Research on Digital Finance Promoting High Quality Development of Manufacturing Enterprises

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Abstract. Digital finance, which combines traditional finance with emerging digital technology, provides new impetus for the high-quality development of manufacturing enterprises. However, technical integration barriers, product supply and demand mismatch, insufficient policy coordination, data security risks and other problems restrict the enabling efficiency of digital finance. Based on this, this paper puts forward some countermeasures such as promoting technology ecological integration, strengthening scenario product innovation, perfecting agile policy system, constructing data security protection mechanism, etc., aiming at providing theoretical support for constructing digital financial service mode suitable for modern manufacturing system and helping China realize leapfrog development from a big manufacturing country to a powerful manufacturing country.

Keywords: Digital Finance, Financing Paths, High Quality Development, Manufacturing Enterprises

1 Introduction

According to the Future of Industrialization report released by the United Nations, China's manufacturing output value already accounts for 35% of the global total. The high-quality development action of key manufacturing industry chains was launched and implemented, and several high-end, intelligent, and green new pillar industries rose rapidly. With the deepening of the digital transformation wave, digital finance, as an innovative form of deep integration of technology and finance, is gradually becoming a key force to promote the optimization and upgrading of economic structure [1]. As the main body of national economy, the high-quality development of manufacturing industry is not only related to the upgrading of industrial chain modernization level, but also the core kinetic energy to realize sustainable economic development. Under this background, the coordinated development of digital finance and manufacturing industry presents unprecedented strategic value. Through new service modes such as digital payment, intelligent risk control and blockchain financing, digital finance is reconstructing the capital flow logic of traditional manufacturing industry, injecting vitality into enterprise technology research and development, production process optimization and market expansion. The interweaving of technical level, product level, policy level,

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data security level and other problems makes the technical dividend of digital finance not completely transformed into the actual kinetic energy of improving quality and efficiency of manufacturing industry [2]. It is urgent to clarify the internal mechanism and practical path of coordinated development of the two from the theoretical level.

Based on the intersection of digital finance and high-quality development of manufacturing industry, this paper systematically discusses the existing problems and solutions, aiming at providing theoretical support for the construction of digital financial service mode suitable for modern manufacturing system and promoting China's strategic leap from a manufacturing power to a manufacturing power.

2 Digital Finance and High Quality Development of Manufacturing Enterprises

2.1 Digital Finance

Digital finance is a new economic model relying on digital technology to reconstruct financial service form. It realizes the comprehensive digitalization of financial product design, transaction clearing, risk management and user service through Internet, big data, blockchain, artificial intelligence and other technologies. Its core features include decentralized transaction structure, real-time data processing and scenario service extension. Digital finance breaks through the physical limitations of traditional financial institutions, covers payment, financing, investment, insurance, and other full-chain businesses, significantly improving capital allocation efficiency and financial inclusiveness [3].

The structure of the digital finance cube is shown in Figure 1. The cube describes the connotation of digital finance from three dimensions: X axis represents digital finance technology, Y axis represents institutions providing digital finance solutions, and Z axis represents digital finance functions and business models. Among these dimensions, the digital financial service model represented by the Z axis is the core dimension. The X axis and Y axis represent digital financial technology and institutions, respectively, which constitute the technical basis of digital financial services and serve as their important executors. The three dimensions are arranged orthogonally to each other so that each region inside the cube can be defined by a specific combination of elements of the three dimensions. Some financial institutions are involved in only one or two businesses, while some digital financial institutions occupy a series of sub-cubes covering multiple businesses and digital technologies. When financial innovation introduces new business functions or technologies, the scope of the cube can be expanded by adding new elements in the corresponding dimensions.

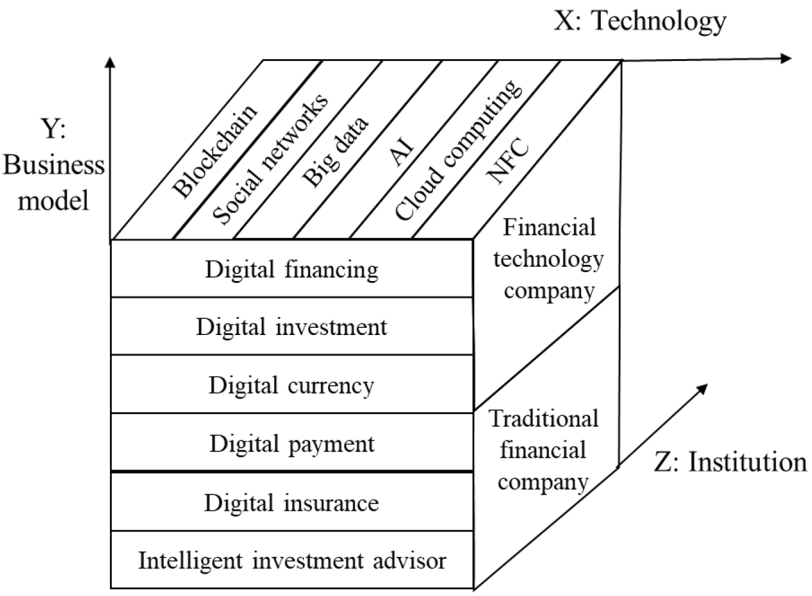

Fig. 1. Multidimensional Cube of Digital Finance (figure credit: original)

2.2 High Quality Development of Manufacturing Enterprises

The high-quality development of manufacturing industry needs supply-side structural reform as the core driving force. This strategy not only focuses on strengthening the innovation capacity of manufacturing industry, but also regards it as a key support for industrial base strengthening, intelligent manufacturing, and green manufacturing. The quality change, efficiency change and power change in this process together constitute a comprehensive framework to promote the manufacturing industry to a higher level of development. High-quality development in manufacturing industry is manifested as the unity of economy, market, and environment, balancing the relationship between quality and quantity, forming a comprehensive concept. High-quality development emphasizes five aspects: benefit, innovation, integration, openness and green [4]. Based on this, this paper constitutes a theoretical model for high-quality development of manufacturing industry, as shown in Figure 2.

The high-quality development of manufacturing industry is an all-round development mode of economic growth, innovation-driven, integrated development, comprehensive opening, and ecological harmony. Economic benefit is the foundation of high-quality development of manufacturing industry. High-quality development of manufacturing industry should first have better economic benefit and higher production efficiency. Under the background of current technological revolution and industrial transformation, the high-quality development of manufacturing industry is at an important tuyere. This period requires all regions to adopt the strategy of innovation to win, actively adapt to and actively fight the rapid changes in the market and technology, in order to grasp and lead the future development trend of manufacturing industry [5]. To

achieve efficient and intensive development, manufacturing enterprises need to optimize the use of labour, capital, land, and resources, and pay attention to environmental protection. The high-quality development of manufacturing industry requires a high degree of integration of industrialization and digitalization, and requires vigorous promotion and application of digital technology to improve manufacturing efficiency and capability supported by Internet, cloud computing, big data, Internet of Things, and artificial intelligence. Green sustainable development is an inevitable requirement for the high-quality development of manufacturing industry. Human healthy life needs manufacturing to provide greener consumer goods, and people advocate green lifestyle, which requires manufacturing to accelerate green transformation.

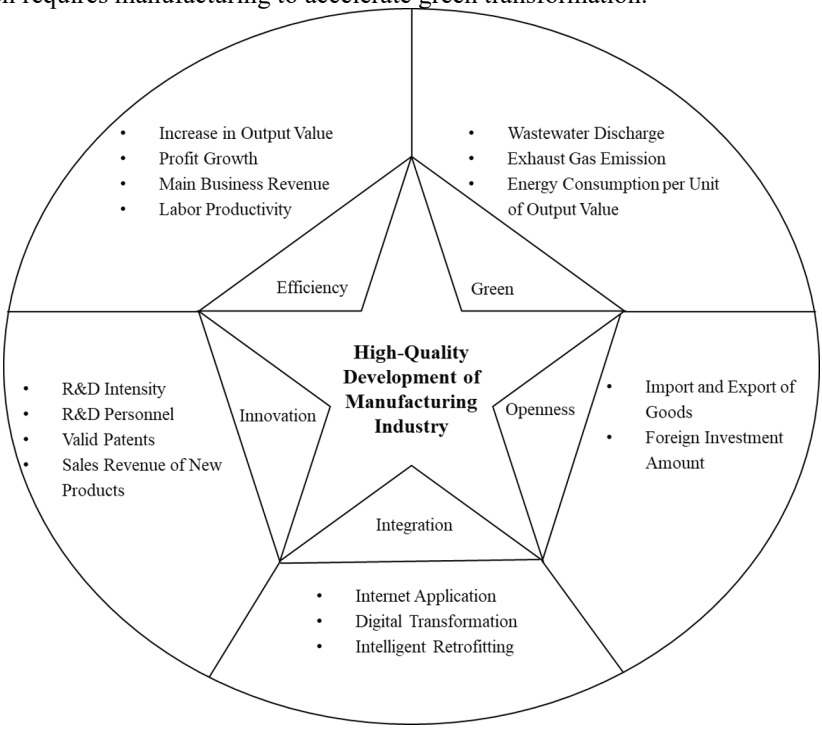

Fig. 2. Theoretical Connotation of High Quality Development of Manufacturing Industry (figure credit: original)

3 Problems of Promoting High Quality Development of Manufacturing Enterprises Through Digital Finance

3.1 Technical Integration Issues

The technological integration of digital finance and manufacturing industry is essentially a process of value reconstruction between digital ecology and traditional industrial system, but it still faces multiple structural contradictions in practice. On the one hand, there are significant differences between the technical architecture of ERP, MES

and other production management systems that manufacturing enterprises rely on for a long time and the digital financial platform, and the inconsistent data interface standards lead to the aggravation of information island phenomenon. On the other hand, the iteration speed of digital financial technology far exceeds the adaptation cycle of traditional manufacturing industry. The rapid upgrading of artificial intelligence algorithm and Internet of Things sensing equipment makes some enterprises fall into the dilemma of "introduction is backward". For small and medium-sized manufacturing enterprises, the high cost of software and hardware adaptation further weakens the feasibility of technology convergence [6]. The deeper contradiction lies in the professional barrier between the big data analysis ability relied on by digital finance and the manufacturing process knowledge, and the lack of deep understanding of the core links such as production process and quality control by financial technology service providers, which leads to the technical solutions often staying at the surface optimization, and it is difficult to touch the high-end links of the value chain such as research design, equipment operation and maintenance. This misplacement of technical logic not only results in waste of resources, but also may lead to the risk of production interruption due to insufficient system stability. The lag of technology integration has become the key bottleneck restricting the enabling effect of digital finance. It is urgent to promote the organic nesting of digital technology and industrial knowledge through the collaborative formulation of cross-field technical standards and the perfection of compound talent training mechanism.

3.2 Product Innovation Issues

The imbalance between the innovation of digital financial products and the demand for high-quality development of manufacturing industry reflects the value perception gap between the service supply end and the industrial demand end. At present, digital financial products mostly focus on general scenarios such as payment settlement and credit financing, but customized financial instruments needed for transformation and upgrading of manufacturing industry are still scarce. Taking green manufacturing as an example, carbon footprint accounting, environmental rights pledge and other subdivision fields lack suitable financial products, and the existing green credit model is difficult to accurately quantify the long-term benefits of emission reduction technology investment, resulting in low efficiency of fund allocation. At the same time, the homogenization tendency of digital financial products weakens its supporting role to the differentiation strategy of manufacturing industry [7]. Whether it is the research cycle financing of high-end equipment manufacturing or the dynamic fund management of flexible production system, highly scene-based financial service scheme is needed, while most institutions still rely on batch promotion of standardized products and lack innovation power aiming at specific pain points of industrial chain. The deeper problem lies in the disconnect between the innovation cycle of digital financial products and the iterative rhythm of manufacturing technology. The optimization speed of intelligent risk control model cannot match the exponential growth of industrial Internet data, resulting in risk assessment lagging behind actual business changes.

3.3 Policy Guidance Issues

The coordinated development of digital finance and manufacturing industry highly depends on the adaptability of policy environment, but the existing policy system still has significant shortcomings in goal synergy, tool innovation and implementation penetration. The lag of policy design leads to insufficient dynamic response to technology iteration and industrial change, which makes enterprises fall into a dilemma between compliance and innovation. At the same time, the decentralization of policy resources weakens the guiding effectiveness. Traditional tools such as fiscal subsidies and tax incentives focus on a single technology or industry, lacking systematic support for the intersection of finance and manufacturing. The lack of cross-sectoral policy coordination mechanisms further exacerbates resource mismatches. Local governments are often limited by the differences in regional industrial foundation and administrative ability when implementing central policies, and the formulation of supporting rules such as access standards and risk compensation for digital financial services is excessively conservative or blindly radical polarization. This regional policy gap not only hinders the formation of a unified national market, but also may lead to repeated construction and inefficient competition. The deeper contradiction lies in the rigidity of policy evaluation mechanism, which is difficult to adapt to the complexity of digital finance and manufacturing integration.

3.4 Security Assurance Issues

As the core production factor of digital financial enabling manufacturing industry, the fuzzy security boundary and risk transmission generalization of data are evolving into potential threats restricting the development of high quality. In the process of accessing the digital financial platform, the cross-border flow of production data, supply chain information and customer privacy makes the ownership of data fall into dispute. Especially in the industrial Internet scenario, the leakage of core data such as equipment status monitoring and process parameters may directly endanger the technical barriers and market competitiveness of enterprises. Although cloud computing and multi-party security computing supported by digital finance can improve data processing efficiency, the openness of underlying architecture also magnifies external attack surface. APT attack, ransomware virus and other new threats pose severe challenges to the stable operation of manufacturing production system. The weakness of internal data governance capability of enterprises further aggravates risk exposure. Some enterprises have not established hierarchical control mechanism covering the whole life cycle of data. There are management blind areas in the links from collection and storage to sharing and destruction. Employee operation error or internal malicious tampering may cause chain risk transmission. The data compliance of third-party service providers should not be ignored either. Problems such as excessive authorization and algorithm black box in financial technology outsourcing services may lead manufacturing enterprises to lose actual control over key data, and even fall into legal disputes due to data abuse by service providers.

4 Suggestions For Promoting High Quality Development of Manufacturing Enterprises Through Digital Finance

4.1 Promote Technical Integration

The deep integration of digital technology and manufacturing industry urgently needs to reconstruct the interactive logic of technology ecology [8]. Its core lies in breaking the cognitive barrier between financial science and technology and industrial system, and constructing a two-way enabling value circulation system. Cross-domain mutual recognition of technical standards and interface protocols is the bottom support for realizing collaborative innovation. It is necessary to establish a general interactive framework compatible with financial data flow and industrial production flow relying on the cooperation mechanism of industry association and technology alliance. For example, the embedded coupling between Internet of Things communication protocol and blockchain intelligent contract shall be promoted on the premise of guaranteeing data sovereignty to enable the real-time working conditions of equipment to seamlessly connect with the risk control nodes of Supply Chain Finance. The establishment of interdisciplinary technology platform can accelerate the integrated application of common technology modules. By decoupling the core functions of blockchain, digital twin and other technologies and packaging them into pluggable service components, it provides low-code agile access scheme for small and medium-sized manufacturing enterprises. Such platforms need to deeply integrate industry knowledge graph and process decision model to reverse optimize the resource allocation efficiency of financial instruments. Production process, such as flexible procurement strategy adjustment based on dynamic credit line. The shortage of compound talent supply restricts the penetration depth of technical value. It is necessary to reconstruct the talent training path through the integration of production and education project, embed intelligent manufacturing case base in financial engineering curriculum, and guide manufacturing enterprises to set up digital technology transfer training mechanism synchronously to eliminate the contextual gap between engineers and algorithm developers.

4.2 Strengthen Product Innovation

The design of financial products should be deeply embedded in the whole life cycle scenario of manufacturing industry. Based on the equipment operation data of industrial Internet platform, supply chain collaboration information and market fluctuation signals, dynamic credit line model and risk hedging tools should be developed. The release of product innovation efficiency cannot be separated from the optimization of demand-side response mechanism. It is necessary to establish a normal demand docking platform between manufacturing enterprises and financial institutions, accurately identify customized financial demands in high-end equipment manufacturing, green process transformation and other fields through mechanisms such as technology road map co-drawing and innovation route consultation, and promote the transition of supply chain bills, carbon asset pledge and other products from standardization to modularization [9]. The construction of cross-institutional innovation ecology can accelerate product

iteration, encourage banks, science and technology companies and scientific research institutes to set up joint laboratories, carry out collaborative research around industrial big data credit reporting, intelligent contract payment and other frontier fields, explore the pilot application of supervision sandbox mechanism in manufacturing scenarios, and provide fault tolerance and trial and error space for high-risk high-value products such as flexible supply chain finance and distributed capacity crowdfunding. The sustainability of product innovation depends on the dynamic balance of risk-return structure, so it is necessary to introduce the concept of risk-sharing product design, and hedge the market fluctuation caused by technical uncertainty through income swap agreement, risk reserve pool and other tools.

4.3 Improve the Policy System

The optimization of policy system needs to break through the path dependence of traditional governance thinking and turn to the construction of agile institutional framework suitable for the symbiosis logic of digital finance and manufacturing industry. The reconstruction of regulatory framework should pay attention to the dynamic balance between inclusiveness and penetration. While adhering to the bottom line of systemic risk, explore the adaptability improvement of "regulatory sandbox" in industrial digital financial scenario, set up transitional fault tolerance mechanism for emerging businesses such as intelligent contract automatic execution and industrial chain credit reporting model, and reserve institutional flexibility for disruptive technology application. The innovation of policy tools urgently needs to go beyond the single dimension of tax incentives and subsidies, develop a policy performance traceability system based on blockchain technology, and embed indicators such as manufacturing green transformation progress and digital technology penetration rate into the issuance conditions of government special bonds. Form linkage feedback between policy incentives and market signals [10]. The deepening of cross-regional policy coordination can rely on the hub function of the national manufacturing innovation centre, construct the data sharing and experience reuse mechanism of the cross-provincial policy experimental area, focus on bridging the policy gap between the eastern technology pioneer area and the traditional manufacturing cluster area in the central and western regions, and promote the reconstruction of the global value chain through policy package design. The competition for the right to speak international rules requires a more outward-looking vision of the policy system, active participation in the formulation of global digital financial governance standards, promotion of the interoperability construction between China's industrial Internet protocol and international payment and settlement system, and reduction of institutional transaction costs faced by manufacturing enterprises in cross-border trade. The innovation of policy evaluation paradigm is the key to improve the effectiveness of the system.

4.4 Ensure Data Security

The clarification of data sovereignty boundary is the logical starting point for the construction of security system. It is necessary to clarify the data confirmation rules of

manufacturing enterprises under the industrial Internet scenario through legislation, establish a full life cycle sovereignty declaration mechanism covering data collection, storage and circulation, and ensure that the ownership of core process parameters and supply chain information cannot be tampered with. The improvement of technical protection level depends on the deep integration of privacy computing and zero-trust architecture. Multi-party security computing protocol is deployed at the interaction node of financial data and industrial data, so that risk control model training, credit scoring and other businesses can be completed in the non-transparent state of original data. Meanwhile, a dynamic access control system with equipment identity authentication as the core is constructed, and the exposed surface of production control network and financial transaction network converges to the minimum necessary range through micro-isolation technology. The strengthening of enterprise internal governance capability shall be based on data classification and grading, establish differentiated encryption strategy and desensitization rules for different classified data such as research design, production operation and maintenance, implement granular management of employee authority simultaneously, monitor abnormal data access mode in real time with the help of behaviour analysis algorithm, and form a closed-loop control chain from identity identification to operation audit. The co-construction of security ecosystem needs to rely on industry alliance to build threat intelligence sharing platform, aggregate security attack feature library upstream and downstream of industrial chain through machine learning, and realize collaborative early warning and joint disposal of APT attack, ransomware virus and other new threats.

5 Conclusions

The deep integration of digital finance and manufacturing industry provides a new path for breaking the financing constraints of traditional industries and activating innovation momentum. The coordination mechanism and implementation path proposed in this paper not only provide theoretical basis for policy makers to optimize system supply and financial institutions to innovate service mode, but also point out the practical direction for manufacturing enterprises to break through the bottleneck of transformation. This paper provides a systematic solution for the deep integration of digital finance and manufacturing industry, and its theoretical model and practical framework have important reference value for policy makers, financial institutions, and manufacturing enterprises.

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