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# Postprint: Research on the Assetization Storage of University Scientific Research Data and Data Reuse Rights Licensing

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## Abstract

[Purpose/Significance] To provide theoretical foundations for "data assets" and recommendations for "assetization" storage, management, and reuse methods for scientific research data management in Chinese universities, thereby serving the development, utilization, and value enhancement of data intellectual property rights in Chinese universities. [Method/Process] Analyze the current research status of data assets, discuss the attributes of data assets, define data asset rights and interests, and propose the main contents of assetization rights storage management for scientific research data in Chinese universities and feasible solutions for data reuse rights licensing. [Results/Conclusion] Recognition of the "assetization" of scientific research data can strengthen effective management of data assets, increase control over scientific research data assets, improve asset protection for scientific research data through administrative policies and technical assistance means, promote open sharing and reuse of data resources in universities, and foster the formation of a benign data information ecological environment.

## Full Text

## Preamble

**Abstract:** [Purpose/Significance] This study provides a theoretical foundation for "data assets" and proposes methods for "asset-based" storage, management, and reuse of scientific research data in Chinese universities, aiming to support the development, utilization, and value enhancement of data intellectual property in higher education institutions. [Method/Process] We analyze the current state of data asset research, discuss the attributes of data assets, define data asset rights, and propose the main components of asset-based rights storage management for university scientific research data along with feasible schemes for

data reuse rights licensing. [Result/Conclusion] Recognizing the "asset" nature of scientific research data can strengthen effective management of data assets, increase control over scientific research data assets, improve asset protection through administrative policies and technical assistance, promote open sharing and reuse of university data resources, and foster a healthy data information ecological environment.

**Keywords:** scientific research data; data assets; data reuse; scientific research data assets; asset rights

The 19th National Congress report proposed "promoting data resource integration and open sharing, ensuring data security, and accelerating the construction of a digital China." The Fourth Plenary Session of the 19th Central Committee elevated data to a production factor alongside labor, capital, land, knowledge, technology, and management from the perspective of modernizing the national governance system and capacity. This framework guides market evaluation of data contributions and compensation based on those contributions, while requiring strengthened orderly data sharing, thereby raising data's role in economic and social development to a higher level. Advancing the evolution from "data resources to data assets to assetization" [1] makes research on the orderly asset-based storage, security, organization, and reuse of data resources a critical issue affecting the development of China's digital economy.

In university and research institution settings, scientific research generates substantial process data and academic outcomes. Traditional institutional knowledge resources (institutional repositories) manage academic papers, monographs, dissertations, and patents, but exclude research data generated during the research process. This omission of research process data from institutional knowledge resources affects research outcome verification, intellectual property protection for research data, and sustainable scientific development. Specific challenges include: difficulty in conceptual definition and unified management regulations (management, statistics, classification, organization); lack of effective research data management, with data not treated as assets; absence of protection basis for ownership relationships and insufficient legal grounds for data reuse rights; and need to establish an asset rights management framework and constraints for data reuse rights. Consequently, as digital research resources constitute an increasing proportion of institutional holdings, digital literature resources including data are being required to be incorporated into asset management processes [2]. Grounded in institutional scientific research data resources, strengthening the asset management positioning and rational use of research data resources to achieve research data reuse based on data asset licensing has important theoretical and practical significance.

## 2. Current Status of Data Asset Research

Research on data assets in China focuses primarily on several aspects:

**Conceptual Understanding:** Before the concept of "data assets" emerged,

there was "digital assets." H. Meyer first introduced the term "digital assets" in 1996 in *Tips for Safeguarding Your Digital Assets* [3]. In 1994, KPMG's *The Hawley Report* identified information as an important resource, defining it as "data that has been or should be recorded with value or potential value" [4], where information equates to data. In 2006, A.V. Niekerk provided a definition of "digital assets" as "anything formatted into binary source code with usage rights, such as text or media" [5], proposing that digital text information constitutes an asset. In 2009, T. Fisher stated in *The Data Asset* that data is also an asset [6]. The Gartner IT Glossary indicates that "information (knowledge) assets refer to data and information acquired from unstructured databases" [1].

**Data Object Attributes:** In 2004, E. Yakel noted that "archives, libraries, and museums no longer treat digital images as objects but rather as digital assets" [7]. In 2007, M. Moon pointed out that "reusability" makes data an asset [8]. At the "SoftBank World 2013" event, SoftBank's Masayoshi Son argued that "the cloud will become humanity's greatest asset" [9]. The 2013 U.S. Army Information Technology Implementation Instructions stated that people, systems, or applications can create data assets [6].

**Asset Rights:** In 2011, L. McKinnon argued that digital assets should be considered and inherited as a new category of estate in legacy planning, requiring understanding of their changing patterns and related properties [10]. In 2013, A. Toygar et al. stated that "digital assets are essentially data generated and stored in computers, smartphones, digital media, or the cloud, with data ownership" [11]. In 2017, R. Genders and A. Steen considered that "digital assets include any assets that can be accessed and held online in digital form" [12].

**Regulations and Laws:** In May 2018, Thailand enacted the *Digital Assets Act*, including the *2018 Digital Asset Businesses Act* and the *2018 Tax Law Amendment* for regulating related taxation, making it one of the first countries with explicit digital asset legislation [13]. Russia and other countries have also placed digital asset legislation on their agendas [1]. The international standard ISO/IEC 27000:2018(E) defines information as an asset requiring appropriate protection like other important organizational assets [14]. In China, the *Personal Information Protection Law* requires review of data use agreements and scientific datasets; agreements not meeting legal requirements must be renegotiated or terminated, and datasets containing legally defined personal sensitive information must be de-identified or encrypted [15].

In summary, data is a key element of the digital economy, widely recognized as a fundamental resource and production material [1]. Information, digital, and data resources are all data assets [1], and digital resources as assets require strengthened management and protection. Current data asset rights regulations remain incomplete, and asset rights management and reuse frameworks will be future research priorities. Against this backdrop, the view that "data is assets" has gained widespread acceptance, driving in-depth research on data assets in areas such as conceptual studies, rights confirmation, asset value, and data security. However, research on university scientific research data as assets is limited,

particularly regarding classification, management, and ownership relationships for reuse in university contexts.

Therefore, this study focuses on scientific research data generated during university research activities, building on previous research to define concepts including data resources, scientific data, research data, data assets, and assetization. We analyze data asset attributes, establish research data asset rights management based on recognition of "assetization," and propose main components of asset-based rights storage management for scientific research data and feasible framework solutions for reuse licensing. This approach strengthens control over scientific research data assets, utilizes intellectual property norms and agreements to safeguard the asset value ecosystem, and promotes sustainable development.

## 3. Concept and Attributes of Scientific Research Data

### 3.1 Conceptual Definition

In foreign literature, "scientific data" is generally expressed as "research data." China's *Measures for the Management of Scientific Data* defines scientific data as primarily including data generated through basic research, applied research, and experimental development in natural and engineering sciences, as well as original and derived data obtained through observation, monitoring, investigation, and testing for scientific research activities [16]. It is typically defined as "useful information generated during scientific research activities." In domestic contexts, "research data" is often translated as "research data" or "scientific research data." English expressions include "scientific data," "research data," and "science and research data" [17], which are essentially equivalent concepts abroad. In university institutional knowledge resource construction, the term "scientific research data" is commonly used. In China, scientific data mainly refers to valuable data generated from exploration and research in natural science fields [18], while scientific research data refers to various types of data throughout the research process (outcome data + research process data), and research data refers specifically to process data generated during research. Therefore, from the connotation of scientific data, scientific research data, and research data, they all encompass valuable data that should be included in institutional data resource management.

In fact, not only natural and engineering sciences involve research processes; humanities and social sciences research also constitutes a research activity process. Thus, the broad concept of scientific research data also includes humanities and social sciences research data. However, since humanities and social sciences data management and application manifest more as social benefits, their asset attributes differ. Due to space limitations, this paper focuses on scientific research data asset storage management and reuse licensing in natural and engineering sciences.

### 3.2 Asset Attributes of Scientific Research Data

Data resources in university institutional knowledge resources refer to digital academic resources within institutions, including academic papers, monographs, dissertations, patents, research reports, and data (research data, statistical data, etc.). Scientific research data constitutes part of these data resources. As an important strategic resource whose value is continuously being mined and created, data is becoming a new asset—data assets [1]. Gu Liping argues that scientific research data, as a knowledge asset, serves as both "raw material" and "finished product" for the "knowledge industry," and also as an asset for individuals in a knowledge-based society to "prove" and "influence" others' evaluations of them, with its storage and dissemination methods already impacting the composition of knowledge-based society [19].

Liu Meijiao identifies three characteristics of assets: assets are formed by past transactions or events of an institution; assets are resources owned or controlled by the institution; and assets bring economic benefits to the institution [20]. Early data assets applied only to economic data [21], but their connotation gradually expanded with deeper understanding. For example, exploration data is also a data asset [22]. The International Data Management Association (DAMA) states that data is capital-type assets, and institutions should treat data as institutional assets [23]. The 2011 World Economic Forum report indicated that personal data is becoming a new economic "asset category" [7]. In China, digital literature resources are primarily managed as intangible assets, which domestic scholars generally define as special long-term assets acquired for a fee, available for long-term use, capable of generating excess differential benefits, and highly uncertain [2]. Additionally, digital scientific research archives can be studied from an asset management perspective [24].

In summary, scientific research data is a subset of data, and valuable data assets are datasets with data rights. Scientific research data possesses data rights characteristics and therefore has asset attributes. While "data assets" have been studied in relevant literature, direct research on the asset attributes of the data subset "scientific research data assets" is limited. This paper argues that scientific research data assets are intangible digital resources owned or controlled by individuals or institutions that can bring future sustainable research benefits or economic benefits to institutions, with asset ownership rights attributes.

The essence of assetization is capturing surplus value, realizing the capitalization value attribute of assets. Data assets, also known as the present value of future value flows, refer to assets expected to generate future value in normal transactional use. Through the above analysis, scientific research data possesses necessary asset characteristics and attributes, mainly manifested as: research data supporting research outcomes can bring expected economic benefits through social application; research data assets are resources owned or controlled by the subject [29]; reuse of research data can generate transactions formed by past events of the subject; research data can generate economic

benefits flowing into industry-academia-research cycles; and data as assets can be reliably measured in cost or value.

## 4. Scientific Research Data Assets and Asset Rights

### 4.1 Ownership and Attribution of Scientific Research Data

Traditional university institutional knowledge resources grant storage and usage rights to the institution. Scientific research data generally remains with researchers or research teams. As institutional knowledge resources, data sources include: individually generated research data, group research data, government-funded data, and various project-funded data. From the perspective of professional outcome attribution, researchers employed by universities or research institutions form a community of interests (investors, creators, and users) with their institutions and outcomes.

Referencing other countries' resource property regulations: The U.S. established through judicial precedent in 1921 that intellectual property rights for work-related inventions prioritize contractual agreements; without contractual agreements, ownership belongs to the inventor [26]. Japan's Patent Law also adopts an "agreement priority, employee priority" distribution model [27]. Israel's Patent Law stipulates that for "service inventions," agreement priority applies; without agreement, the service invention becomes employer property [28]. From the proposed amendment to Article 6 of China's Patent Law in the first draft amendment, the property rights incentive method for "executing unit tasks" inventions delegates ownership determination and reward implementation to the unit. Such property rights incentives often result in unit-exclusive ownership, which discourages creators' enthusiasm.

Current ownership of research data generated by university researchers includes: national asset data, institutional asset data, personal asset data, and special-type data. Classification by owner is shown in Table 1 .

**Table 1. Classification of Scientific Research Data Assets by Owner**

| Research Data Source (Asset Source) | Ownership | Development Method | Openness | Examples |
|---|---|---|---|---|
| Individual spontaneous research data | Researcher decides | Selective development | Shared and specialized data | - |
| Various funded research data | Comply with IP rules | Execute per IP law | Open or partially open | - |

| Research Data Source (Asset Source) | Ownership | Development Method | Openness | Examples |
|---|---|---|---|---|
| Intellectual property-obtained data | Institution/Individual | Selective development | Per IP law | - |
| Government investment project data | Government controls | Selective development | Open or partially open | - |
| Team collaboration data | Institution/Individual | Selective development | Per agreement | - |
| Government census data | State-owned institution/owner | - | Open or partially open | Population census, etc. |

Current issues with scientific research data as assets include: research data comprises process and outcome data, not equivalent to independent data, with research scenarios and methods in its generation process. Data generated during specific data semantics, exploration testing, experimental research, and model calculations may have accompanying or subsidiary relationships with research outcomes, showing uncertainty and non-independence; most research data lacks unified management, scattered among individuals or research teams; terms like knowledge, resources, data, capital, and assetization are closely related, with concepts like knowledge resources, information resources, data resources, scientific data, research data, data assets, assetization, etc., being used convergently or equivalently; and most research data originates in research institutes or universities, but systems, rules, and regulations for data deposit, attribution, rights management, and rights reuse remain unclear.

Scientific research data encompasses all types of data throughout the research process (outcome data + research process data). Research process data (research data) is published and stored mainly as: individual data entities, attachments accompanying various digital literature resources, or specialized data, including entities recording scientific research data [19] (such as journals, books, conference papers, courseware, technical reports, dissertations, patents) and dedicated datasets.

The rights setting for scientific research data and existing asset rights for academic outcomes are shown in Table 2 .

**Table 2. Existing Rights of Scientific Research Data Assets by Resource Type**

| Resource Type | Ownership | Licensing Method | Rights Description |
|---|---|---|---|
| Digital journal assets (papers containing research data) | Individual (OA publishing) | CC BY-SA | Publisher or individual |
| Digital book assets (books containing research data) | Publisher/individual | CC BY-SA | Publisher or individual |
| Digital conference assets (conference papers containing research data) | Individual/institution | CC BY-SA | Publisher or individual |
| Digital courseware assets | Institution | CC BY-SA | Generally publisher |
| Technical report assets (reports containing research data) | Institution, author, third party | Data use agreement | Open access resources |
| Dissertation assets (dissertations containing research data) | Institution/author | Data use regulations | Training institution or individual |
| Data chart assets | Creator's copyright | Public domain | Not applicable |
| Independent scientific data assets | Collection institution | Multiple authorization methods | Random (current status) |

### 4.2 Value Attributes of Scientific Research Data Assets

Data has become a strategic resource and new production factor. Advancing the strategic transformation of scientific research data assetization realizes data value through evolution from "potential value—value creation—value realization—value appreciation (multiplication)" [30]. Du Qinghao, He Wei, Yin Ximing et al. argue from a data factor perspective that the logic of data factor capitalization is: data factors achieve assetization based on data rights confirmation and data interests; assetized data can be traded, promoting widespread multi-scenario application, fully stimulating data vitality, releasing data factor value, thereby achieving data capital appreciation (multiplication)

and capitalization—following the pattern "data resources—data assets—data capital" [30]. Scientific research data can generate benefits through data transfer, sustainable research data, or providing research data reuse services.

Scientific research data is a resource that can bring expected economic benefits or service potential. Efficient utilization of scientific research data resources to serve and benefit society represents a future industry research hotspot. Transforming scientific research data into effective data assets can support more comprehensive analysis, more accurate prediction, and more valuable decision-making services, promoting data valuation and benefit appreciation, and enabling data value quantification and assetization. Valuable scientific research data resources may become assets, then assetize into data capital, requiring value assessment through data evaluation management to lay the foundation for data appreciation.

### 4.3 Analysis of Scientific Research Data Asset Rights

Scientific research data rights management fundamentally concerns data copyright management. Copyright status represents the intellectual property situation of resource content, so resource use, sharing, and reuse should follow copyright regulations, authorizations, and licenses. However, with diverse knowledge media and resource types, resource reuse is constrained not only by copyright but also by other rights and emerging interests beyond copyright control, such as usage rights for databases, scientific data, and research data. Restrictions apply to rights holders, users, reusers, acquisition methods, usage frequency, and download limits [31], as shown in Table 3 .

**Table 3. Data Asset Attributes and Rights Status Description**

| Data Type | Copyright Control | Licensing Method | Beneficiary |
|---|---|---|---|
| Special-type data | National authorization/owner | Multi-copyright reference | State |
| Personal asset data | Owner's copyright | Institution authorization | Institution/individual |
| Institutional asset data | Institution's copyright | Institution authorization | Institution |
| National asset data | State authorization/owner | Multi-copyright reference | State |

Additionally, with open access, data sharing, technological updates, and changing research work patterns, issues such as resource mining, asset rights, relationship rights, validity periods, and usage rights have become prominent. Common resource rights restrictions include: intellectual property protection methods like copyright and patents; internal resource property protection methods like trade secrets; open rights protection methods like gold OA, green OA,

OAZREA [32]; and value of research data recovery for sustainable research and economic development.

For research data resources, after evaluation, collection, organization, and processing into valuable assets and further assetization, required data rights description elements are shown in Table 4 .

**Table 4. Research Data Resource Rights Elements and Framework**

| Rights Element | Description |
|---|---|
| Authorization method | CC BY-SA, etc. |
| Asset rights use | Non-commercial use |
| Relationship with copyright attribution | No clear description |
| Agreement license description | Restricted license use |
| Integrity protection right | Adaptation and translation rights |

### 4.4 Licensing Methods for Scientific Research Digital Asset Rights

Current rights management of research data resources only enables asset rights management and implementation when the relationship chain of data input (collection management) and output (use licensing [33]: sharing, reuse, sale, confidentiality management) is formed. This requires clarifying the ownership and usage relationships among rights parties, as shown in Table 5 .

**Table 5. Research Asset Rights and Licensing Restrictions**

| License Type | Usage Scope | Commercial Use | Derivative Works | Rights Reserved |
|---|---|---|---|---|
| Public Domain | Very broad use | Allowed | Allowed | None |
| CC BY-SA | Use with license compliance | Allowed | Allowed | Some rights reserved |
| CC BY-NC | Certain constraints | Non-commercial only | Allowed | Some rights reserved |
| CC BY-NC-SA | Cannot be used commercially | Non-commercial only | Allowed with same license | Some rights reserved |
| CC BY-ND | Cannot be adapted | Allowed | Not allowed | Some rights reserved |
| Agreement-based management | Per Data Use Agreement (DUA) | Per agreement | Per agreement | Per agreement |

| License Type | Usage Scope | Commercial Use | Derivative Works | Rights Reserved |
|---|---|---|---|---|
| Commercial management | Owner pricing | Commercial use allowed | Per agreement | All rights reserved |
| Collection/Confidential management | Student restrictions (research secrets, trade secrets, etc.) | Not allowed | Not allowed | CC BY-NC-ND |

Table 5 shows that scientific research data use follows copyright, patent, trade secret rules, and scientific data use agreements, with attribution based on possible usage attributes.

Copyright rights for scientific research data and assets have certain complexities. When research data or datasets are published with papers, the rights attributes of the research paper represent the attributes of the attached data [34]. For example, scientific research data in dissertations possesses the same attributes as the dissertation itself. Much research data appears in technical reports, but technical report copyright restrictions are more complex than other resource types. Copyright for free and open technical reports mainly involves three forms: institution, individual author, and third party (generally funding agencies).

## 5. Main Content of Asset-based Storage Management for Scientific Research Data

Unlike other papers on research data management, this paper focuses on research data asset rights management to verify that research data as assets requires rights management constraints matching asset status.

### 5.1 Assetization of Scientific Research Data

Assetization of data resources is the process of endowing research data with asset properties. From the nature of data assets, assetized data resources should have three management properties: controllability, quantifiability, and profitability. Controllability means universities must have control over their data assets. Quantifiability means data assets can be evaluated based on privacy levels, quality, value, and other indicators, rather than merely by storage size. Profitability means assetized data can generate current or future benefit appreciation.

### 5.2 Content of Scientific Research Data Asset Rights Management

Data Asset Management (DAM) refers to a set of business functions for planning, controlling, and providing data and information assets, including collection, storage, evaluation, development, reuse, implementation, and supervision of data-related plans, policies, programs, projects, processes, methods, and procedures to control, protect, deliver, and enhance data asset value [35]. Research data rights management is key to sustainable development of research data services [19]. Long-term operation of research data services relates to management, demand, openness, cost, and policy support under regulations, technology, finance, and organization. Therefore, a scientific data rights management framework serves as the foundation for research data asset management [35], with specific content shown in Table 6 .

**Table 6. Full Academic Research Process Resource Composition and Rights Management**

| Resource Formation Stage | Research Resource Type | Rights Management Basis | Resource Form | Rights Description |
|---|---|---|---|---|
| Project initiation | Project proposal, completion reports, achievement compilations, appraisal documents, patent applications | Copyright law, patent law | White, grey literature | Institution/individual |
| Research process | Research data, discussion documents, records, reports, experimental photos, spectra | Data use agreements | Research foundation data | Institution/individual/third party |
| Outcomes | Papers, patents, monographs, lectures, reports | Copyright law | White literature | Publisher/institution/author |

| Resource Formation Stage | Research Resource Type | Rights Management Basis | Resource Form | Rights Description |
|---|---|---|---|---|
| Social impact | Think tank documents, decision files, news reports | Government reports, network resources | White, grey, black literature | Various |

The Data Asset Framework (DAF) is used to implement data management in institutions, supervise data management behaviors in universities and research institutions, and identify scientific data management needs in research workflows [36]. Asset management helps fully leverage information technology advantages, capturing and registering valuable digital research archives and using digital management platforms for full-process management and audit tracking. This not only improves institutional research archive management efficiency but also realizes appreciation, preservation, and value-added of digital research archive assets, maximizing their value [37].

### 5.3 Hierarchical Management and Protective Management of Scientific Research Data

Research data management requires integrated institutional, technical, and technological management. Blockchain technology provides technical support for asset-based management of research data, with its characteristics enabling analysis of the logical relationship between "blockchain technology—data—outcomes—intellectual property—reuse—openness." It can integrate into the Research Data Management (RDM) organizational process to reveal multi-dimensional relationships between institutional knowledge resources and intellectual property asset data [25]. Blockchain data management enables distributed data, transmission, mutual citation, and functional model development, empowering data to "stimulate data factor value" on the basis of digital intellectual property [38].

The management model can be divided into four layers: collection standardization, privacy setting, processing, and data packaging. Collection standardization involves establishing data knowledge bases, setting collection standards and multi-dimensional format relationships, and recording elements and descriptions to ensure source consistency [39]. Privacy setting involves setting confidentiality levels based on data secrecy, value matching, and openness potential.

Processing involves cleaning, classifying, standardizing, and encrypting raw data for asset positioning, enabling data mining and analysis (i.e., data asset positioning) to form usable databases or packages. Data packaging involves completing quality management, effectiveness standards, and disciplinary classification matching assessments, and opening corresponding usage ports.

Based on these four layers, business processes are established: data collection

and cataloging standards → data security and privacy rating → data processing → data product packaging [40].

## 6. Data Reuse from an Asset Perspective

As assets with intellectual property characteristics, scientific research data can be shared and reused. Reuse capability is influenced by usability, scientific value, usage environment, and value, and is associated with differentiated intellectual property protection, data verification difficulty, research support capacity, and contributions to outcome transformation and industrial development. Research data reuse requires constructing an asset-based data system to enable data to promote sustainable scientific development in openness, rational use, and value realization.

### 6.1 Data Asset Reuse and Permissions

Data resources, data assets, and data capital represent different types of data value attributes. Resources refer to data collections; data with value attributes becomes assets; processed assets become capital. Research data type, usage form, and reuse method determine its value (see Table 5), while value attributes determine reuse permissions.

### 6.2 Technical-assisted Permission Control and Reuse

Scientific research data asset storage and reuse must satisfy data security, copyright licensing regulations, and agreement management to avoid abuse and infringement. Blockchain technology provides technical support for these requirements, with its decentralization, tamper-proofing, and traceability features being highly suitable for intellectual property deposit and rights confirmation [41]. Blockchain deposit uses decentralization to achieve evidence solidification and permanent preservation. In copyright disputes, users can obtain evidence from different blockchain nodes at any time, with full-chain node deposits ensuring data security, tamper-proofing, enhanced credibility, and direct data acquisition and verification from operational nodes, making deposited data direct evidence. However, blockchain is only a technology without capacity to protect content intellectual property rights.

Blockchain can effectively distinguish version rights and serve as a deposit tool, but it does not help prevent or reduce research data plagiarism, piracy, or abuse [42]. Artificial intelligence has advantages over blockchain in detecting plagiarism, piracy, non-agreement content use, or content theft. Only multi-dimensional technology combinations can better solve permission control and reuse issues.

## Conclusion

From a strategic perspective on digital resources, this paper clarifies the characteristics and rights of scientific research data in institutional knowledge resources. By developing and laying out the knowledge value, commercial value, use value, and integrated management of owned and accessible scientific research data assets, and by improving regulations, systems, and agreements with technical assistance for managing research data assets and their reuse, we can implement rights-based management for data collection, rights confirmation, rights information registration, and rights element management. This enables research data to embody the capitalization attributes of data factors, promoting the formation of a well-functioning data value ecological environment.

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