Promoting the Circulation of Industrial Data Space Elements in Shanghai

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Abstract: This paper contextualizes the current development of China's digital economy and introduces the concept of Industrial Data Space (IDS), emphasizing its pivotal role in future industrial advancement. Using Shanghai as a case study, we assess the necessity of establishing an IDS and analyze its current usage of industrial data, including the challenges and issues regarding data circulation. Learning from the experiences of Shenzhen, China, and key examples from Germany, we offer insights for Shanghai's IDS development. A comprehensive feasibility analysis, considering market demand, policy support, and technological capabilities, suggests that establishing an IDS in Shanghai is both viable and beneficial. Finally, we propose practical recommendations for its implementation. We believe that the Shanghai Industrial Data space will be successfully established in the next few years.

Keywords: Industrial Data Space, Industrial Development, Circulation of Industrial Data, Shanghai

1. Introduction

With the growing emphasis on the role of data in the production process, the concept of Industrial Data Space (IDS) has increasingly garnered attention across various sectors. IDS is a secure, reliable virtual space for data sharing created through standard communication interface technologies and systems. It encompasses numerous certified enterprises and organizations, promoting the circulation and value realization of data resources.[1] Industrial sectors view IDS as an effective mechanism to enhance the circulation of industrial data and as a critical foundation for harnessing the value of industrial data.

2. Shanghai's Industrial Background And the Importance of Building an Industrial Data Space

As the demographic dividend fades and global value chains shorten due to emerging information technologies, developing countries should shift their focus from factor-driven to innovation-driven growth. Enhancing the digitalization of the real economy is crucial and necessitates promoting industrial digital transformation. As a key economic hub in China, Shanghai is facing various industrial development challenges. The city is at a pivotal point in its manufacturing sector, with Shenzhen surpassing Shanghai in 2022 for the highest industry-added value, and Xi'an overtaking it in new energy vehicle manufacturing. Meanwhile, foreign investment has been instrumental in Shanghai's industrial development. However, as Western countries curb China's advanced manufacturing and low-end manufacturing enterprises move to Southeast Asian nations with demographic dividends and geographical advantages, foreign capital no longer propels Shanghai's industrial development as it once did.

Shanghai boasts a robust financial and service industry where commercial data is extensively utilized. Yet, the circulation of industrial data elements is still in its infancy. Hosting key industrial sectors such as automotive, electronics, petrochemical, and steel, Shanghai stands as an important industrial base in China. With the Fourteenth Five-Year Plan underway, the importance of industrial data is escalating. Through the collection and analysis of industrial data, companies can optimize production processes, enhance efficiency, reduce costs, and improve product quality—thus holding substantial value for industrial enterprises. A strategic approach to developing the industrial data space can significantly boost industrial data circulation and sharing, maximizing the value of data.

Studying the circulation of industrial data space elements in Shanghai holds the following significance:

2.1 Advancing the Perfection of Industrial Data Space Policy System:

The industrial data space is not merely confined to industrial development. It possesses certain public property characteristics in its functional positioning; hence, the initial development and construction require government coordination, policy guidance, and collaborative construction among multiple entities. By establishing the industrial data space in Shanghai, experience can be gathered for the development of related fields in other regions of China; simultaneously, the collaboration among multiple entities in this field can also serve as a model for future government-enterprise cooperation.

2.2 Facilitating Scientific-Technological Development:

Relevant industry entities will play the following roles in the construction of the industrial data space: First, they improve the related technical infrastructure and expedite the construction of technical infrastructure that supports trusted data circulation; Second, they stimulate the vitality of various market entities, encouraging big data enterprises, software and information technology service companies, digital solution providers, etc., to participate in R&D innovation related to the construction of the industrial data space; Third, they cultivate a positive atmosphere for innovation, promoting the development of open-source projects in the industrial data space.

2.3 Catalyzing Economic Growth

Despite the vigorous development of the tertiary industry in Shanghai in recent years, Shanghai's development has always been industry-oriented. In 2021, the total output value of industries above designated size in Shanghai reached 3.949854 trillion yuan, and the added value of industries surpassed one trillion yuan for the first time, reaching 1.07 trillion yuan.[2]The establishment of Shanghai's industrial data space makes Shanghai's industries more orderly and secure, drives the sustainable and stable development of the industry, and stimulates the overall economic enhancement of Shanghai.

3. Challenges Faced by Shanghai's Industrial Data Space Construction

Shanghai has played a vital role in reform and opening up, particularly due to its advanced secondary sector. However, despite its advantages, there are challenges regarding the sharing and circulation of industrial data in Shanghai.

3.1 Insufficient Systemic Policies for Industrial Data Space Construction

In 2019, the Ministry of Industry and Information Technology initiated key tasks, followed by related administrative measures issued by various government departments aimed at standardizing the industrial data space construction and defining fundamental standards. Nonetheless, critical aspects such as data ownership, value assessment, and sharing rules remain inadequately defined and regulated. The absence of authoritative guidance has further led to inconsistencies among enterprises in their understanding, architectural frameworks, and methodologies pertaining to the industrial data space, hindering the formulation of long-term strategies for the circulation of industrial elements.

3.2 Dependence on Imported Industrial Data Collection Software

China is heavily dependent on imported industrial software due to its late entry into the information technology and the lack of substantial investment in corresponding research fields. Core industrial chain components, including industrial protocols, intelligent devices and software designs, are under foreign control. For instance, the information management type of industrial software (such as ERP, CRM, etc.), used for managing and controlling industrial enterprise information flow, is dominated by global software giants like SAP and Oracle. Similarly, production control type of industrial software (like MES, DCS, etc.), utilized for controlling production processes and gathering relevant data, is predominantly under the control of overseas corporations, such as Honeywell.[3]

3.3 Businesses' Hesitancy in Data Sharing

While technical solutions for data interconnection, a fundamental aspect of industrial data circulation, are available, Shanghai continues to grapple with obstacles such as weak industrial data collection capabilities and data barriers. These issues prevent valuable data from being shared and circulated, hindering the optimization of benefits from industrial element circulation. Research has revealed that the principal difficulty in data collection stems from companies' unwillingness to share industrial data with industrial internet platforms or to deploy their data into various sensors for business profitability reasons. Even when businesses cooperate with industrial internet platforms, they prefer to store the data within their own local systems.

3.4 Imperfect of the ecology of production, university and research

The circulation and utilization of industrial data is a complex endeavor that requires diverse professional knowledge, including data science, industrial understanding, data regulations, and information security. Despite Shanghai's international metropolis status and abundance of top talent across various fields, there is still a significant shortage of interdisciplinary talent. This deficiency stems from an imperfect industry-academia-research system. The curricula in Shanghai's universities, and indeed across the country, have certain gaps; related majors often lack interdisciplinary learning and fail to provide comprehensive skill training. Even though Shanghai's universities provide education of an exceptionally high standard, there still remain similar gaps. Students often excel in specific fields like law, industrial manufacturing, or data management, but lack interdisciplinary competence.

4. An Analysis of Industrial Data Spaces Development in Shenzhen

On March 17, 2023, the Shenzhen Data Exchange collaborated with the China Academy of Information and Communications Technology, Sichuan Changhong Electronic Holding Group Co., Ltd., and Shenzhen Suxin Technology Co., Ltd. They utilized trusted data space technology to launch China's initial data space application in intelligent manufacturing. This endeavor effectively established a secure and transparent data communication channel, aiming to ensure dependable data exchange, reduce costs, and overcome limitations of the industrial internet platform. However, being the pioneering case of data space application in China, this initiative naturally encounters challenges:

Data Rights Legal Protection: Comprehensive legal protection mechanisms for data rights and interests are lacking, despite ongoing discussions on confirming data element flow rights in China.

Innovation in Digital Economy Theories: Due to recent digitalization, China's innovation in digital economy theories remains insufficient. Despite the relatively advanced Shenzhen Data Exchange, there is an incomplete theoretical foundation, leading to an inadequate understanding of the digital economy.[4]

Policy System: As the first of its kind in intelligent manufacturing data space in China, Shenzhen's industrial data space lacks national precedents, resulting in unexpected challenges in data exchange due to an incomplete policy system.

5. Examination of Germany Industrial Data Spaces and Implications for Learning

With an advanced industrial level, Germany initiated its digital transformation early and has led the world in building industrial data spaces, excelling in architectural construction, mechanism design, and industry ecology. Germany's industrial data space model embraces a "five layers and three principles" approach, featuring security, authentication, and governance principles. Lessons from Germany that could be applicable to the construction of the Shanghai Industrial Data Space include[5]:

Top-level design enhancement: Drawing on Germany's "five layers and three principles," Shanghai can adapt this model, aligning it with its unique strengths in technology and modernization

Data flow environment creation: Germany utilizes a "double authentication" mode to ensure a trusted data circulation environment. Shanghai can similarly authenticate data exchange participants and core components to create a secure and stable industrial data exchange environment.

Emphasis on data exchange security: Germany's "data connector" technology ensures safe data exchange. Shanghai can adopt similar technologies to guarantee secure data exchange.

Deeper understanding of industrial data spaces: Studying Germany's experience and leveraging Shanghai's unique advantages could enhance the innovation of its industrial data space, potentially leading to the development of technologies such as an "Industrial data classifier."

6. Feasibility Analysis of Industrial Data Space Development in Shanghai

Due to the urgent need for nationwide digital economy promotion and transformation, Shanghai, a key manufacturing hub in China, is highly feasible for establishing an industrial data space.

6.1 Shanghai's Plentiful Industrial Data Requires a Common Platform for Efficient Circulation

Shanghai's manufacturing sector is transitioning toward high-tech industrial transformation. The city is home to prominent Chinese manufacturing enterprises such as China Baowu Iron and Steel Group Co., Ltd., as well as foreign manufacturers like Tesla. The number of similar manufacturing companies means that Shanghai generates a huge amount of industrial data every year. A unified industrial data space has thus become an essential platform for facilitating all industrial data exchanges. It simplifies the previously methods of industrial data exchange and allows for seamless transmission.

6.2 Shanghai's Advanced Technology Supports Construction Efforts

The establishment of an industrial data space requires the backing of cutting-edge technologies such as cloud computing, and the Internet of Things (IoT), all of which have been widely promoted in Shanghai. For instance, the "Shanghai Cloud Computing Innovation Base" has been established in Yangpu District, aiming to form a "four-in-one" industrial functional zone that comprises a cloud computing business incubator, accelerator, headquarters, and talent training center. Furthermore, Shanghai is home to major big data centers and technology parks like Zhangjiang High-tech Park, all of which provide technical assurances for the construction of an industrial data space in Shanghai.

6.3 Shanghai's Series of Digital-Related Policies Provide Policy Support

The Shanghai government, showing strong support for the nation's digital transformation and smart manufacturing, has introduced a series of related policies, such as the "14th Five-Year Plan for Comprehensively Promoting Urban Digital Transformation in Shanghai".[6]Meanwhile, to ensure the feasibility of data trading, the Shanghai Stock Exchange has issued seven trial norms and six directives centered on the construction of the data element market. The introduction of these policies provides a favorable environment for the sustainable development of Shanghai's industrial data space in the future.

7. Policy Recommendations for the Construction of Shanghai's Industrial Data Space

Recently Shanghai has introduced several policies, aiming to accelerate digital transformation. We propose the following suggestions to advance the development of an industrial data space in Shanghai:

7.1 Cultivate Leading Enterprises and Platforms to Spearhead the Development

A group of leading enterprises should be cultivated, concentrating on traditionally strong sectors such as automotive industry, commercial large aircraft, shipbuilding, aerospace, and electrical equipment. Resources should be allocated to support entities willing to establish industrial data spaces. Additionally, the leading role of the state-owned economy should be leveraged in the construction of an industrial data space that impacts public domains.

7.2 Enhance Intellectual Property Protection and Foster an Open-Source Innovation Ecosystem

The protection of intellectual property rights should be reinforced, along with the establishment of open-source organizations in Shanghai, to advocate for an open and collaborative ecosystem, nurturing application developers. The creation of a "Shanghai Open Source Foundation" could serve to coordinate funding and support for open-source projects in the realm of industrial data space.

7.3 Accelerate the Development of Data-Related Technologies to Minimize Import Dependence

Specialized research and development institutions should be established, focusing on breakthroughs in core technologies. With the advantage of Shanghai's talent pool, capital resources, and conducive business environment, strategies for localizing crucial technologies such as industrial software and platform systems should be developed, aiming for self-reliance in related fields.

7.4 Promote Academic Field Advancement Through Industry-Academia-Research Integration.

The structure of related disciplines in the industrial data space should be improved. Encouraging universities to introduce relevant majors, bringing in a cohort of research and application experts in industrial data space, and supporting foreign firms in conducting related research are all crucial steps.

8. Conclusion and Future Prospects for Shanghai's Industrial Data Space

In conclusion, Shanghai boasts a robust manufacturing base, a vibrant large market, and a vast economic hinterland. Supported by a series of recently implemented policies, the future of Shanghai's industrial data space is assuredly heading towards greater completeness. We believe that Shanghai, with its digital transformation, will empower high-quality development in the manufacturing industry.

Acknowledgement

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