

Research on the Mechanisms by Which Data Resources Empower the Development of New-Quality Productive Forces

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Abstract. The development of new-quality productive forces must be supported by science and technology. As a product of the digital age, data resources are bound to become the core support for the development of these new-quality productive forces. Starting from data resources and taking equipment manufacturing enterprises as the analytical context, this paper examines the pathway mechanisms through which data resources empower the development of new-quality productive forces, thereby promoting iterative upgrading toward new-quality productivity. The study shows that data resources, as a new production factor, can dynamically and iteratively empower the development of new-quality productive forces; while enabling significant improvements in the quality and efficiency of these productive forces, they also facilitate the gradual construction and refinement of the data ecosystem. The process mechanisms explored here extend existing research on data resources, new-quality productive forces, and practices of value creation, and provide references and insights for the application of data resources in manufacturing and for the development of new-quality productive forces.

Keywords: data resources, new-quality productive forces, equipment manufacturing enterprises

1. Introduction

In June 2025, the Ministry of Industry and Information Technology issued the Action Plan for Metrology Supporting the Development of New-Quality Productive Forces (2025–2030), which identifies key fields and industries for the development of new-quality productive forces. The emphasis lies on the terms “new” and “quality.” According to Huang Qifan, academic advisor of the China Finance 40 Forum (CF40), the “new” in new-quality productive forces is mainly reflected in three dimensions: “new manufacturing,” “new services,” and “new business models.” The term “quality” highlights changes in the nature of productive forces, specifically the multiplier effect of technological empowerment in reshaping the combinations of production factors. In short, the development of new-quality productive forces requires technological innovation to drive high-quality industrial development.

The development of new-quality productive forces stresses technological innovation. Since traditional production factors contribute little to innovation, digital technologies and data resources have become indispensable. In the wave of the digital era, enterprises rely on data centers, data

middle platforms, and other smart applications to provide robust data support. As a novel production factor, data grants new endowments to productive forces on the basis of traditional elements. Supported by digital technologies, data resources demonstrate digital momentum across all stages of enterprise activities—production, circulation, and processing—thus giving rise to a new production factor: the data factor. The massive accumulation of corporate data highlights the strong complementarity, spillover effects, boundarylessness, and deep accumulation characteristics of data. Its boundaryless nature enables integration and empowerment across all aspects of enterprise production and sales activities. By leveraging complementarity and accumulation, enterprises can achieve multidirectional closed-loop flows of data resources throughout the production process. When integrated with other production factors, this leads to qualitative leaps in productivity. In particular, the integration of data resources with “new manufacturing” empowers the development of new-quality productive forces.

This paper conducts a longitudinal single-case study of Jereh Group, a company that embodies both extensive data resources and a positioning in “new manufacturing.” The study extracts the mechanisms by which data resources couple with other production factors to reconstruct, empower, and enable leaps in new-quality productive forces, ultimately achieving value creation. By opening the black box of how the company’s data assets dynamically couple, reconstruct, and transform into new-quality productive forces, the paper provides insights for other data-rich manufacturing enterprises seeking to harness the full potential of their data assets.

2. Literature review

2.1. Research on data resources empowering new-quality productive forces

With the development of digital technologies, the foundational and strategic roles of data have become increasingly prominent. As an inevitable outcome of the technological revolution, unlocking data value, coordinating data quality and quantity, and better leveraging data’s foundational and innovative functions are of great significance [1]. By classifying and identifying data resources, enterprises can utilize them to build brand value, optimize quality, and enhance innovation efficiency [2]. On the basis of data efficiency, enterprises can gradually construct a digital ecosystem driven by data resources, thereby accelerating digital transformation, enabling qualitative leaps in productivity, and aligning with the trend of developing new-quality productive forces [3]. Leveraging the characteristics of data resources—such as dependence, systemicity, and externality—allows their integration into the factors of productivity development, thereby generating synergistic substitution effects that empower the development of new-quality productive forces [4].

From the early development of digital technologies, to the widespread application of data resources, and eventually to the formation of digital ecosystem models, the iterative upgrading process of data empowering new-quality productive forces can be analyzed through resource orchestration, thereby revealing the development logic of new-quality productive forces [5]. At present, most research on data resources and new-quality productive forces remains at the theoretical level, exploring pathways and formation logics [6]. Discussions of process mechanisms are mainly concentrated in service sectors such as education and governance, while studies in the field of manufacturing remain insufficient [7]. Therefore, it is necessary to conduct research on how data resources empower the development of new-quality productive forces in manufacturing.

2.2. Theoretical framework analysis

In summary, for the manufacturing industry, perceiving data as a new factor of production and keeping pace with the development of new-quality productive forces requires a systematic analytical approach. Following the overall logical thread of “data resource value perception—leap in new-quality productive forces,” this paper conducts its research. The logical framework is as follows: drawing on value chain theory, the study analyzes how data resources empower enterprise factors to achieve capability reconstruction, enabling enterprises to achieve comprehensive iteration in strategy, organization, and manufacturing ecosystems, thereby promoting the development of new-quality productive forces. The theoretical framework of data resources empowering new-quality productive forces is shown in Figure 1.

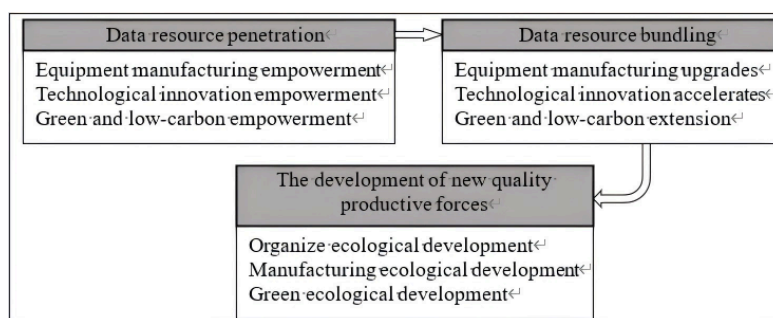


Figure 1. Theoretical framework analysis diagram

3. Research design

3.1. Research method

This paper adopts a longitudinal single-case study approach, based on the following considerations. First, the research aims to conduct an in-depth and detailed analysis of how equipment manufacturing enterprises integrate data resources along the data value chain, thereby empowering the development of new-quality productive forces. The single-case method allows for comprehensive and systematic induction of process mechanisms within a specific context. Second, a longitudinal single-case study makes it possible to deeply mine and analyze the case, thereby uncovering the internal logic of development. Third, for cases characterized by individual differences, the single-case method facilitates targeted exploration.

3.2. Case selection

Following the principle of case typicality, this paper selects Jereh Group as the research case. In recent years, Jereh has made substantial progress in utilizing data resources through digital transformation. Supported by its self-developed “Orange Cloud” and “Jereh Digital,” the company has accumulated massive amounts of data resources and made initial explorations in data-driven applications. At the same time, Jereh has actively responded to policy initiatives and contemporary trends, exploring the development of new-quality productive forces and achieving significant results in fields such as new manufacturing equipment and new energy. Hence, Jereh Group aligns well with the research objectives.

3.3. Data collection

Data collection for this study primarily relied on indirect channels such as company announcements and media reports. In addition, field investigations were conducted to gain first-hand insights into the status of data resource development and the progress of new-quality productive forces. On this basis, supplementary methods such as web scraping were employed to track company-related information in real time, ensuring timeliness, accuracy, and reliability of the data. Through multi-channel data collection, materials totaling tens of thousands of words were compiled to support the research.

4. Case analysis

4.1. Pathways of data resources empowering new-quality productive forces

Data resources empower new-quality productive forces primarily through three mechanisms: driving technological innovation, upgrading manufacturing, and extending green ecosystems.

First, data resources driving technological innovation. Innovation is the foundation of new-quality productive forces, which must emphasize the integration of data with real industries (“integration of digital and real”). Building on existing industrial foundations, enterprises progressively integrate digital technologies, leveraging their advantages to fully utilize and analyze data resources. This enables multiple transformations: end-to-end digitalization within industries, aggregation across upstream and downstream industrial chains, and efficiency improvements in product manufacturing. Jereh Group, with decades of experience in oil and gas equipment manufacturing, has both a solid industrial foundation and a commitment to steady yet adaptive change. The company was quick to recognize the potential of digital technologies, capitalizing on their rapid development. By focusing on innovation and breakthroughs, Jereh achieved high-efficiency, high-quality integration of digital technologies with its industrial base, thus driving innovation across both technological and industrial chains.

First, data resources driving manufacturing upgrading. Digital technologies, with their strong self-learning and data-processing capabilities, not only enable exponential data growth but also use data for product simulation and upgrading, leading to rapid product iteration. At the same time, enterprises can leverage their own initiative to enhance production efficiency and quality, accelerate product commercialization, and thereby promote manufacturing upgrading.

Third, data resources driving green ecosystem extension. The digitalization process generates vast amounts of data resources. By further developing and repurposing these resources, data quickly permeates from traditional equipment manufacturing into new energy and environmental industries. Data-driven technological innovation and transfer exhibit precision and controllability, enabling maximum data reuse and enhanced data availability. Through green industry transfer powered by data, enterprises can significantly shorten R&D cycles, reduce failure rates, and improve both safety and efficiency of operations. The mechanism by which data resources empower the development of new-quality productive forces is illustrated in Figure 2, and the coding results are presented in Table 1.

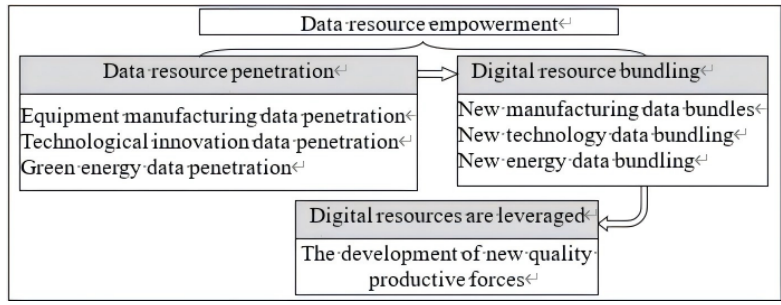


Figure 2. Data resources empower the development of new quality productivity

Table 1. Core concepts and evidence invocation of digital resource orchestration

Second-order concept	First-order concept	Typical evidence cited
Data resource penetration	New manufacturing data layout	At the time of the strong rise of the Internet, Jereh Group began to lay out digital transformation, explore the integration of Jereh and Internet+, and launched the first domestic O2O oil and gas equipment platform for the world.
	New technology data layout	Driven by Jereh Environmental Protection's "technology-driven, value-added environmental protection", Jereh Environmental Protection extends oil and gas treatment technology and data to the environmental protection and new energy industries.
	Layout of new energy field	In terms of development strategy, Jereh proposed to lead the intelligent and high-end development strategy of traditional oil and gas equipment and the strategic plan to expand the environmental protection industry.
Digital resource bundling	New manufacturing data bundles	AI oilfields developed through the cloud platform use digital twin technology to develop special simulators for oilfield equipment and virtual simulation training centers for oil and gas exploitation.
	New technology data bundling	Jereh New Energy Yantai Research Institute focuses on the product development of lithium-ion and sodium-ion battery anode materials and the research of key technologies of high-quality raw materials.
	Green industry data bundling	Through technology migration, Jereh Group has built equipment manufacturing as the support to extend to green and low-carbon fields such as oil pollution treatment, lithium batteries, and waste treatment, providing integrated environmental protection solutions.
The development of new quality productive forces	Data resource capabilities are leveraged	At the same time, through the accumulation of data, a unified data center is established to form valuable data resources, which can mine and analyze data, give full play to the value of data, and give full play to the initiative of data resources in strategic insight, organization and coordination, quality and efficiency improvement, and green development.

4.2. Mechanisms by which data resources leverage the development of new-quality productive forces

New quality productive forces emphasize the development concepts of innovation, greenness, and coordination. The characteristics of data resources—extensibility, agility, greenness, and

innovativeness—are highly compatible with the requirements of enterprises in developing new quality productive forces.

From the perspective of the manufacturing ecosystem, data resources, when embedded into traditional production factors and integrated across the industrial chain, have enabled the creation of new manufacturing equipment, new energy, and new information technologies, thereby supporting diversified development within the group. This is reflected in the following aspects: First, data elements are applied in R&D to accurately identify market demand, select optimal R&D processes and factors, and conduct simulation of R&D outcomes, which reduces resource waste and improves efficiency. Second, through the deep integration of artificial intelligence, big data, and other information technologies with Jereh Group’s oil and gas engineering, new energy, and equipment manufacturing businesses, the company can provide products and services that are more personalized, intelligent, and high-end.

From the perspective of the green ecosystem, data ecosystems have created opportunities for the group’s green development. At the industrial foundation level, data support has facilitated rapid entry into the new energy sector through technology transfer. Along the production value chain, the analysis of data resources and the application of digital technologies allow for precise monitoring of pollutant generation during production, pollutant source analysis, and minimization of emissions, thereby enhancing the greenness of products and equipment. At the service end, Jereh Group actively develops post-pollution treatment services, using data-driven simulation to continuously improve pollution control capabilities.

From the perspective of the innovation ecosystem, data resources empower new quality productive forces in several dimensions. At the level of strategic insight, managers can leverage macro-level data on markets, consumers, and the economy to enhance foresight in strategic direction and risk awareness, capturing changes in consumer demand, market structure, and potential economic risks, thus driving the group’s development of new manufacturing, new services, and new business models in line with the requirements of new quality productive forces. At the level of enterprise management, data ecosystems are shifting decision-making from “rule by people” to “rule by data,” enabling leaner management teams. This also builds an “intelligent external brain” for the group, strengthening talent support for data ecosystem construction and enhancing organizational resilience. At the level of technological transformation, data continue to function as new production factors, integrating with other elements of production to drive both the upgrading of existing technologies and the breakthrough of emerging ones. The integration of old and new technologies further promotes the migratory development of technological innovation. The mechanism of new quality productive force formation is illustrated in Figure 3, and the coding results are presented in Table 2.

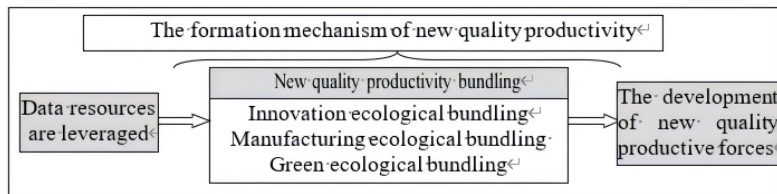


Figure 3. The formation mechanism of new quality productivity

Table 2. The core concept and evidence of the formation of new quality productivity are cited

Second-order concept	First-order concept	Typical evidence cited
Data resources are leveraged	The development of new quality productive forces	Data resources have injected new momentum into the development of new quality productivity in various fields such as technological innovation, manufacturing upgrading, and organizational optimization, and leveraged the development of new quality productivity.
	The innovation ecology is perfect	The sound ecological model makes internal innovation mature and efficient, and strengthens the flexibility of internal organization. Personnel updates and technology iterations are efficient and reasonable under the empowerment of data.
New quality productivity bundling	The manufacturing ecology is perfect	With the support of digital technology, the realization rate is digitally controlled, production and marketing, and the R&D situation innovation is achieved with the construction of the R&D platform.
	The green ecology is perfect	Under the empowerment of data, the environmental protection industry and new energy industry will develop, and a comprehensive industrial chain with oil and gas equipment as the core.
New quality productivity is formed	Productivity is new and qualitative	In the development of productivity, enterprises further tend to the concept of "innovation, green, coordination, sharing and development", injecting development vitality into enterprises.

5. Case discussion

5.1. Research conclusions

The empowerment of new manufacturing by data resources is a process of parallel progress in multiple directions. New quality productive forces encompass various aspects, and in the process of empowerment, the “integration of digital and real” is achieved by combining physical manufacturing with fundamental digital technologies. Within the digital technology system, the data ecosystem fully leverages the multiplier effect of data elements, enabling the qualitative leap of traditional productivity into new quality productivity. The overall pathway of this leap takes data resources as a bridge, building channels for the transformation of outcomes in new quality productivity, elucidating the mechanism of enterprise data empowerment, and providing guidance for enterprises to fully unleash the dynamism of data.

In the digital economy era, data resources are the core driver of industrial paradigm shifts, with their application in equipment manufacturing reshaping traditional production models. The construction of internet platforms and digital twins acts as multipliers for disruptive technologies and innovations, consolidating the technological foundation of new quality productive forces. At the same time, they empower carbon footprint management and recycling, providing precise support for the development of the green economy and ensuring the sustainability of new quality productivity. By activating the potential of data resources, manufacturing is driven toward advanced forms of “servitization, greening, and intelligence,” shifting the development of new quality productive forces toward a dual circulation driven by “data and innovation.”

5.2. Research implications

Based on the analysis of specific enterprise cases, the following insights can be drawn. First, the development of new quality productive forces is an action aligned with the trends of the times. Enterprises must assess their own capabilities, identify suitable pathways for development, and ensure that decision-makers possess market insight and exercise comprehensive leadership and management. Second, new quality productive forces require the guidance of digital technology. As the carrier of digital technology, data resources themselves have become production factors and new drivers of economic growth. Enterprises should promptly seek to unleash the multiplier effect of data resources, identify new growth poles, and leverage their industrial advantages to design pathways for data valorization. Third, there exists a close interrelationship between new quality productive forces and data: they are mutually embedded and mutually reinforcing. Therefore, in the resource orchestration process from data ecosystems to new quality productive forces, the key focus for enterprises lies in how to reorganize and integrate resources to activate the dynamism of data as a critical resource. In sum, empowering new quality productive forces with data resources requires a strategic vision for data value and an innovative spirit in promoting data applications, so as to advance the high-quality development of China's manufacturing industry.

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