundaries to encompass both technical and social dimensions, addressing the unique demands of the AI era. Employing a mixed-methods approach that integrates qualitative and quantitative analyses, the study utilizes a comprehensive review of existing literature to trace the transformation of the "domain" concept, alongside case studies to evaluate its practical challenges in various fields. Comparative analysis is employed to identify governance strategies tailored to specific contexts. By focusing on data right confirmation as a pivotal entry point in the absence of formalized data ownership legislation, the research develops an integrated framework combining technical, legal, and economic perspectives to address disputes over ownership and the equitable distribution of interests. The findings aim to serve as valuable references for policymakers and industry practitioners.

2. The Relationship Between Artificial Intelligence and Data Circulation

2.1. Brief Overview of Artificial Intelligence Technology

Artificial Intelligence (AI) is a discipline focused on simulating and extending human intelligence in computers, with the core goal of endowing machines with capabilities such as learning, reasoning, decision-making, and perception. Its evolution has progressed from symbolic logic to deep learning, becoming a key driver of digital transformation across industries. Machine learning, as the foundation of AI, extracts patterns from historical data via algorithms to enable prediction. Deep learning, a subfield of machine learning, leverages neural networks for efficient processing of complex data and automatic feature extraction. Together with natural language processing and computer vision, these technologies constitute the core technical directions of AI, offering transformative potential across diverse applications (As shown in Table 1).

Table 1. Main Technical Directions of Artificial Intelligence and Their Typical Application Scenarios.

Technical Direction	Description	Typical Application Scenarios
Machine Learning	Trains models based on data to realize prediction and decision-making	Risk assessment, recommendation systems
Deep Learning	Processes complex data using neural networks	Image recognition, speech synthesis
Natural Language Processing	Enables machines to understand and generate human language	Intelligent customer service, text analysis
Computer Vision	Extracts information from images or videos	Autonomous driving, security monitoring

The development of AI relies on three core elements: algorithms, computing power, and big data. Algorithms play a critical role in determining the efficiency of task execution, while computing power provides the essential hardware foundation for processing complex computations. Big data serves as the indispensable resource for model training, enabling AI systems to learn and adapt effectively. With ongoing technological advancements, AI has demonstrated extensive application potential in various fields, including urban construction, industrial manufacturing, and education. Its ability to

operate across domains highlights its significance as a general-purpose technology, capable of driving innovation and enhancing productivity in numerous sectors.

2.2. Basic Concepts of Data Circulation

Data circulation is a fundamental aspect of the modern digital economy, encompassing the flow and transfer of data among various entities, such as governments, enterprises, and individuals, under clearly defined rules and mechanisms. It includes scenarios such as data exchange, sharing, trading, and opening-up, with data trading serving as the primary market-oriented form [4]. The concept can be understood as the transmission of raw data between controllers to enable intelligent analysis and decision-making. Furthermore, it extends across the entire data lifecycle, including stages such as collection, storage, processing, transmission, and utilization. This process is characterized by both technical and governance dimensions, while also presenting challenges such as potential security risks, including data leakage, tampering, and misuse. In practical applications, data circulation operates through three primary modes: sharing, opening-up, and trading, with trading being the most prevalent [5]. Trading platforms facilitate these processes by offering services through APIs and data packages, while additional services, such as data quality evaluation, contribute to the enrichment of the ecosystem. Importantly, data circulation is not limited to market-based activities. Non-market forms, such as charitable donations, government-led data opening, and collaborative efforts among enterprises, also play significant roles. These diverse modes of circulation collectively enhance the value of data and establish a robust foundation for advancements in artificial intelligence.

3. The Evolution of the Connotation of the Domain

3.1. Theoretical Foundations of "Domain"

Against the backdrop of artificial intelligence (AI) development, the "domain" has emerged as a pivotal theoretical construct for analyzing data circulation and technological ecosystems. As a techno-social field characterized by temporal and spatial attributes, it emphasizes the synergies among diverse technological clusters, with its theoretical underpinnings rooted in two primary dimensions: technical holism and module interoperability. Technical holism conceptualizes the "domain" as a complex and integrated ecosystem. It is defined as a collection of technologies unified by shared objectives. In AI-driven smart domains, elements such as algorithms, computational power, and extensive datasets coalesce into an inseparable entity, fundamentally transforming social ecosystems. Module interoperability, on the other hand, highlights the "domain's" adaptable and dynamic structure [6]. This is exemplified by a systemic network of independent yet interdependent sub-modules, such as digital virtual spaces that rely on the interaction between virtual and real-world modules, as well as the optimization of sub-modules to meet evolving requirements. Historically, the concept has evolved from the Logos domain to smart domains through successive technological revolutions. Looking ahead, advancements in AI are anticipated to further refine "domain" theory, offering new insights into data governance and its applications.

3.2. Historical Evolution of the "Domain"

Driven by artificial intelligence, the concept of "domain" has undergone significant transformation, evolving from simplicity to complexity and transitioning from static to dynamic states. Initially, the term "domain" referred to physical or functionally specific technological systems, characterized by isolated mediums such as newspapers, radio, and television, which exhibited limited scalability [2, 7]. The advent of digital technology expanded the scope of "domain" into a multi-dimensional framework, connecting humans and objects across electromagnetic and cyberspace. This progression laid the groundwork for the emergence of smart domains. By integrating big data, cloud computing, and advanced algorithms, smart domains have developed into interconnected ecosystems

driven by data [8]. These ecosystems not only redefine technological applications but also reshape social structures, reflecting underlying dynamics of power, including political, economic, and societal influences. The historical trajectory of "domain" highlights its transition from a static construct to a dynamic and multifaceted entity, underscoring its pivotal role in modern technological and social paradigms (As shown in Table 2).

Table 2. Historical Evolution Stages and Core Characteristics of the "Domain".

Stage	Core Characteristics	Representative Technologies
Single-medium Technology Domain	Single function, lack of compatibility	Newspapers, radio, television
Digital Domain	Information interconnection, preliminary intelligence	Computers, the Internet
Smart Domain	Internet of Everything, data-driven	Big data, cloud computing, intelligent algorithms

From the perspective of the philosophy of technology, the evolution of the "domain" signifies not only advancements in technical capabilities but also the reconfiguration of social ecosystems. The conceptual framework defining "domain" integrates dimensions of field, entity, and problem, emphasizing its dynamic and complex nature. This approach facilitates a deeper understanding of smart domain development. The progression of "domain" is driven by the interplay between technological innovation, societal transformation, and ecological considerations, forming a holistic model that captures the essence of its evolution. This interaction underscores the importance of viewing technological domains as adaptive systems influenced by broader environmental and social factors.

$$D_{evolution} = f\left(T_{technology}, S_{society}, E_{ecology}\right) \quad (1)$$

This formula encapsulates the reciprocal relationships among the three factors, illustrating their interconnected nature and mutual influence in shaping the evolution of the "domain".

4. Key Issues Between the Domain and Data Circulation

4.1. Data Privacy and Security Issues

4.1.1. Legal Framework for Data Privacy

The rapid advancement of artificial intelligence has elevated data privacy to a critical legal concern, as traditional legal systems face challenges in addressing the unique risks posed by AI-driven technologies [8]. The unconsented collection, storage, and analysis of large-scale data present significant threats to personal privacy rights. Such practices can lead to breaches of privacy or even violations of fundamental human rights, underscoring the urgent need for a comprehensive and robust legal framework to address these issues effectively [9, 10].

Certain regulatory frameworks have emerged as benchmarks for addressing data privacy concerns [11]. For instance, some regulations establish principles such as data minimization and the requirement for explicit user consent to protect the rights of individuals. Similarly, other legal systems emphasize the protection of sensitive personal information, particularly in scenarios involving advanced technologies. However, no single framework can comprehensively address the multifaceted risks associated with complex AI applications, highlighting the need for continuous refinement and adaptation of legal mechanisms.

The involvement of multiple stakeholders in AI systems introduces significant challenges in determining liability for data breaches, as responsibilities often become fragmented and unclear [12]. Additionally, the cross-border flow of data exacerbates these

challenges, creating legal conflicts and regulatory gaps due to varying national standards. To address these issues, future legal frameworks must prioritize adaptability, establish clear accountability mechanisms, and incorporate dynamic regulatory approaches. Such measures are essential to achieving a balance between safeguarding privacy and fostering the continued development of artificial intelligence technologies.

4.1.2. Technical Measures for Data Security

Technical measures serve as the fundamental backbone for ensuring data security during its circulation. Encryption acts as a pivotal tool to safeguard data by preventing unauthorized access and tampering [13]. The combination of symmetric and asymmetric encryption methods strikes a balance between robust security and operational efficiency. However, traditional encryption techniques encounter significant limitations when applied to large-scale data environments, prompting the development of lightweight encryption algorithms designed to address these challenges effectively.

Access control mechanisms play a vital role in maintaining data security. Approaches such as Role-Based Access Control (RBAC) and Attribute-Based Access Control (ABAC) provide adaptable frameworks for managing user privileges. These systems enable the implementation of fine-grained policies that restrict access to sensitive data exclusively to authorized individuals. Nonetheless, improper configuration of these systems can leave vulnerabilities that fail to fully mitigate internal security threats, underscoring the need for meticulous management and oversight [14, 15] (As shown in Table 3).

Table 3. Characteristics and Application Scenarios of Mainstream Data Security Technologies.

Technology Name	Core Characteristics	Application Scenarios
Data Encryption	Prevents data leakage and tampering	Data storage and transmission
Access Control	Refined permission management	Multi-user collaboration environments
Blockchain	Immutability and transparency	Data traceability and transaction records
Data De-identification	Removes sensitive information while retaining utility	Data sharing and opening-up

Blockchain technology facilitates comprehensive traceability through the use of distributed ledgers and smart contracts, significantly reducing the risks associated with data misuse. Despite its advantages, the high computational and storage demands of blockchain systems pose barriers to widespread adoption in large-scale applications. Emerging technologies, such as federated learning and homomorphic encryption, offer innovative solutions by enabling model training without exposing raw data, thereby addressing privacy concerns in data circulation [16]. However, these approaches face notable challenges related to efficiency and implementation costs, which require further refinement to achieve broader applicability.

4.2. Standardization Issues of the Domain

4.2.1. The Necessity of Standardization

Standardization plays a pivotal role in facilitating data circulation and utilization. The implementation of unified standards is essential for enhancing the operability and compatibility of information, particularly in the context of advanced AI applications and cross-domain data sharing. Without such standards, significant challenges arise, including barriers to inter-system communication, difficulties in integrating complex datasets, and the potential for flawed decision-making processes. By addressing these

issues, standardization contributes to improved efficiency in areas such as financial resource sharing, environmental monitoring, and comprehensive risk management.

From a technical perspective, standardization minimizes the workload associated with data cleaning and conversion, ensuring that data remains comparable and consistent across various platforms. In terms of circulation, it facilitates the seamless flow of information across departments, regions, and even international borders. This capability supports the integration of heterogeneous data, enabling global enterprises to coordinate their operations more effectively and efficiently [17, 18]. Such advancements are critical for fostering collaboration and achieving operational excellence on a global scale.

Standardization serves as both a technical and managerial solution, unifying data specifications to enhance universality, shareability, and reusability [19, 20]. By reducing errors and lowering operational costs, it becomes a cornerstone for constructing efficient systems of data circulation. This dual role underscores its importance in creating robust frameworks that support the seamless exchange and utilization of information across diverse domains and applications.

4.2.2. International Standards and Domestic Practices

In global data circulation, international standards establish unified technical frameworks that facilitate interoperability and consistency. For instance, some regions adopt systems that combine pre-approved mechanisms with subsequent regulatory oversight, while others implement stringent personal data protection laws to govern cross-border data exchanges. In contrast, certain domestic practices rely heavily on pre-approval mechanisms, which can hinder the efficiency of data circulation. This approach reveals gaps in management models and technical standardization, particularly in areas such as data quality management. Although significant progress has been made in areas like data classification and transaction standards, challenges persist in aligning regional practices, which increases institutional costs and complicates integration with global frameworks. The broad compatibility offered by international standards plays a pivotal role in advancing technologies such as the Internet of Things. However, delays in contributing to transnational rule-making can undermine competitiveness in the global data economy. To address these challenges, it is essential to pursue dual standardization, focusing on both technological and regulatory frameworks [21, 22]. By refining privacy and cross-border compliance standards through the adoption of international best practices, domestic systems can better align with global expectations and enhance their overall effectiveness.

5. The Future Development Direction of the Domain

5.1. The Integration of the Domain and Emerging Technologies

5.1.1. Application Prospects of Blockchain Technology

Blockchain's decentralization, immutability, and transparency offer innovative solutions for data circulation. In the context of artificial intelligence, it effectively addresses the issue of data silos, thereby enhancing the efficiency and security of data flows. This makes it a pivotal driver of digital economic development. In data transactions, blockchain facilitates secure and transparent management of data assets. Smart contracts automate authorized workflows, while cryptographic algorithms ensure the privacy of data transmission. These features demonstrate significant potential for applications in sectors such as finance, healthcare, and supply chain management. As blockchain technology continues to mature, it is expected to drive widespread adoption in data circulation, particularly as a foundational technical pillar for establishing a globally unified data circulation network. The overall value of such a network can be expressed as:

$$V=\sum_{i=1}^{n}\sum_{j=1}^{m} f\left(D_i,D_j\right) \quad (2)$$

where V denotes the overall value of the data circulation network, D_i and D_j represent distinct datasets, and $f\left(D_i, D_j\right)$ describes the interactive relationship between these datasets. This mathematical representation underscores the interconnected nature

of data within the network, highlighting the importance of efficient data integration and interaction.

Blockchain also plays a critical role in promoting data standardization. Through the use of smart contracts, it can enforce predefined rules, standardize data formats, and establish uniform interface protocols. This significantly enhances data interoperability, creating a robust foundation for cross-industry collaboration. However, despite its broad application prospects in data circulation, blockchain technology must overcome several challenges, including technical bottlenecks and governance issues [23, 24]. Only through a combination of policy support and continuous technological innovation can blockchain truly facilitate the sustainable development of data circulation networks, ensuring their scalability and reliability in diverse applications.

5.1.2. Interaction between the Internet of Things (IoT) and the Domain

As a fundamental pillar of next-generation information technology, the Internet of Things (IoT) has significantly transformed the mechanisms and breadth of data circulation. The extensive data generated by IoT devices introduces fresh dimensions to the conceptual evolution of the "domain" while imposing more stringent demands on data circulation processes. By facilitating a profound integration of the physical and digital realms, IoT enables data generation, collection, and transmission to become increasingly decentralized and dynamic. This evolution challenges traditional understandings of domain boundaries, necessitating a redefinition that aligns with the complexities of modern data ecosystems. Furthermore, the dynamic nature of IoT-driven data flows underscores the need for adaptive frameworks capable of accommodating the fluid interplay between physical and digital environments.

Data circulation within IoT ecosystems is characterized by multi-source heterogeneity, which underscores the critical need for unified technical standards and protocols to ensure seamless device interaction. The absence of consistent specifications currently hampers interoperability among diverse devices, thereby limiting the efficiency of cross-platform data sharing [8, 25]. For instance, the incomplete adoption of standardized data exchange protocols within industrial IoT environments restricts the potential for streamlined data integration. Addressing these challenges requires a dual approach: resolving technical-level data standardization issues and fostering efficient data circulation mechanisms that prioritize security. By establishing robust frameworks for interoperability, IoT ecosystems can achieve greater cohesion, enabling devices to interact seamlessly while safeguarding the integrity and confidentiality of the data being exchanged.

The extensive deployment of IoT devices introduces complex privacy and security challenges, as data generated in open environments becomes increasingly vulnerable to unauthorized access and misuse. Within this context, the domain assumes a pivotal role in not only classifying and managing data but also safeguarding data sovereignty. Establishing a trusted mechanism for data circulation is essential to address these vulnerabilities. By enhancing technical support and governance systems, data holders can engage in circulation processes with greater confidence, while ensuring that data users operate within secure and regulated frameworks. The interaction between IoT and the domain extends beyond technical integration, representing a transformative shift in governance models. To meet the intricate and evolving demands of data circulation, intelligent solutions must be developed to enhance the domain's adaptability, ensuring that it remains responsive to the dynamic challenges posed by IoT-driven ecosystems.

5.2. Policy and Governance Framework

5.2.1. Challenges in Policy Formulation

In the context of artificial intelligence, the development of data circulation policies encompasses a wide array of dimensions, including technological, legal, economic, and societal aspects, which collectively contribute to its inherent complexity. Stakeholders

often hold differing perspectives regarding the demands and risks associated with data circulation. This divergence highlights the central tension in policy design, which revolves around balancing development and security. On one side, efficient data circulation has the potential to unlock significant value, fostering innovation and driving economic growth [26–28]. On the other side, concerns related to privacy protection, national security, and ethical considerations necessitate the imposition of stringent restrictions on data flows. This duality underscores the intricate nature of crafting policies that can simultaneously promote progress while safeguarding critical interests.

A significant challenge in this domain arises from the ambiguous definition of data ownership and the lack of a well-defined mechanism for benefit distribution. Unlike physical assets, data is characterized by its replicability and non-rivalrous nature, making ownership disputes particularly complex [29–31]. Issues such as determining equitable ratios for data sharing among enterprises and addressing risks related to information leakage create substantial barriers to the healthy development of the data transaction market. These challenges also hinder the effective implementation of comprehensive policy frameworks. Furthermore, shifts in the international landscape exacerbate the difficulties associated with policy formulation. Divergent data governance strategies, shaped by geopolitical and value-based differences, impose restrictions on cross-border data flows. For example, stringent regulatory conditions in certain regions may conflict with domestic data management practices, complicating efforts to harmonize global standards. This fragmentation of international systems not only increases the complexity of establishing unified frameworks but also places additional pressure on domestic policy coordination efforts (As shown in Table 4).

Table 4. Main Challenges and Influencing Factors in Data Circulation Policy Formulation.

Challenge Category	Specific Manifestation	Influencing Factors
Ownership and Distribution Issues	Ambiguous ownership of data rights	Technical characteristics, market structure
Security and Compliance Risks	Security risks such as data leakage and abuse	Insufficient legal supervision, technical vulnerabilities
Inconsistent International Rules	Restricted cross-border data flows	Geopolitics, cultural differences

5.2.2. Innovation in Governance Models

In the context of artificial intelligence (AI), the governance model for data circulation necessitates significant innovation to accommodate its dynamic and cross-border characteristics. Traditional governance frameworks often fall short in addressing the intricate and evolving requirements of data circulation [32, 33]. In contrast, agile governance, which emphasizes adaptability, diversity, and flexibility, has emerged as a pivotal paradigm for ensuring data security. This approach fosters a more effective balance between technological advancements and the imperative for robust data governance through multi-stakeholder collaboration. By integrating diverse perspectives and expertise, this model enhances the capacity to address the multifaceted challenges posed by modern data ecosystems.

The future of governance innovation must harmonize a global perspective with localized practices to create tailored solutions for data governance. For instance, initiatives emphasizing high-level data security as a foundation for high-quality data development underscore the importance of lawful and orderly data flows. These efforts also advocate for equitable data training practices and the collaborative construction of high-quality datasets, providing a structured framework for progress. Industry participants are encouraged to define their roles clearly and work in tandem with public regulatory bodies. By leveraging multi-tiered frameworks, stakeholders can address persistent issues such

as data silos and disparities, fostering a more integrated and equitable data governance landscape.

From a technical standpoint, the establishment of efficient, science-based regulatory tools is essential. This involves the meticulous definition of workflows for data collection, storage, processing, and sharing, alongside the assignment of responsibilities and the establishment of approval protocols. Dedicated data management teams should be formed to oversee quality control and ensure compliance with established standards. Additionally, sensitive data must be systematically classified to enable the implementation of differentiated security measures. These measures collectively contribute to a more robust and resilient framework for managing data in an increasingly complex technological environment [34–36].

6. Conclusions and Prospects

Against the backdrop of artificial intelligence (AI), the complexity of data circulation and utilization is embodied in the evolution of the connotation of the "domain." The "domain" serves not only as the technical infrastructure for data circulation but also as a critical component of the governance framework. This study identifies data privacy and security, standardization construction, and innovation in policy governance models as the core challenges in current data circulation and utilization. Addressing these issues requires the synergistic advancement of technical means and institutional design to guarantee the unlocking of data value. Furthermore, the interplay between technological innovation and governance frameworks highlights the importance of fostering adaptable systems that can respond to the rapidly changing landscape of data ecosystems. By prioritizing these challenges, stakeholders can ensure that data circulation contributes to broader societal and economic benefits.

In the future, the further development of emerging technologies such as blockchain and the Internet of Things (IoT) will render the boundaries of the "domain" increasingly blurred and dynamic. The decentralized nature of blockchain offers new possibilities for data right confirmation and circulation, while the proliferation of IoT devices raises higher requirements for real-time data processing and security. Constructing a dynamic "domain" adaptable to multi-scenario demands will become a shared research topic for academia and industry. Additionally, the integration of global standards with localized practices will play a pivotal role in fostering a robust and sustainable data circulation market. This evolution will necessitate interdisciplinary collaboration to address technical, ethical, and operational challenges, ensuring that the "domain" remains resilient and inclusive in the face of technological advancements.

Improving policy and governance frameworks is a vital direction for data circulation development. Policymakers must strike a balance between flexibility and regulation: on one hand, strengthening supervision over monopolistic practices to prevent large enterprises from forming market barriers; on the other hand, encouraging technological and model innovation to lower the threshold for small and medium-sized enterprises (SMEs) to participate in data circulation. Building a multi-stakeholder win-win data ecosystem relies on collaborative efforts from law, technology, and the market. Moreover, fostering inclusive policies that empower diverse participants will be essential for creating equitable opportunities within the data economy. By addressing these governance challenges, stakeholders can pave the way for a more transparent and efficient data circulation framework that benefits all sectors of society.

Overall, research on the "domain" in data circulation and utilization concerns not only technological progress but also social governance and economic development. Future studies should continue to advance theoretical deepening and practical innovation, refine the definition and governance system of the "domain," and contribute insights to the development of the global digital economy. Expanding the scope of research to include interdisciplinary approaches will be crucial for addressing the multifaceted challenges posed by data circulation. Additionally, fostering international collaboration can help harmonize diverse perspectives and practices, ensuring that the "domain"

evolves in a manner that supports sustainable growth and equitable access to digital resources. By prioritizing these efforts, the academic and industrial communities can drive meaningful progress in shaping the future of data ecosystems.

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