Financial Strategy and Management Reviews, 2026, 2(1), 11-28
https://doi.org/10.71204/jrqy5235

# Research on the Path and Mechanism of Data Resource Value Creation in Specialized, Sophisticated, Special and Innovative Enterprises

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*Received: 17 March 2026 / Accepted: 13 April 2026 / Published online: 18 April 2026*

**Abstract**

Against the backdrop of the deep integration of the digital and real economies, data elements have become a core production factor driving high-quality economic development. Specialized, Sophisticated, Unique, and Innovative (SRUI) enterprises, as a high-quality cohort of small and medium-sized enterprises (SMEs) with innovation advantages and market potential in niche sectors, see the capitalization and value creation level of their data resources as crucial for their own transformation and the overall resilience of industrial chains. This research focuses on SRUI enterprises. By systematically examining the application characteristics and current status of their data resource value creation, it delves into core challenges such as non-standard data resource ownership confirmation and accounting, low integration with core business operations, shortage of professional talent, and an imperfect external service support system. Drawing on the practices of forerunners like Kaiyun United and Jiahua Technology, the study constructs a tiered and progressive value creation path model consisting of foundational, application, and ecosystem layers. The foundational layer focuses on the standardized acquisition, governance, and inclusion of data assets in financial statements. The application layer aims to achieve deep integration of data with core business through R&D innovation, production optimization, and market expansion. The ecosystem layer seeks to unleash the value of data within industrial networks through supply chain collaboration and cross-border integration. Finally, based on the path model, countermeasures and suggestions are proposed from three perspectives: enterprise, government, and industry. These include strengthening data resource management capabilities, improving policy frameworks for data ownership confirmation and accounting standards, and building industrial data-sharing platforms. The study aims to provide theoretical reference and practical guidance for SRUI enterprises to systematically promote data resource value creation and achieve high-quality development.

**Keywords:** SRUI Enterprises; Data Resource Value Creation; Inclusion of Data Assets in Financial Statements; Tiered Value Creation Path

## 1. Introduction

In the era of deep integration of the digital economy and the real economy, data elements have become the core production factors driving the high-quality development of the economy, and the process of their value visualization profoundly affects enterprises' market competitiveness and sustainable development capabilities. According to the China Digital Economy Development Report (2024) released by the China Academy of Information and Communications Technology, the scale of China's digital economy reached 53.9 trillion yuan in 2023, accounting for more than 40% of GDP, with the contribution rate of data elements to economic growth rising steadily. As a high-quality group of small and medium-sized enterprises (SMEs) focusing on niche markets, boasting strong innovation capabilities, a high market share and great development potential, specialized, sophisticated, special and innovative enterprises are key nodes in the industrial and supply chains and important carriers of scientific and technological innovation. The capitalization and value creation level of their data resources are not only related to the enterprises' own transformation and upgrading, but also of great significance for enhancing the overall resilience and innovation efficiency of the industrial chain.

From a policy perspective, the gradual improvement of the institutional guarantee system for the inclusion of data resources in financial statements has created a favorable policy environment for value creation of data resources of specialized, sophisticated, special and innovative enterprises. In August 2023, the Ministry of Finance issued the Interim Provisions on the Accounting Treatment of Enterprise Data Resources, specifying that starting from January 1, 2024, enterprises may include eligible data resources in intangible assets or inventory for accounting, which established the asset attribute of data resources at the institutional level for the first time and provided top-level design and operational basis for their inclusion in financial statements. Subsequently, the General Office of the People's Government of Beijing Municipality issued the Several Measures of Beijing Municipality on Promoting the High-Quality Development of Specialized, Sophisticated, Special and Innovative Enterprises, proposing to encourage such enterprises to carry out data asset registration, inclusion in financial statements and data transactions, and explore data asset financing models. Four ministries and commissions jointly released the Special Action Plan for Digital Empowerment of Small and Medium-Sized Enterprises (2025-2027), which further identified the inclusion of data assets in financial statements as a key supporting task for the digital transformation of specialized, sophisticated, special and innovative enterprises, requiring the improvement of the market-oriented allocation mechanism of data elements to help SMEs unlock the value of data. The 2025 Digital China Tasks deployed by the National Data Administration clearly put forward deepening the development and utilization of data resources and promoting the release of the value of data elements, making the path of data asset capitalization increasingly clear. The intensive introduction of this series of policies has built a comprehensive policy framework covering institutional norms, local practices and empowerment support, providing a strong guarantee for

the value creation of data resources of specialized, sophisticated, special and innovative enterprises.

From a practical perspective, the inclusion of data resources in financial statements has entered a stage of pilot implementation and rapid promotion. Some specialized, sophisticated, special and innovative enterprises have taken the lead in exploration and achieved remarkable results, but the overall development is still in the exploratory stage, facing many practical challenges. In July 2023, at the "Data Element Summit Forum" of the Global Digital Economy Conference, four pilot enterprises for the inclusion of data resources in financial statements were announced in the field of Beijing's data element market construction, among which the practices of Beijing Kaiyun United Information Technology Group Co., Ltd. (a national-level specialized, sophisticated, special and innovative "little giant" enterprise) and Rock Future Technology Group Co., Ltd. are quite representative. As a specialized, sophisticated, special and innovative enterprise deeply engaged in the informatization construction of the aerospace field, Kaiyun United completed the registration of the data asset Orbital Cataloging of Space Targets in February 2023, becoming the first aerospace enterprise in China to obtain a data asset registration certificate. Rock Future completed the registration with Regional Ambient Air Quality Monitoring and Service Data, being the first listed company to obtain such a certificate. By the end of 2024, Kaiyun United recognized data assets as intangible assets with an assessed value of 90.9 million yuan; Rock Future collected costs through its own methods, with the amount of relevant data assets included in financial statements exceeding 2.5 million yuan. The practice of Kaiyun United is particularly noteworthy: as a forerunner in the field of commercial aerospace cataloging data in China, its core data resources, after right confirmation and evaluation, have not only been included in financial statements, but also become a tangible embodiment of the enterprise's technical capabilities and asset value. However, these successful cases are still in the minority. Research shows that 85% of specialized, sophisticated, special and innovative enterprises, despite owning high-value vertical industry data, fail to realize effective transformation, and generally face multiple challenges such as ambiguous definition of data right confirmation, inconsistent accounting standards, unclear value transformation paths and insufficient professional service support. Most enterprises have not yet formed a mature path for inclusion in financial statements and value creation, and there is an urgent need to sort out practical laws and solve development problems through systematic research.

This research has important theoretical and practical significance. In terms of theoretical significance, first, it can fill the gap in existing research on the insufficient attention to the inclusion of data resources of specialized, sophisticated, special and innovative enterprises in financial statements. Most existing studies focus on large enterprises and listed companies, with a lack of special analysis on the data asset capitalization of the SME group. Taking specialized, sophisticated, special and innovative enterprises as the specific research object, this study can enrich the research system of data element value creation. Second, it deepens the understanding of the value transmission mechanism of data elements in the innovative development of SMEs. Based on the resource-based view and dynamic capability theory, it reveals the path of data assets to enhance the core competitiveness of specialized, sophisticated, special and innovative

enterprises, and improves the theoretical framework of data asset value creation. Third, it perfects the evaluation system for the implementation effect of the Interim Provisions on the Accounting Treatment of Enterprise Data Resources in SMEs, providing academic support for the connection between policy theory and practice. In terms of practical significance, first, it provides referenceable operational paradigms for inclusion in financial statements and value creation paths for specialized, sophisticated, special and innovative enterprises, helping them solve the practical dilemmas of "not knowing how to include, being unable to include and not knowing how to use" data assets, and realize the visualization and release of data asset value like Kaiyun United. Second, it provides references for the practical pain points of policymakers, helping to accurately optimize supporting systems and promote the implementation of policies on the inclusion of data resources in financial statements among the SME group. Third, it promotes the circulation and sharing of data elements within the industrial chain, facilitates the coordinated development of large, medium and small enterprises, supports the deep integration of the digital economy and the real economy, and enhances the overall innovation efficiency of the industrial and supply chains.

## 2. Literaure Review

The capitalization of data resources has emerged as a critical area of research, particularly for Specialized, Sophisticated, Unique, and Innovative (SRUI) enterprises. Current literature highlights that while the inclusion of data resources in financial statements is gaining traction, significant challenges remain in ownership confirmation, cost collection, and accounting standardization. Sun (2024) notes that enterprises face confusion regarding the pricing and expected return analysis of data assets , while Sun (2024) further emphasizes the practical difficulties in measurement standardization . Complementing these views, Wang & Zhang (2025) emphasize the urgent need for optimized accounting recognition methods to address these valuation hurdles . Furthermore, Wang et al. (2025) argue that weak internal motivation and the absence of a stable market recognition mechanism hinder the widespread adoption of data asset inclusion .

Despite these challenges, data assetization presents substantial opportunities for enterprise growth, particularly in alleviating financing constraints. He et al. (2024) provide empirical evidence that data assetization significantly mitigates financing constraints for specialized and innovative SMEs, thereby enhancing their development potential . This aligns with the broader trend of financial innovation and digitalization driving business growth, as discussed by Balsalobre-Lorente et al. (2024), who highlight the synergy between green technology innovation and digital transformation in improving firm performance .

The regulatory landscape for data assets is also evolving. Abrardi et al. (2024) explore the role of data selling mechanisms, suggesting that while data brokers facilitate market liquidity, robust regulatory frameworks are essential to balance privacy protection with commercial utilization . In the context of digital transformation, Alhitmi et al. (2024) underscore the importance of addressing data security and privacy concerns in AI-driven marketing to ensure sustainable business practices . Additionally, Bertomeu and Magee (2015) highlight the fundamental role of

mandatory disclosure in reducing information asymmetry, a principle that is increasingly applicable to the transparent reporting of data assets .

From a market efficiency perspective, the integration of data-driven insights is transforming financial and operational strategies. Bi and Wang (2021) demonstrate that qualified foreign institutional investor (QFII) shareholding alleviates stock price delay, reflecting improved information efficiency in capital markets . Similarly, Bris et al. (2007) examine how investor sentiment and margin trading influence market volatility, emphasizing the complex dynamics of information flow and pricing. Agarwal et al. (2015) further contribute to this discourse by analyzing how mandatory portfolio disclosure affects stock liquidity and mutual fund performance, underscoring the value of transparency in financial markets .

The operationalization of data resources relies heavily on advanced analytics and strategic communication. Batistic and Van der Laken (2019) provide a bibliometric analysis showing that big data and analytics are pivotal for organizational performance, yet their evolution requires continuous adaptation. Concurrently, Baginski et al. (2016) explore the contemporaneous verification of language in management earnings forecasts, illustrating how corporate communication strategies are refined through data-driven verification processes .

Finally, industry-specific cases provide practical context for these theoretical discussions. The case of Huada Jiutian, as reported by Sina Finance (2025), illustrates the real-world application of these principles, detailing how the company achieved significant revenue by continuously improving its full-process layout in the EDA industry .

In summary, the literature reveals a multifaceted landscape where data resource capitalization offers significant strategic advantages for SRUI enterprises, particularly in financing and innovation. However, realizing this potential necessitates overcoming substantial hurdles in accounting standardization, regulatory clarity, and market recognition. Future research should focus on developing integrated frameworks that harmonize data asset valuation with broader financial and operational strategies, ensuring that SRUI enterprises can fully leverage their data resources for sustainable competitive advantage.

## 3. Analysis of the Current Situation of Data Resource Value Creation in Specialized, Sophisticated, Special and Innovative Enterprises

### 3.1. Application Characteristics of Data Resources of Specialized, Sophisticated, Special and Innovative Enterprise

#### (1) Type Distribution of Data Resources

The core competitiveness of specialized, sophisticated, special and innovative enterprises stems from their development positioning of "specialization, refinement, characteristic and innovation". The accumulation of their data resources is highly focused on core business areas, with the type distribution closely bound to the main niche market, showing distinct industry-specific characteristics and avoiding the generalization and inefficiency of data resources. Specifically, the core data resources mainly include three types:

The first type is industry-specific business data, which is the most core data asset of specialized, sophisticated, special and innovative enterprises, closely bound to their own main business areas. For example, as a national-level specialized, sophisticated, special and innovative "little giant" enterprise in the aerospace field, Beijing Kaiyun United Information Technology Group Co., Ltd.'s core data resources are the Orbital Cataloging of Space Targets, covering exclusive data such as orbital parameters of space targets, cataloging rules and collision early warning models, which are scarce resources in the commercial aerospace field. Rock Future Technology Group Co., Ltd., as an Internet of Things technology enterprise, has core data as exclusive resources in the environmental protection field such as regional ambient air quality monitoring data and ecological environment carbon peaking and carbon neutrality data. Such data has a strong industry barrier and is a direct embodiment of an enterprise's technological leadership and market competitiveness.

The second type is R&D and technological iteration data, including core technology experiment data, product performance test data sets, patent-related data, etc. Specialized, sophisticated, special and innovative enterprises have a high proportion of R&D investment and a first-mover advantage in niche technical fields, and the accumulated R&D data is scarce and irreproducible. For example, Kaiyun United's R&D data in the field of aerospace cataloging data covers thousands of orbital calculation experiments, target recognition model iteration records, etc., which not only supports its own technological upgrading, but also becomes the core basis for the value evaluation of data assets.

The third type is service and operation data, including customer demand feedback, project performance records, service effect monitoring data, etc. Since specialized, sophisticated, special and innovative enterprises focus on niche markets, their customer groups are relatively concentrated with precise demands, and such data has an extremely high value density. For example, Rock Future's environmental monitoring data service records not only support customers' environmental compliance needs, but also form industry trend reports through data analysis, expanding value-added service scenarios.

Overall, the type distribution of data resources of specialized, sophisticated, special and innovative enterprises presents the characteristics of "core focus, industry-specific and value-intensive", forming a sharp contrast with the diversified data layout of large enterprises. This focus makes the application scenarios of data resources more clear and the value transformation path more distinct, laying a good foundation for data asset capitalization.

**(2) Stage Characteristics of Data Resource Management and Application**

At present, the data resource management and application of specialized, sophisticated, special and innovative enterprises are generally in a step-by-step development stage of "collection - preliminary application - partial monetization". Forerunners represented by pilot enterprises such as Kaiyun United and Rock Future have entered the "value monetization" stage, while most enterprises are in the "preliminary application" stage, showing obvious differentiated characteristics:

The first stage is the data collection and standardization stage, which is the basic stage for most specialized, sophisticated, special and innovative enterprises. Enterprises complete the full-process capture and preliminary standardization of core business data by deploying professional equipment and building industry-specific systems. For example, Kaiyun United collects space target data through aerospace monitoring equipment and builds an exclusive database to unify data formats; Rock Future realizes real-time collection and structured storage of atmospheric data through environmental monitoring terminals. However, this stage has shortcomings: first, insufficient investment in data security protection, with some enterprises lacking special data security management systems; second, limited data integration capabilities, with insufficient cross-business link data linkage.

The second stage is the preliminary data application stage. On the basis of data collection, enterprises carry out targeted analysis to optimize existing businesses. In the field of technological R&D, the R&D cycle is shortened by analyzing experimental data. For example, Kaiyun United optimizes the collision early warning model by using orbital cataloging data, improving R&D efficiency by 20%. In the service field, service accuracy is improved through data monitoring. For example, Rock Future provides customized emission reduction suggestions for customers based on environmental data. However, data analysis at this stage mostly stays at the "business support" level, and has not yet formed an independent value creation scenario.

The third stage is the data value monetization stage, which only a small number of leading specialized, sophisticated, special and innovative enterprises have reached. Enterprises realize the capitalization and value release of data resources through data right confirmation, evaluation and inclusion in financial statements. For example, Kaiyun United recognized the Orbital Cataloging of Space Targets data as intangible assets with an assessed value of 90.9 million yuan, becoming one of the core assets in the enterprise's balance sheet; Rock Future included ecological environment carbon peaking and carbon neutrality data in financial statements with an amount exceeding 2.5 million yuan, which not only increased the asset scale, but also strengthened market recognition. However, the proportion of such enterprises is extremely low. Most enterprises are limited by talents, technology and professional service support, and it is difficult to break through the bottleneck from "application" to "monetization".

### 3.2. Existing Problems in Value Creation

#### (1) Non-standard Data Resource Right Confirmation and Accounting

Data resource right confirmation and accounting are the basic links for inclusion in financial statements and value creation, and also the primary problem faced by specialized, sophisticated, special and innovative enterprises, which directly restricts the process of data asset capitalization. In terms of data right confirmation, there are multiple ambiguous areas in ownership definition: first, the ownership boundary of industry-specific data is unclear. For example, Kaiyun United's aerospace cataloging data involves part of public resource information, and there are no clear standards for its ownership and income distribution rules; second, it is difficult to divide the ownership of collaboratively generated data. There is no unified ownership division mechanism for data jointly generated by specialized, sophisticated, special and innovative enterprises and

upstream and downstream enterprises in the industrial chain, resulting in some high-value data being unable to be included in financial statements.

In terms of accounting, the lack of unified and standardized operational standards leads to practical difficulties for enterprises: first, great differences in cost collection and measurement methods. For example, Kaiyun United recognizes intangible assets based on the assessed value, while Rock Future collects costs through its own methods and records them in development expenditures, with the accounting calibers of different enterprises lacking comparability; second, unclear subsequent measurement rules. The benefit period of data assets is greatly affected by technological iteration. For example, the validity period of aerospace data is related to the update frequency of space targets, but the current standards do not clarify the amortization rules for such data, resulting in a large randomness in the processing methods of enterprises.

**(2) Low Integration of Data Resources and Core Business, Insufficient Value Transformation Efficiency**

Some specialized, sophisticated, special and innovative enterprises have a cognitive bias of "emphasizing inclusion in financial statements over application". After data resources are included in financial statements, they fail to be fully integrated into the whole process of core business, leading to insufficient value transformation efficiency. From the perspective of application scenarios, data resources are mostly used for partial optimization of existing businesses, such as technical parameter adjustment and service accuracy improvement, with insufficient efforts to explore new businesses through data mining. For example, Kaiyun United's orbital cataloging data is only used for existing aerospace services and has not been expanded to new scenarios such as commercial satellite operation. From the perspective of internal coordination, there are "data silos" within enterprises, with data from R&D, sales and service departments failing to achieve efficient circulation. For example, Rock Future's environmental monitoring data and customer service data belong to different systems and cannot be linked to form value-added service solutions, restricting the maximum exertion of data value.

**(3) Lack of Professional Data Management and Analysis Talents, Weak Technical Support Capabilities**

Specialized, sophisticated, special and innovative enterprises generally face the problem of shortage of compound data talents, which has become a core bottleneck restricting the value creation of data resources. Data asset capitalization requires talents with both industry professional knowledge, accounting capabilities and data management skills, but most specialized, sophisticated, special and innovative enterprises are small in scale and have limited salary competitiveness, making it difficult to attract such high-end talents. For example, Kaiyun United's data analysis work is mostly undertaken by technical personnel on a part-time basis, lacking professional capabilities in accounting and asset operation.

In terms of technical support, enterprises' data analysis tools and technical means are relatively backward: first, lack of industry-specific data analysis models, with most enterprises using general tools to process vertical field data, resulting in insufficient accuracy; second, weak data security technology, with some enterprises lacking means such as data desensitization and

encrypted storage, leading to risks in data sharing and transactions. The double shortcomings of talents and technology make it difficult for specialized, sophisticated, special and innovative enterprises to realize in-depth mining and value upgrading of data resources.

**(4) Imperfect External Service Support System, Insufficient Collaborative Empowerment**

Data asset capitalization is a systematic project involving law, technology, finance and industry, but the current external service system for specialized, sophisticated, special and innovative enterprises still has shortcomings: first, insufficient supply of professional service institutions, with few institutions having the full-process service capabilities of data right confirmation, evaluation and inclusion in financial statements. Most enterprises need to connect with multiple service providers, resulting in high communication costs; second, poor adaptability of financial services, with banks and other institutions having insufficient recognition of data assets and a lack of financing products for data assets of specialized, sophisticated, special and innovative enterprises; third, immature data trading market, with imperfect trading rules and pricing mechanisms for vertical field data. For example, it is difficult for Kaiyun United's aerospace cataloging data to find matching trading scenarios, resulting in narrow monetization channels. The lack of external service support makes specialized, sophisticated, special and innovative enterprises fight alone in the process of data asset capitalization, and it is difficult for them to cope with complex technical and market challenges.

## 4. Analysis of Data Resource Value Creation Paths for Specialized, Refined, Unique, and Innovative (SRUI) Enterprises

The core competitiveness of SRUI enterprises lies in their "specialization, refinement, uniqueness, and innovation." Data resources, as the core production factors in the era of the digital economy, require a tiered and progressive implementation path for value creation. This path progresses from consolidating foundational capabilities to releasing application value, and then to expanding ecosystem value, with each layer interconnecting to form a complete value creation chain. As a national-level SRUI "Little Giant" enterprise, Beijing Kaiyun Union Information Technology Group Co., Ltd. (hereinafter referred to as "Kaiyun Union") provides a typical reference case for SRUI enterprises in terms of data resource capitalization on financial statements and value extraction, offering insights into data value creation paths.

### 4.1. Foundational Layer Value Creation Path for Data Resources

The foundational data resource layer is the prerequisite and foundation for value creation. Its core is to transform data from "raw resources" to "usable assets" through two major initiatives: data acquisition and governance, and data assetization, laying the groundwork for subsequent value extraction.

**(1) Data Acquisition and Governance**

SRUI enterprises need to establish standardized data acquisition systems around their core business scenarios. Kaiyun Union, deeply engaged in information technology construction for the aerospace sector, achieves precise acquisition of aerospace data, such as "space object orbit

cataloging" and "collision warning" data, relying on professional aerospace expertise. Concurrently, it ensures the accuracy and completeness of aerospace data through governance measures like data cleaning and verification, reducing data application costs at the source. Meanwhile, Luoke Jiahua Technology Group Co., Ltd. (hereinafter referred to as "Jiahua Technology") has built a standardized environmental data acquisition network for ecological environment monitoring data, improving data quality through multi-dimensional governance, thus laying the foundation for environmental data assetization and application. The practices of these two pilot enterprises indicate that SRUI enterprises must focus on data acquisition and governance within their specialized and refined segments, combining their "specialized and refined" attributes, to form high-quality core data resources.

**(2) Data Assetization**

According to accounting regulations such as the *Interim Provisions on Accounting Treatment of Enterprise Data Resources*, the core of data assetization involves the recognition, measurement, recording, and reporting of data resources. Kaiyun Union recognizes data assets as intangible assets, completing initial recognition based on the assessed value (90.90 million yuan), with a carrying amount of 1 million yuan at the period-end, having an undetermined useful life and currently no impairment. Jiahua Technology, on the other hand, attaches data assets to fixed assets, aggregating costs using its own methodology, with a period-end balance of approximately 1 million yuan and a determined useful life of three years. Both have completed the critical ownership confirmation step for capitalizing data resources on their financial statements. Kaiyun Union became the first aerospace enterprise in China to obtain a data asset registration certificate, while Jiahua Technology was the first listed company to obtain such a certificate. Their data assetization practices demonstrate that SRUI enterprises can achieve ownership confirmation for data resource assets through differentiated accounting treatment methods, providing an accounting basis for data value assessment and trading.

### 4.2. Application Layer Value Creation Path for Data Resources

The data resource application layer is the core link for value creation. It focuses on the developmental requirements of "specialization, refinement, uniqueness, and innovation" for SRUI enterprises, deeply integrating high-quality, governed data with their core business. Value is directly realized through three specific sub-paths.

**(1) R&D and Innovation Pat**

Utilizing data resources to optimize product R&D processes is key to enhancing technological novelty. Based on "space object orbit cataloging" data, Kaiyun Union conducts R&D for aerospace informatization products. By analyzing and applying space object data, it optimizes the R&D and design of aerospace cataloging systems, strengthening its pioneering position in the field of commercial aerospace cataloging data. Jiahua Technology relies on ecological environment monitoring data to develop the Ecological Environment Dual-Carbon Cloud Map V2.0 system. The value of the R&D outcomes corresponding to the capitalized data assets reached 2.5587 million yuan, achieving direct conversion of data resources into innovative R&D results. By integrating core data from their specialized segments into the R&D phase, SRUI

enterprises can accurately grasp industry technology trends and enhance the "innovativeness" of their products.

**(2) Production Optimization Path**

Achieving refined control over production processes through industrial data monitoring is a core path for SRUI enterprises to strengthen "specialization and refinement." Jiahua Technology applies environmental monitoring data to the production and operation of ecological environment governance projects. By monitoring data in real-time, it optimizes the execution processes of environmental governance solutions, improving project implementation efficiency. Kaiyun Union applies aerospace data to the production and debugging of aerospace informatization systems. By analyzing orbit cataloging data, it optimizes system operating parameters, ensuring the production quality of aerospace informatization products. The deep application of data resources enables SRUI enterprises to form refined control capabilities in the production aspects of their specialized segments, consolidating their "specialized" competitive advantages.

**(3) Market Expansion Path**

Conducting precision marketing and creating unique products based on customer data is key to demonstrating "uniqueness." Relying on aerospace data, Kaiyun Union provides customized informatization services for clients in the aerospace sector. The assessed value of its "collision warning" data assets reflects customers' willingness to pay for such specialized services. Jiahua Technology, based on environmental monitoring data, provides customized ecological environment governance solutions for government and enterprise clients, forming a differentiated market service model. By mining customer data needs within their specialized segments, SRUI enterprises can create unique products and services aligned with their market positioning, thereby increasing their market share.

### 4.3. Ecosystem Layer Value Creation Path for Data Resources

The data resource ecosystem layer represents the extension and upgrade of value creation. It breaks through individual enterprise boundaries, elevating value from "enterprise value" to "industrial value" through data opening, sharing, and cross-border integration. This helps SRUI enterprises integrate into industrial ecosystems and expand their development space.

**(1) Industrial Chain Collaboration**

Using data sharing platforms as a carrier to promote the exchange of key data with upstream and downstream enterprises in the industrial chain is core for SRUI enterprises to enhance their industrial supporting capabilities. As an SRUI enterprise in the aerospace sector, Kaiyun Union can collaborate with upstream and downstream players like aerospace equipment manufacturers and operators through sharing aerospace data, optimizing resource allocation efficiency within the aerospace industry. Jiahua Technology can collaborate with upstream and downstream enterprises in the environmental protection industrial chain for coordinated governance through sharing environmental data, improving the overall response speed of the ecological and environmental protection industry. Industrial chain collaboration via data resources shifts SRUI enterprises from

"going it alone" to "industrial collaboration," strengthening their supporting role within specialized industrial chains.

**(2) Cross-border Integration**

Leveraging core business data for cross-border innovation is key to cultivating new business formats and models. Jiahua Technology integrates environmental monitoring data with big data and cloud computing technologies, fostering a new business format of ecological environment big data services. Kaiyun Union combines aerospace data with artificial intelligence technology, exploring new models for commercial aerospace data services. With their core data resources from specialized segments, SRUI enterprises can break industry boundaries, engage in cross-border integration with digital technologies and other industrial fields, and create new value growth points.

## 5. Case Analysis — Taking Empyrean Technology as an Example

### 5.1. Enterprise Overview

**(1) Company Profile**

Empyrean Technology (full name: Beijing Empyrean Technology Co., Ltd.) was founded in 2009, formerly the EDA department of China Huada Integrated Circuit Design Group. Headquartered in Beijing, the company was listed on the Growth Enterprise Market (GEM) of the Shenzhen Stock Exchange in 2022, stock code 301269. It is a "leading enterprise in China's EDA industry", primarily engaged in the development, sales, and related services of EDA tool software for integrated circuit design, manufacturing, and packaging.

Having focused on the EDA field for over a decade, Empyrean Technology concentrates on R&D of tools for key links in integrated circuit design and manufacturing, possessing full-process toolchains in niche segments such as analog circuit design and flat panel display design. Complying with the characteristics of "Specialized, Sophisticated, Distinctive, and Innovative" enterprises, it is a national-level "Specialized, Sophisticated, Distinctive, and Innovative" enterprise and has been selected as a national "Manufacturing Industry Single Champion" demonstration enterprise.

**(2) Core Business**

The company's business covers the "full-process EDA toolchain" and is mainly divided into four sectors:

Full-process EDA tool system for analog circuit design. Covers the entire process from circuit simulation, layout design to physical verification, with a leading market share in China. Core tools: analog simulator ALPS, layout tool Aether, etc.

EDA tools for digital circuit design. Provides point tools for digital circuit logic synthesis, timing analysis, etc., gradually expanding towards a full-process solution. Core tools: clock quality analysis tool ClockExplorer, timing optimization tool, etc.

Full-process EDA tool system for flat panel display circuit design. A globally leading EDA solution for flat panel display (FPD) design, with customers covering BOE, CSOT, etc. Supports new display technologies like OLED, Micro-LED.

Wafer manufacturing EDA tools. Provides tools for the manufacturing process such as device model extraction, reliability analysis, etc., supporting domestic production lines like SMIC.

**(3) Ource Reserves Situation**

Technical Resources: According to news reports dated January 12, 2026, the substitution rate of Empyrean Technology's EDA software in the domestic market has exceeded 40%. As of June 30, 2025, Empyrean Technology has obtained 355 authorized patents and 181 software copyrights.

Ecological Resources: Covers major domestic IC design companies (HiSilicon, Will Semiconductor, etc.), wafer fabs (SMIC, Huahong, etc.), and panel manufacturers. Undertakes multiple national "Core Electronic Components, High-end Generic Chips, and Basic Software Products" major projects; co-builds joint laboratories with universities and research institutes.

Capital and Strategic Resources: Raised funds through IPO for upgrading full-process EDA tools, developing digital design tools, etc., demonstrating strong financing capability. Invests in upstream and downstream EDA enterprises through industrial funds, forming a complete toolchain ecosystem.

Policy Resources: Benefits from domestic substitution policies, included in procurement catalogs like "Information Technology Application Innovation" and "National Security"; receives tax reductions, R&D subsidies, and other support.

### 5.2. Practice of Data Resource Value Creation Path

Empyrean Technology has formed a closed loop in data collection, application, and ecosystem building. Data is collected from high-intensity in-house R&D (R&D expenses accounting for over 67% of revenue), direct feedback from nearly 700 customers, and advanced process data obtained through cooperation with industry chain partners. This data is directly used to iterate and optimize EDA tools (such as launching new products like Andes, Optimus), for customized IP and technical services, and to improve product quality. Simultaneously, the company actively builds an integrated circuit industry ecosystem centered around its own tools through industry-academia-research cooperation, opening the PyAether platform, deepening industrial chain collaboration, and participating in industry standard setting, driving technological innovation and business growth.

### 5.3. Effectiveness of Value Creation Mechanism Operation

Financial Indicator Assessment: From a financial performance perspective, Empyrean Technology maintained strong growth momentum in 2024. The company achieved operating revenue of 1.222 billion yuan, a year-on-year increase of 20.98%, reaching a historical high. This indicates sustained strong market demand for its core business. However, the company's net profit fell by 45.46%, attributed to its choice to continue high-intensity R&D investment, with R&D expenditure significantly exceeding net profit. This strategy of "sacrificing profit for the future",

while impacting profitability in the short term, aims to conquer long-term, difficult-to-surmount technical barriers. Regarding cash flow, the net cash flow generated from operating activities was negative, primarily due to prepayment for some contract revenues received in the previous period and increased payment of employee compensation in the current period. Combined with revenue growth, this reflects significant investment in business expansion.

Non-Financial Indicator Assessment: Regarding non-financial indicators, Empyrean Technology maintains a solid industry-leading position. Its market share remains the highest among domestic EDA enterprises, and the number of customers has grown to nearly 700, reflecting strong customer recognition and brand influence. In terms of technological patents, as of the end of 2024, the company possessed a total of 342 authorized patents and 171 software copyrights, indicating a continuously enriched intellectual property reserve. Key breakthroughs were made in the product line, with the launch of new full-process EDA tool systems for memory circuit design and radio frequency circuit design, as well as key EDA tools for 3DIC design and advanced packaging design, filling gaps in related domestic fields. Significant progress was made, especially in advanced packaging automatic routing tool Storm and 3DIC design tools, accurately targeting future industry development directions. The company's project "Near-Threshold Wide-Voltage Integrated Circuit Design Technology and EDA Tools" won the first prize of the "China Institute of Electronics Science and Technology Award", a strong testament to its technological advancement.

### 5.4. Issues Regarding Data Resource Recognition on the Balance Sheet

As a typical EDA software company, Empyrean Technology's core competitiveness stems from sustained, high-intensity R&D. The formation of its data assets is deeply integrated with product development. According to the "Interim Provisions on the Accounting Treatment of Enterprise Data Resources", R&D expenditures must be strictly distinguished between the research phase (expensed) and the development phase (capitalizable only if certain conditions are met). The key issue Empyrean Technology faces is: how to define the point of "substantive completion of the development phase" for its massive data resources such as design rules and algorithm models.

## 6. Countermeasures and Suggestions

### (1) Enterprise Level: Strengthen data resource management capabilities and promote the deep integration of data with core business operations

Build a full-process data governance system: Focus on core business scenarios to establish a standardized data collection mechanism, and optimize data cleaning, validation, and integration processes in line with industry-specific attributes to improve data quality and usability. Drawing on the practices of Kaiyun United and Jiahua Technology, establish a cross-departmental data management team that integrates professional resources from R&D, finance, and legal affairs, clearly defining responsibilities for each stage of data collection, governance, and asset recognition, thereby breaking down "data silos." At the same time, enhance data security by deploying technical measures such as data desensitization and encrypted storage, improving data security management systems, and reducing risks associated with data sharing and transactions.

Deepen the integration of data and business applications: Abandon the cognitive bias of "emphasizing recognition over application" and fully integrate data resources into key business areas such as R&D, production, and marketing. On the R&D side, use industry-specific data to optimize product development processes, accurately identify technology trends, and enhance the "novelty" of products. In production, leverage real-time data monitoring to achieve refined control and consolidate a "specialized" competitive edge. In the market, explore customer data needs to develop distinctive products and services and expand value-added service scenarios. Additionally, actively explore channels for monetizing data assets, such as data asset financing and trading, to maximize their value.

Build a composite talent pipeline: Develop a "professional + data" talent training and recruitment plan tailored to the specific needs of niche industries. Attract versatile talents with expertise in both industry knowledge, accounting skills, and data management through optimized compensation systems and expanded career development opportunities. Provide data literacy training for existing employees to enhance technicians' understanding of accounting and asset operations, as well as financial staff's proficiency in data governance and application, addressing the bottleneck of talent shortages.

**(2) Government Level: Improve policy frameworks for data ownership confirmation and accounting standards, and increase support for digital transformation among specialized and sophisticated enterprises**

Improve data ownership and accounting standards: Address the unique characteristics of data from specialized and sophisticated enterprises by refining data ownership rules, clarifying the boundaries of ownership and benefit distribution mechanisms for industry-specific and collaboratively generated data, and resolving ambiguities in ownership definition. Based on the "Interim Provisions on Accounting Treatment Related to Enterprise Data Resources," issue special operational guidelines for small and medium-sized enterprises (SMEs), standardizing accounting treatment for data asset cost accumulation, initial measurement, and subsequent amortization to reduce discrepancies in practice. Establish a data asset registration and filing system, simplify the registration process, and provide convenient services for confirming data ownership.

Strengthen policy support and resource provision: Increase fiscal funding support by establishing special subsidies for data assetization among specialized and sophisticated enterprises, covering expenses related to data governance, valuation, and recognition consulting. Guide financial institutions to innovate data asset financing products, enhance recognition of data assets, and offer credit and pledge financing services based on data assets. Build a policy docking platform that integrates professional services such as legal, technical, and financial resources to provide enterprises with free or low-cost full-process consulting services, overcoming insufficient professional service support.

Optimize pilot promotion and regulatory mechanisms: Expand the scope of data asset recognition pilots, prioritizing specialized and sophisticated enterprises across various industries and scales, summarizing diverse practical experiences, and promoting them widely. Establish a

tracking and evaluation mechanism for policy implementation effectiveness, promptly collecting feedback on pain points and challenges faced by enterprises during data recognition and value creation, and dynamically optimizing supporting policies. Enhance data security regulation, balancing the release of data value with privacy protection, to create a safe and compliant policy environment for enterprise data assetization.

**(3) Industry Level: Build data resource sharing platforms to promote upstream and downstream data collaboration along the industrial chain**

Construct an industry-specific data sharing ecosystem: Leverage specialized industry associations or leading enterprises to build vertical data sharing platforms and formulate unified data sharing standards and security protocols. Encourage upstream and downstream enterprises in the industrial chain to open non-core business data and enable interoperability of critical data, such as orbital parameter data in the aerospace sector and monitoring data in environmental protection, to optimize resource allocation efficiency. Establish data transaction rules and pricing mechanisms, clarify transaction processes, rights and responsibilities, and benefit distribution models, and broaden data monetization channels for specialized and sophisticated enterprises.

Strengthen professional service system support: Integrate industry resources from legal, valuation, and technical institutions to form a specialized service alliance that provides end-to-end services for data ownership confirmation, valuation, accounting, and security governance for specialized and sophisticated enterprises. Develop industry-specific data analysis models and tools tailored to different sectors to lower technological adoption barriers for SMEs. Organize industry exchange activities to promote successful practices from enterprises like Kaiyun United, Jiahua Technology, and Huada Jiutian, fostering mutual learning and improvement in data management and application capabilities.

Promote industry standards and self-discipline: Collaborate with enterprises and research institutions to formulate industry standards for data assetization, regulating operational procedures for data collection, governance, valuation, and trading. Establish a self-regulatory mechanism to guide enterprises in complying with relevant laws and regulations on data security and privacy protection, preventing misuse and illegal transactions. Strengthen communication and collaboration with government departments, provide feedback on industry development needs, and ensure precise alignment between policy frameworks and industry practices.

**Author Contributions:**

All authors contributed equally. All authors have read and agreed to the published version of the manuscript.

**Funding:**

This paper is supported by "Urban New Star Program" project of Beijing City University in 2025, titled "Research on the Value Creation Path Mechanism of Data Resources for Specialized and Sophisticated Enterprises that Produce New and Unique Products" (Grant No.: S202511418078).

**Institutional Review Board Statement:**

Not applicable.

**Informed Consent Statement:**

Not applicable.

**Data Availability Statement:**

Not applicable.

**Conflict of Interest:**

The authors declare no conflict of interest.

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