

A CONTROL-DRIVEN DATA ASSET CLASSIFICATION METHOD FROM A RIGHTS PERSPECTIVE

DaXing Chen, Kun Meng*, YuChen Zhao, QiYuan Wang
Beijing Information Science and Technology University, Beijing 100192, China.
**Corresponding Author: Kun Meng*

Abstract: Against the backdrop of the digital economy, the process of data assetization is accelerating. However, in operational links such as registration, utilization, and transaction, institutional data rights have failed to be translated into enforceable implementation mechanisms, leading to ambiguous rights, responsibilities, and inefficient circulation. From a rights management perspective, this paper proposes a tripartite classification framework for data assets: identification data resolves issues of attribution, raw material data regulates usage based on clarified ownership, and tool data further enables the distribution of benefits. This framework integrates the national policy of "Tripartite Rights Separation", analyzes the distinct rights characteristics of different data types, and designs differentiated governance pathways. It aims to provide institutional support for data assetization operations and foster the efficient functioning of the data factor market.

Keywords: Data assetization; Data classification; Tripartite rights separation; Differentiated governance

1 INTRODUCTION

With the rapid development of the global digital economy, data is transitioning from a traditional auxiliary resource into a core asset with quantifiable and tradable characteristics [1]. This transformation not only promotes industrial upgrading and business model innovation but also brings entirely new challenges for data governance. The core challenge in data asset governance lies in achieving efficient utilization and value release of data resources on the premise of ensuring data security and privacy [2], and the issue of data rights attribution is the root of this challenge [3]. For data assets, given that related subjects exist, and these subjects may not be a single entity but rather diverse, and are often separated from the producing entity and the value carrier. It is therefore difficult to clarify which subject the data belongs to, and it is also difficult to represent the rights relationships that continuously change during the circulation process. This inevitably leads to disputes over related rights and interests.

In view of this situation, the Opinions of the CPC Central Committee and the State Council on Building a Basic Data System to Better Harness the Role of Data as a Production Factor (hereinafter referred to as the "Data Twenty Measures") innovatively proposes an institutional framework for the separation of data property rights. This framework establishes a tripartite structure consisting of data resource holding rights, data processing and usage rights, and data product operation rights. Building on this logic, this paper develops a differentiated governance framework by categorizing data assets into three groups—identifier-type, material-type, and tool-type. The aim is to formulate management strategies tailored to the specific characteristics of different data assets in ownership determination, usage authorization, and revenue allocation, thereby effectively addressing the current issues of unclear rights and responsibilities and inefficient circulation in data-asset operations.

2 OPERATION OF DATA ASSETIZATION

2.1 Overview on Data Assetization

"Assets" is an accounting concept [4], referring to resources arising from an enterprise's past transactions or events, owned or controlled by the enterprise, and expected to yield economic benefits. In contrast, resources place greater emphasis on the potential input of production factors and generally lack defined asset attributes in economic accounting. Asset attributes require clear rights and control over the resource. Data, as a form of electronically recorded information, possesses heterogeneity and value appreciation, making it an important production factor in modern economic systems. Unlike traditional resources, data exhibits non-exclusivity and replicability [5]; the same dataset can be simultaneously utilized by multiple entities, and its value is continuously enhanced through repeated use and in-depth analysis. These characteristics endow data with significant potential commercial value and provide impetus for its development toward assetization.

It is generally acknowledged that data resources represent the collective term for data with value potential, whereas data assets refer to data resources legally owned or controlled by a specific entity, measurable in monetary terms and capable of generating economic benefits. The transition of data from a potential resource to an explicit carrier of value constitutes a trend [6]. This shift not only signifies the realization of data's value but also reflects enterprises' strategic objective of achieving full lifecycle management and value appreciation through assetization operations. The core of this transformation lies in establishing a supportive ecosystem for data value discovery, rights confirmation, dynamic

governance, and efficient circulation, thereby endowing data with asset attributes and enabling systematic management and commercial transactions.

2.2 Implementation Path of Data Assetization

Data assetization must fulfill three key conditions: clear ownership, measurability, and tradability. Its implementation pathway can be summarized into three stages: data governance, data packaging, and data transaction (as shown in Figure 1). This pathway exhibits a progressive relationship: data governance serves as the foundation, achieving a usable and trustworthy state for data resources through systematic management; data packaging is the critical transformation stage, endowing data with legal and economic asset attributes through rights confirmation, valuation, and registration; data transaction is the value realization stage, enabling the market circulation and monetization of data assets based on established rules and platforms. These three stages advance progressively, collectively forming a complete closed loop from data resources to assets, ultimately realizing market value.

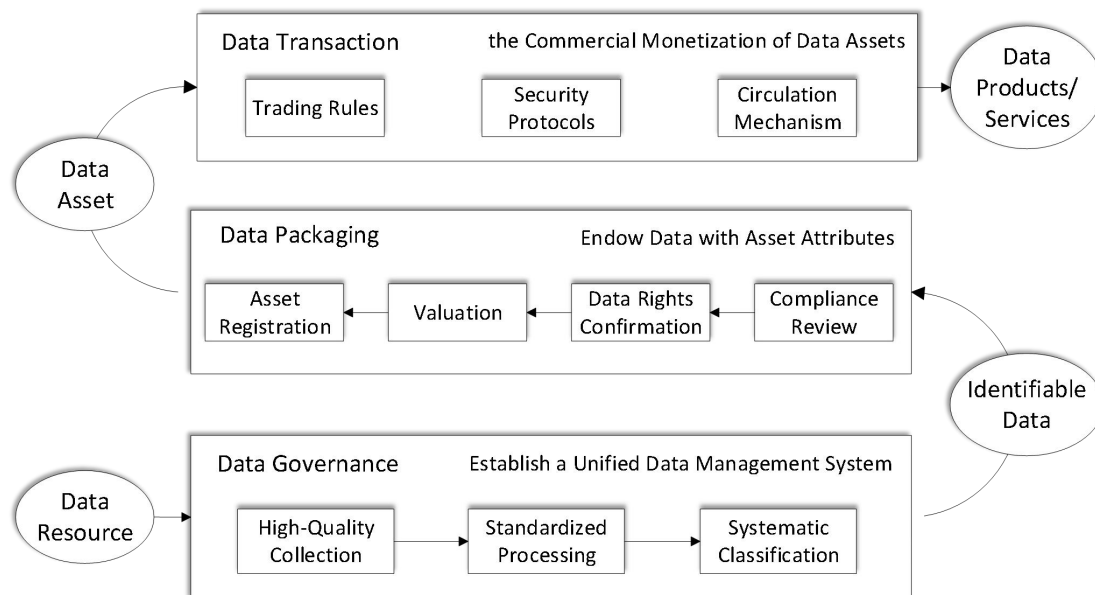


Figure 1 Schematic Diagram of the Data Assetization Implementation Path

2.3 Challenges in the Operationalization of Data Assetization

As stated in the Introduction, the core challenges in the operationalization of data assetization lie in the unclear definition of rights and inefficient circulation mechanisms. Specifically, at the operational level, these are mainly reflected in the following two issues:

Lack of actionable implementation standards for data rights confirmation: There is currently a lack of unified laws and regulations clarifying the nature, subjects, and content of data rights, leading to an overreliance on a singular ownership concept in practice, which fails to accommodate the characteristics of multi-party contribution and dynamic circulation of data.

Lack of differentiated rule design for data transactions: The failure to establish tiered and classified transaction standards and contractual frameworks based on the different rights attributes and application scenarios of data constrains circulation efficiency.

3 DATA CLASSIFICATION FROM A RIGHTS PERSPECTIVE

3.1 Basis for Data Asset Classification

Due to differences in data classification methods, data assets can be categorized differently [7]. They can be distinguished by rights attribution into public data, enterprise data, and personal data; by source into internal data and external data; and by purpose into data for self-use, commercialized use, and public welfare use. These classifications each have their own focus and are conducive to establishing differentiated standards at a macro level. However, they also possess significant limitations: Attribution-oriented classifications emphasize the subject scope but often fail to trace the chain of contributors, making it difficult to reflect the multi-party contributions and rights distribution in the process of data generation and circulation. Source or purpose-oriented classifications help identify the data origin and usage scenarios but are inadequate in providing granular governance rules for the rights and usage constraints involved in complex circulation scenarios. Therefore, relying solely on single-dimensional, generic classifications can hardly support the governance requirements of data assetization. To enhance the suitability of control measures, rules should

be further refined under the overall classification framework, using rights requirements as the starting point to formulate differentiated controls, thereby addressing the challenges in the operationalization of data assetization.

3.2 The Tripartite Rights Separation in Data Assets

Data property rights constitute the cornerstone of the fundamental data institutional system. Regulating data rights and interests based solely on “ownership” is not conducive to realizing the value of data assets or facilitating their circulation. The future returns from data assets depend not only on “who owns them” but, more importantly, on “who exploits and utilizes them.” Based on the data property rights separation framework outlined in the aforementioned “Data Twenty Articles,” this paper operationalizes the relevant rights as follows:

Right to Hold: This requires that the data subject matter clearly and uncontroversially identifies all contributor information and the authorized entity for that data. Contributors include the subject reflected in the data content, the collector or generator, and participants in its storage, transmission, processing, etc. The authorized entity for the data must comply with legal and regulatory requirements and may be a single entity, a collective, or a specific mechanism.

Right to Use: This is the right to perform operations on the data subject matter in accordance with the data authorization stipulations. These stipulations include viewing, copying, modifying, publishing, etc., and primarily pertain to operations on the data content itself.

Right to Operate: This is the right, given the necessary resource support, to generate greater value and obtain economic benefits from the data subject matter by providing services related to it. Services involve establishing service relationships and delivering service content, which includes providing storage, transmission, transaction, operation, deployment, etc. Economic benefits primarily stem from the value of the services provided and from any new valuable outcomes subsequently generated through these services. Confirmation of the service relationship typically involves the authorized entity of the data.

3.3 Data Asset Classification Based on the "Tripartite Separation of Rights"

Building upon the rights-related logic of the "Tripartite Separation of Rights," and centering on the perspective of the data holder, data assets are categorized into three types according to their control objectives: Identification, Material, and Tool categories (as shown in Figure 2). This classification adopts "Ownership Confirmation—Usage Authorization—Value Operation" as its governance thread, aiming to translate institutional rights and functionalities into executable control rules.

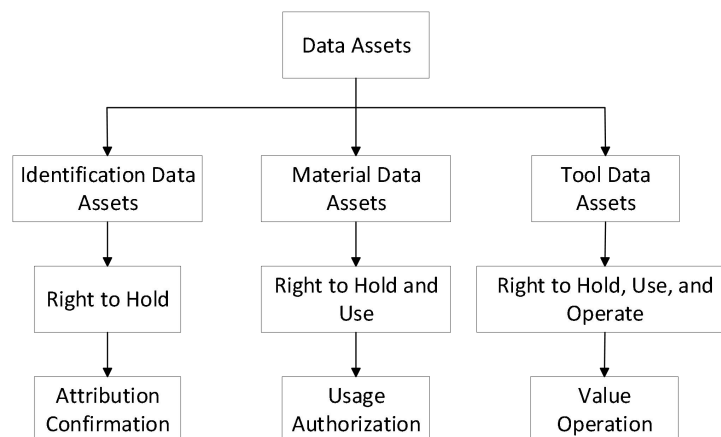


Figure 2 Data Asset Classification and Control Objectives

3.3.1 Identification data assets

Identification Data Assets primarily aim for open sharing and transparent attribution. Typical examples include government statistics and industry benchmark data. The emphasis for this category lies in ensuring reliable sources and accurate contributor identification. They are usually open for public use and do not serve as direct commercial products. Consequently, the control focus is on the clarity of the Right to Hold and the identification mechanism, with no restrictions required on the Right to Use and the Right to Operate (as shown in Table 1).

Table 1 Rights Control for Identification Data Assets

Subject Rights	Right to Hold	Right to Use	Right to Operate
Data Provider	Yes	No	No
Data Requester	No	No	No

3.3.2 Material data assets

Material Data Assets have "Usage Authorization" as their core objective. Serving as the raw material of data, such data assets include internally collected data and data obtained through legal channels. They function as fundamental inputs

within enterprises, with their commercial value often realized in subsequent deep processing and application. Control for this category requires the provider to ensure the Right to Hold while regulating "who can use" and "how to use" through explicit access authorization (as shown in Table 2). The Right to Operate, however, is not open to external parties; meaning the data itself is not independently commercially operated or involved in profit distribution, and does not directly participate in transactions as a commodity. The control emphasis for Material Data Assets lies in formulating detailed usage authorization rules and ensuring that the data, as "raw material," is applied within the defined scope after authorization, thereby enabling the secure transformation and reasonable sharing of data value.

Table 2 Rights Control for Material Data Assets

Subject Rights	Right to Hold	Right to Use	Right to Operate
Data Provider	Yes	Yes	No
Data Requester	No	Yes	No

3.3.3 Tool data assets

Tool Data Assets have "Value Operation" as their core objective. Their control objective is the right to obtain benefits based on attribution confirmation and usage authorization. These benefits primarily stem from two aspects: firstly, the Tool Data itself (such as algorithms, models, software, etc.) possesses direct service value; secondly, the derived data generated by processing, integrating, and analyzing data through these tools achieves "secondary value appreciation" in the market by providing data services, reflecting the additional commercial value of the new outcomes.

Table 3 Rights Control for Tool Data Assets

Subject Rights	Right to Hold	Right to Use	Right to Operate
Data Provider	Yes	Yes	Yes
Data Participant	No	Yes	Yes

Compared to the previous two categories of data assets, the governance of Tool Data Assets is more complex (as shown in Table 3), as it requires the simultaneous clarification of rights attribution and operational rules for both the tool itself and the derivative data generated from it. The core logic of this rights allocation scheme is as follows: The Data Provider, because they bear the development and maintenance costs of the original data, core tools, or platforms, and are the bearers of initial risk, therefore retains the Right to Hold over the original data and core tools and naturally enjoys the Right to Use them; simultaneously, as the initiator of the value ecosystem, they also retain the Right to Operate over the overall assets. Data Participants (including technical processors, service applicators, etc.), because they directly participate in the value-added process of the data and the creation of derivative value, are consequently granted the Right to Use to perform data processing and analysis; and based on their specific contributions in service provision, technical investment, and outcome production, they flexibly share the Right to Operate and its benefits through contracts or quantitative metrics, thereby achieving fair value return and incentive.

4 DATA ASSET CONTROL MODELS BASED ON CLASSIFICATION

The classified control of data assets is a critical pathway to unleashing the value of factors. Building upon the data asset classification framework and its corresponding rights configuration established in Chapter 2, this chapter will delve into the technological implementation paradigms for classified control. By analyzing the rights confirmation elements and technical implementation paths for each category of data, it aims to provide a verifiable institutional-technical dual-track solution for the rights confirmation and circulation of data assets.

4.1 Analysis of Data Rights Confirmation Elements

Data rights confirmation aims to address three fundamental issues: first, the nature of data rights, i.e., what type of rights protection should be granted to data; second, the subject of data rights, i.e., clarifying who should enjoy data rights; and third, the content of data rights, i.e., specifically defining what rights the data subject enjoys. To make the process of changes in data rights presentable and analyzable in a legal sense, it is necessary to adopt an internal perspective of rights analysis and complete the extraction of fundamental rights confirmation elements (as shown in Figure 3). In the process of building a data rights confirmation system, the bottom-up logic of "object → subject → behavior" is followed: first, the data "object" must be defined and identified to provide an anchor point for rights; on the basis of a clearly defined object, the identity and rights boundaries of the "subject" become meaningful; and only when both the subject and object are clear can the rules constraining the operational "behavior" of the subject be effectively defined and executed.

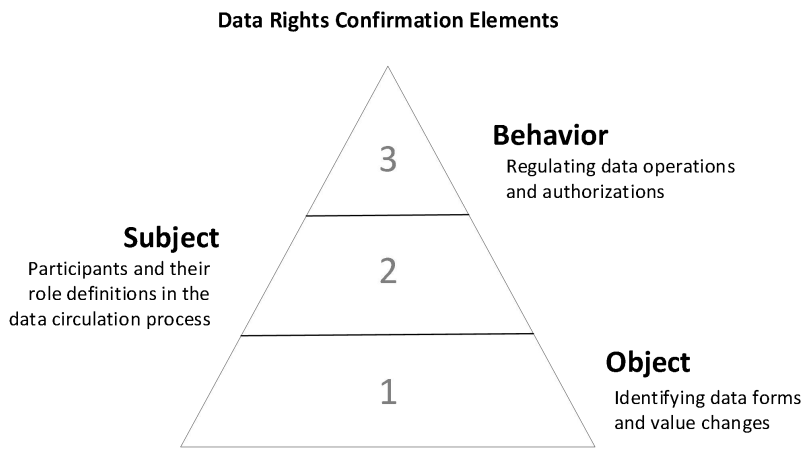


Figure 3 Schematic Diagram of Data Rights Confirmation Elements

4.2 Implementation Path for Data Rights Confirmation Based on the Classification Architecture

To translate the rights confirmation logic of "Object-Subject-Behavior" into an operational system, we have constructed a data asset circulation architecture (as shown in Figure 4). This architecture uses the blockchain network and cloud storage system as its underlying infrastructure [8], and through core components such as the identity authentication module, access control module, and value distribution module, provides differentiated technical implementation paths for the three categories of data.

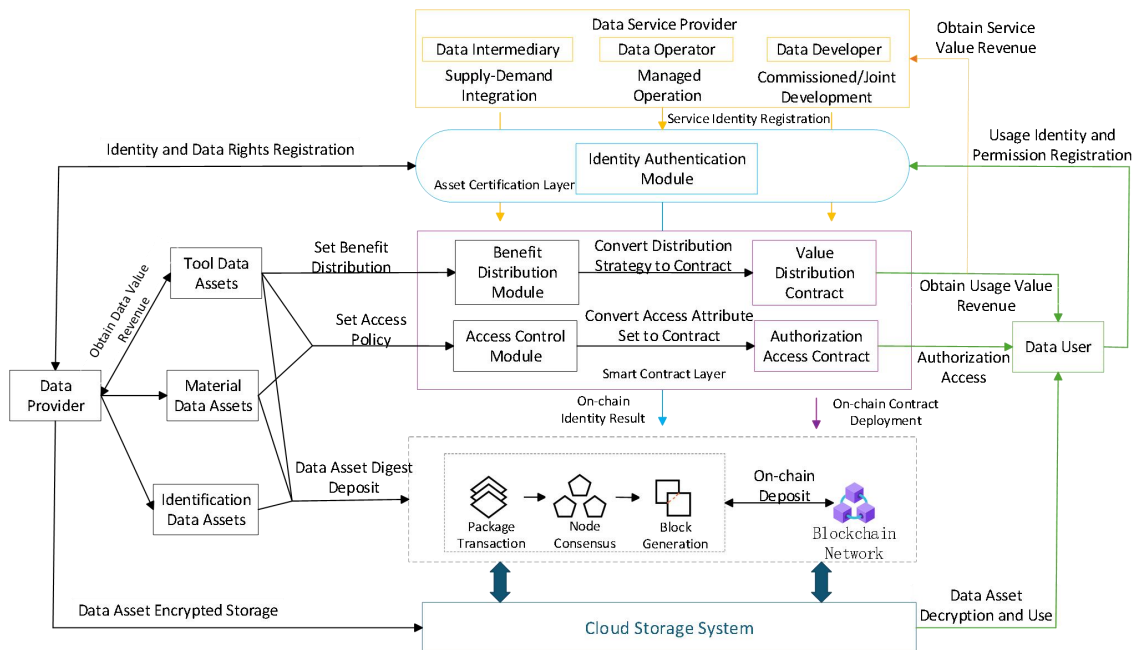


Figure 4 Architecture Diagram of Data Asset Circulation Based on This Classification

For Identification Data Assets, the rights confirmation path focuses on "Object" authentication and "Subject" binding to establish a credible ownership foundation. By depositing the data hash value as evidence on the blockchain network, the unique identification of the data "Object" is completed; simultaneously, by relying on the identity authentication module, the reliable association between the data provider's "Subject" identity and the data object is achieved. The technology combination centered on blockchain deposit and digital identity, through the clear labeling of contributor information and authorized subjects, provides a credible rights credential for the open sharing of data in a lightweight manner.

Building upon the rights confirmation of Identification Data Assets, the control of Material Data Assets extends further to the fine-grained control of usage "Behavior". Its implementation path, while ensuring "Object" confidentiality (through data encryption storage) and clarifying "Subject" permissions, transforms institutionalized usage rules into executable code in smart contracts. When a data user initiates an access behavior, the system automatically verifies their permissions and controls the data decryption scope through the contract, thereby achieving real-time authorization and post-event auditing for each usage behavior.

The rights confirmation for Tool Data Assets comprehensively covers the three elements, focusing on resolving the "Behavior" quantification and value distribution issues in multi-party collaboration. A version traceability system for data objects is constructed through trusted timestamps, multiple subject identities are confirmed relying on the identity

registration layer, and finally, the contribution behaviors of all parties are converted into automatically executable economic benefits through the value distribution contract. On the basis of credible objects and clear subjects, a sustainable value creation and distribution system is built through the precise quantification of operational behaviors.

Table 4 Analysis of Data Rights Confirmation Elements and Implementation Paths

Data Category	Core Rights	Rights Confirmation Elements	Implementation Path
Identification	Right to Hold	Object, Subject	Object hash deposit; Subject identity binding
Material	Right to Use	Object, Subject, Behavior	Object encryption; Subject authorization; Behavior controlled via smart contracts
Tool	Right to Operate	Object, Subject, Behavior	Object version tracing; Multi-subject registration; Behavior contribution quantification and profit-sharing

The rights confirmation solutions for the three data categories constitute a layered and progressively advancing technical system (as shown in Table 4): the Identification category employs low-overhead deposit, focusing on the object-subject attribution confirmation; the Material category relies on medium-overhead data encryption and policy execution, requiring the addition of constraints and auditability for usage behaviors on the basis of object-subject; the Tool category necessitates a high-overhead on-chain accounting system, constructing a verifiable value closed-loop supporting the Right to Operate distribution while comprehensively covering the three elements. This differentiated technical adaptation confirms the "scenario-specific rights and capabilities" control paradigm, systematically building a progressive control chain from attribution confirmation, through behavior constraints, to value distribution, providing a solution for the efficient circulation of the data factor market.

5 CONCLUSION

This research addresses the issues of rights attribution and circulation efficiency in the process of data assetization by innovatively constructing a classified control framework based on the "Tripartite Separation of Rights". By analyzing the rights and functionalities of the data assets' Right to Hold, Right to Use, and Right to Operate, a three-category system was established. Based on the analysis of rights confirmation elements, differentiated technical implementation paths were designed for each data category. The Identification category ensures open sharing through rights transparency, the Material category achieves secure circulation through dynamic constraints on the Right to Use, and the Tool category activates multi-party collaboration through revenue contribution quantification. This paper provides an institutional foundation for data registration, transaction, and compliance operations. In the future, better implementation can be achieved through iterations in technologies such as privacy-preserving computation and cryptography, and the application of this classification standard in more complex data circulation scenarios can be explored.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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