



Research on Financing Structure Innovation for the Digitalization and Intelligentization Development of High-end Equipment Manufacturing Industry

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Abstract. Digital and intelligent transformation is the core path for the high-end equipment manufacturing industry to achieve high performance, and the process of industrial transformation is closely related to the adaptability of financing structure. This article sorts out the basic status quo of digital intelligence and financing in china high-end equipment manufacturing industry, selects 295 sample companies to build a fixed-effect model, and empirically analyzes the impact of financing structure on industrial digital intelligence. The study found that subsidies and enterprise scale have a significant positive effect on the digital and intelligent transformation of the industry, while debt financing, equity financing and operating performance have a significant inhibitory effect, and the impact of endogenous capital and fiscal and tax relief has not passed the significance test. This article also analyzes the financing pain points existing in the digital and intelligent transformation of industries, including insufficient accuracy and nature of financial support, mismatch between debt financing period and products and demand, mismatch and low efficiency of equity financing resources, and poor transmission of commercial credit financing and other issues. Accordingly, financing innovation strategies are proposed from the four dimensions of financial support, debt financing, equity financing, and commercial credit financing, providing practical reference for resolving the digital and intelligent transformation financing of the high-end equipment manufacturing industry and optimizing the industrial financing structure.

Keywords: High-end equipment manufacturing industry; Digital and intelligent transformation; financing structure; Financing innovation.

1 Introduction

As the fundamental support and core representative of the modern industrial system, the transformation and upgrading of the high-end equipment manufacturing industry has become an inevitable path for the development of the entire industry. In the new era, digitalization and intelligentization transformation has become an inevitable choice for various industries in terms of industrial technology breakthroughs and core competitiveness enhancement. The smooth progress of digitalization and

intelligentization transformation cannot be separated from the promotion of funds. The financing structure and financing efficiency of the digitalization and intelligentization development of the high-end equipment manufacturing industry will directly determine the progress of the industry's digitalization and intelligentization transformation.

2 Analysis of the Current Status of Digitalization and Intelligentization Development and Financing of High-end Equipment Manufacturing Industry

2.1 Digitalization and Intelligentization Development of High-end Equipment Manufacturing Industry

Currently, the digital transformation of my country's high-end equipment manufacturing industry has entered a critical stage of system integration, gradually extending from single-link technology pilot trials to the intelligent development of the entire industrial chain and life cycle. From the perspective of the industry's overall development status, the coverage rate of digital applications has exceeded 75%, the CNC level of core links has reached 63.6%, and the application coverage rate of digital R&D design tools has reached 80.8%^[1]. In terms of specific technology implementation, the cumulative number of "5G + Industrial Internet" related projects has exceeded 20,000. Cutting-edge technologies such as digital twins and industrial artificial intelligence are widely used in production practices. The popularization of these technologies has not only effectively improved production efficiency but also reduced the proportion of defective products, while also helping core domestic equipment and industrial software achieve independent substitution.

In the process of digitalization and intelligentization transformation, the various sub-sectors of my country's high-end equipment manufacturing industry have shown differentiated development trends. Intelligent manufacturing equipment plays a leading role in the industry, and the domestic market share of its core products is continuously rising. In key areas such as aerospace and rail transportation, digitalization and intelligentization transformation has achieved substantial results. Marine engineering and high-end energy equipment have successfully overcome various difficulties in complex application scenarios. The level of digitalization and intelligentization in the field of engineering machinery has reached a world-leading position. To date, the industry has built over 80 top-tier smart factories, establishing a digital transformation pattern led by leading enterprises and with SMEs progressing in an orderly manner. Eastern regions such as the Yangtze River Delta and Pearl River Delta have significant advantages in this transformation process, while the central and western regions are gradually accelerating their transformation and steadily moving forward.

2.2 Current Status of Financing in High-End Equipment Manufacturing

In the financing channels of the high-end equipment manufacturing industry, traditional financing methods still dominate, while the supply of innovative financial financing tools is relatively scarce. In terms of financing scale, the capital market's support for the high-end equipment manufacturing industry is continuously increasing. By the end of June 2025, the total equity financing amount for the entire industry reached 48.56 billion yuan, a year-on-year increase of 81.0%. The Yangtze River Delta region is particularly prominent, accounting for nearly 47% and 49% of the national total in both the number of financing events and the total financing amount. The "1+6" policy framework launched by the Science and Technology Innovation Board has significantly relaxed the entry standards for high-tech enterprises, providing them with multiple equity financing channels, thereby promoting a number of digital transformation enterprises to successfully complete their listing and financing processes^[2].

A random sample of 20 high-end equipment manufacturing companies revealed a financing pattern characterized by "debt-dominated, diversified financing." Debt financing was the core method, with an average debt of approximately RMB 1.57 billion, accounting for over 60% of external financing. Significant differences in size between leading companies and SMEs reflected financial institutions' preference for company size and credit rating. Internal capital averaged RMB 2.18 billion, remaining stable and serving as a fundamental guarantee for companies' digital transformation; most companies had internal capital accounting for 30%-40%. Government subsidies achieved full coverage, averaging RMB 1.72 billion, but the amount received varied significantly among different companies. Tax reductions and exemptions showed a "concentration on leading companies," with policy benefits tilting towards high-quality enterprises. Equity financing averaged RMB 2.32 billion, highly correlated with corporate innovation capabilities, but accounting for only 15%-20%, lower than debt financing, indicating a need to expand direct financing channels. The industry as a whole had strong financing demand, aligning with the "high investment, long cycle" requirements of transformation, while SMEs generally faced problems of limited financing channels and insufficient policy support.

3 Research on Financing Performance of Digitalization and Intelligentization Development in High-end Equipment Manufacturing Industry

To verify the impact of financial support on the digitalization and intelligentization of high-end equipment manufacturing industry, this paper selected 295 sample enterprises and constructed a fixed-effects model for research.

3.1 Data Source and Indicator Design

The data in this study comes from the CSMAR Guotai An Database. The dependent variable is the digitalization of the high-end equipment manufacturing industry. This paper uses the term frequency analysis method of listed company annual report texts to measure the level of enterprise digitalization development (denoted as SZH).

Table 1. Indicator Design

Indicator Classification	Indicator Name	Indicator Code	Indicator Calculation
Explained Variable	Digitalization and Intelligentization of High-end Equipment Manufacturing Industry	SZH	SZH = Total frequency of original occurrences of digital intelligence-related keywords in the annual report
	Internal Capital	Icap	icap = LN(Capital Reserve + Retained Earnings)
Explanatory Variables	Debt Financing	deb	deb = Long-term debt + Short-term debt + Total other bonds
	Equity Financing	equ	equ = LN(Total Market Capitalization)
	Tax Reduction and Exemption	gov	gov = Tax Reductions + Fee Reductions
Control Variables	Government Subsidies	sub	sub = LN(Government Subsidies)
	Enterprise Size	size	size = LN(Total Assets)
	Innovation Potential	inn	inn = LN(R&D Expenses)
	Operating Performance	busi	busi = LN(Net Profit)

Data Source: Designed by the author.

Explanatory variables cover all dimensions of the financing structure: Internal capital (ICAP) is measured by the natural logarithm of "capital surplus + retained earnings"; Debt financing (DEB) is the sum of long-term debt, short-term debt and other bonds; Equity financing (Equ) uses the natural logarithm of total market capitalization; Tax relief (Government) is the sum of tax relief and fee relief; Government subsidies (Sub) are measured by the natural logarithm (Table 1).

Control variables include: firm size (size) expressed as the natural logarithm of total assets; innovation potential (inn) measured by the natural logarithm of R&D expenses; operating performance (busi) reflected by the natural logarithm of net profit.

3.2 Model Construction

To study the impact of the financing structure of the high-end equipment manufacturing industry on its digital and intelligent development, this paper constructs the following empirical test model:

$$SZHit = \alpha + \beta 1intit + \beta 2debit + \beta 3equit + \beta 4govit + \beta 5subit + \gamma 1sizeit + \gamma 2innit + \gamma 3busiit + \varepsilon it \tag{1}$$

In this model:

i represents an individual enterprise, used to distinguish different high-end equipment manufacturing enterprises;

t represents time, reflecting the time dimension of the data.

α is the intercept term of the model, which is the predicted value of the explained variable when all explanatory and control variables are 0.

$\beta 1 - \beta 5$ are the estimated coefficients of the explanatory variables (internal capital, debt financing, equity financing, tax reduction and exemption, government subsidies), used to measure the marginal impact of each financing structure variable on the digital and intelligent development of high-end equipment manufacturing industry;

$\gamma 1 - \gamma 3$ are the estimated coefficients of the control variables (enterprise size, innovation potential, operating performance), reflecting the degree of influence of these control factors.

ε it is the random error term.

3.3 Empirical Results Analysis

3.3.1 Regression Analysis.

Substituting the sample data into STATA 15.0 for empirical analysis yields the following empirical results, as shown in Table 2.

Table 2. Empirical Results

SZH	Coefficient (Coef.)	Standard Error (Std. Err.)	t value	P> t	[95% Conf. Interval]
icap	-0.0410393	0.0592041	-0.69	0.488	-0.1572933 0.0752147
deb	-1.46e-10	7.82e-11	-1.87	0.062	-3.00e-10 7.58e-12
equ	-1.178261	0.476236	-2.47	0.014	-2.113405 -0.2431172
gov	-1.32e-10	7.59e-10	-0.17	0.861	-1.62e-09 1.36e-09
sub	0.473065	0.2454725	1.93	0.054	-0.0089445 0.9550785
size	4.039119	0.7026328	5.75	0.000	2.6594819 5.418755
inn	-0.475846	0.2950487	-1.61	0.107	-1.055208 0.103516
busi	-0.0494407	0.0192619	-2.57	0.010	-0.0872636 -0.0116179
cons	-57.55606	16.52471	-3.48	0.001	-90.00422 -25.10789

The coefficients for debt financing (deb) and equity financing (equ) were significantly negative at the significance level ($P=0.062$), respectively ($P=0.014$), government subsidies (sub) were significantly positive at the significance level ($P=0.054$), firm size (size) was significantly positive at the significance level ($P=0.000$), and operating performance (busi) was significantly negative at the significance level ($P=0.010$). The coefficients for internal capital (icap), tax relief

(gov), and innovation potential (inn) were all not significant at the significance level (P values were 0.488, 0.861, and 0.107, respectively).

The F-test results show that $\text{Prob} > F = 0.0000$, indicating that the model is statistically significant overall, and the combined impact of financing structure, control variables, etc., on the digitalization and intelligentization development of high-end equipment manufacturing is statistically significant.

3.4 Endogeneity Test

The endogeneity test of each indicator is then performed, and the results are as follows (Table 3).

Table 3. Endogeneity Test Results

Variable	VIF	1/VIF
size_std	7.76	0.128947
equ_std	6.00	0.166717
deb_std	4.85	0.206390
gov_std	3.91	0.255921
inn_std	3.61	0.276815
sub_std	2.80	0.357026
busi_std	1.18	0.846500
icap_std	1.14	0.877248
Mean VIF	3.91	-

The endogeneity test results are within a reasonable range, and there is no endogeneity problem in the empirical study.

4 Analysis of Financing Issues in the Digital and Intelligent Development of the High-end Equipment Manufacturing Industry

At present, the support effect of various financing models on the digitalization development of high-end equipment manufacturing industry shows heterogeneous characteristics, and there is still room for optimization in some financing methods.

4.1 Financial Support: Insufficient Precision and Sustainability, Making It Difficult to Match Transformation Needs

There is great potential for optimizing the actual benefits of the digital transformation of high-end equipment manufacturing industry in finance, and financial support is biased. Most subsidies and tax incentives are widely implemented in top enterprises, which have already established a relatively strong foundation in digitalization. However, small and medium-sized manufacturing enterprises that may become key players in transformation in the future are difficult to receive strong government

support because these manufacturing companies generally do not meet credit qualification standards and have relatively high risk levels for digitalization projects^[3].

Another specific difficulty is the high investment in technological transformation during the early stages of digital transformation. For example, the investment in the transformation of a single intelligent production line often exceeds 5 million yuan, while financial funds are limited, resulting in the current market financial and tax incentive measures being short-term incentive models. Faced with the current situation where the production cycle and project implementation cycle are usually 3-5 years, short-term financial incentive measures are difficult to meet the operational needs of the entire lifecycle of digital transformation, leading to some companies with broken capital chains having to delay or abandon digital transformation^[4].

4.2 Debt Financing: Maturity Mismatch and Product Monopoly Create Constraints on Transformation Funds

Empirical research shows that there is a significant negative correlation between debt financing (DEB) and explained variables, which reflects the contradiction between traditional debt financing methods and the demand for industrial digital and intelligent transformation, 70% of today's commercial bank loans are medium-term loans of 1 to 3 years, and the capital collection of digital intelligence projects usually takes more than 5 years. At the same time, the traditional debt financing model is still dominated by "fixed asset mortgage", while the "new core assets" required for digital and intelligent transformation, such as industrial software, data platforms, and intellectual property rights, are facing the problem of unclear evaluation standards and difficult value determination^[5]. These problems limit the breadth of credit funds to support the digital intelligence of the high-end equipment manufacturing industry.

4.3 Equity Financing: Resource Mismatch and Low Efficiency Distort the Supporting Role of Funds

Empirical results show that equity financing has a 5% inhibitory effect, indicating that the equity financing system contains deep-seated structural problems in supporting the digitalization of the high-end equipment industry^[6]. On the one hand, IPOs and refinancing are mostly concentrated in the activities of mature companies; on the other hand, growth companies in the digital transformation stage often fail to meet the listing requirements due to insufficient profitability and abnormally tight cash flow; currently, the attitude of private equity investment and venture capital funds towards funding in the digitalization field is unclear and lacks enthusiasm.

In addition, some companies also exhibit low efficiency in the use of funds. Taking Naike Equipment (stock code: 688419), a high-end equipment manufacturing company listed on the Science and Technology Innovation Board, as an example, it completed its initial public offering in 2022, raising more than 700 million yuan. The funds were mainly invested in digital transformation-related projects such as the expansion of semiconductor packaging equipment production and the establishment

of an advanced packaging equipment enterprise R&D center. As of November 2025, the cumulative investment progress of these three major fundraising projects was only 45.11%, with most of the funds still being used for routine operations.

4.4 Commercial Credit Financing: Insufficient Scale and Poor Supply Chain Transmission

Empirical research shows that operating performance (busi), as a core standard for measuring the degree of dependence on commercial credit, has a significant negative correlation with the process of digitalization and intelligentization transformation^[7]. The main reason is that the accounts receivable credit sales model and credit sales limit dominated by core enterprises are constrained by the upper limit of transaction volume, making it difficult to cope with the increasing financing needs after digitalization and intelligentization transformation. Meanwhile, SMEs have poor bargaining power and can only obtain short-term credit support of 3-6 months.

From a supply chain perspective, digital collaboration increases the level of potential risks. Upstream procurement of intelligent components and downstream extended payment terms drive up accounts payable, hindering cash flow transmission. If core enterprises experience a shortage of funds during the digital transformation process, they may shorten the credit sales cycle to upstream suppliers. Once the transformation fails and triggers an operational crisis, the credit rating of the entire supply chain will generally decline. Without an effective mechanism to diversify credit risk, the risk will spread rapidly, and enterprises' willingness to finance will be suppressed.

5 Innovative Financing Paths for the Digital Transformation of High-End Equipment Manufacturing

The digital transformation of high-end equipment manufacturing requires substantial funds and has a long return cycle, which is not well-matched with the existing financial system. Solving its financing difficulties can be approached from the following aspects:

5.1 Fiscal Support: Building a Precise, Full-Cycle Policy Empowerment System

To ensure the equal and fair allocation of fiscal funds, it is recommended to build a tiered and differentiated support system. For small and medium-sized enterprises (SMEs) in the early stages of digital enhancement and with low credit ratings, a dedicated start-up fund can be established to ensure these enterprises can carry out their digital transformation work.

For example, for enterprises upgrading their intelligent production lines with an investment exceeding 5 million yuan, the government can provide tiered financial

subsidies ranging from 10% to 30%. For leading enterprises in a single industry, policy support can be non-substantial, focusing on problem-oriented approaches. A dynamic monitoring system for transformation projects, led by an independent third-party institution, needs to be established to monitor the use of special funds and ensure that these funds are used in key areas such as technological innovation and high-level talent development^[8].

It is recommended that government departments implement a "preliminary start-up + diversified support" system. Initially, a one-time start-up subsidy should be provided for transformation projects to alleviate initial expenditures for enterprises. In the medium term, a 3-5 year low-interest loan interest subsidy system should be implemented to address the financing difficulties of long-term capital-intensive projects such as industrial internet platforms. In the later stage, tax reduction and exemption rewards should be provided to outstanding enterprises. Government-guided funds should be used to attract social capital through a "mother fund + sub-fund" model, improving the utilization rate of government fiscal funds and building a sustainable development model jointly promoted by the government and multiple parties^[9].

5.2 Debt Financing: Innovative Products and Mechanisms Adapted to the Characteristics of Asset-Light Businesses

The key to solving the debt financing problem lies in the innovation of financing models. It is recommended that the banking system take into account the needs of both large and small enterprises in the high-end equipment manufacturing industry, develop long-term special loans for digitalization with terms of 5-8 years, and lower the benchmark interest rate by approximately 1 percentage point compared to conventional short-term loans. A special repayment model can also be innovated, where only interest is paid for the first two years, followed by a six-year repayment period with interest payments. Special loans should be provided for projects that purchase intelligent sensing equipment and robots for equipment upgrades, thereby enhancing the flexibility and suitability of debt financing tools.

Regarding the lack of collateral for SMEs, it is recommended that the government take the lead, in conjunction with industry associations and professional appraisal institutions, to create a new asset-light valuation system that includes intellectual property rights, production data, and other assets. This system should refine the specific valuation rules for industrial software copyrights, core technology patents, and operational data. Based on this, a new model combining intellectual property pledge with government risk compensation should be promoted. The government should establish a special fund to subsidize 5%-15% of the default losses on pledged loans, mitigating the risks for financial institutions. This would incentivize insurance companies to launch intellectual property pledge performance guarantee insurance products and improve the entire process from assessment, registration, guarantee to claims settlement. This would increase the financing coverage rate for asset-light enterprises from the current less than 10% to over 30%, truly alleviating their financing difficulties.

5.3 Equity Financing: Market Mechanism Innovation to Optimize Resource Allocation Efficiency

Further enhance the inclusiveness of the Science and Technology Innovation Board and the Beijing Stock Exchange for high-tech enterprises. Their listing conditions have been systematically improved. For growth-oriented digital enterprises that have not met the profitability threshold but have outstanding technological innovation capabilities and high R&D investment ratios (such as R&D expenditure ratios of no less than 8% in the past three years and holding core invention patents), a two-dimensional evaluation method of "R&D expenditure + intellectual property rights" is adopted to implement differentiated access control measures. In addition, a special board for digital transformation is established in the National Equities Exchange and Quotations (NEEQ) to improve supporting services such as equity pledge financing, private placement, and share transfer, forming a multi-level capital market service supply system covering the entire life cycle of enterprises from start-up to growth to maturity^[10].

Establish a special venture capital fund for digital transformation, focusing on supporting high-quality enterprises in core technology fields such as industrial software, digital twins, and intelligent control. The government guides the investment and, together with tax incentives, attracts more social capital to participate. A collaborative mechanism of "joint lending and dynamic supervision" is established. After the venture capital institution completes the investment, commercial banks are organized to provide matching credit support to the enterprise. The information disclosure obligations of the invested enterprises are clarified, requiring the invested enterprises to write special reports on the use of special funds for digital transformation in accordance with the prescribed cycle. The flow of these funds is monitored at any time using the digital supervision platform, fundamentally preventing the possibility of the raised funds not matching the actual use, and helping to improve the efficiency of equity capital use^[11].

5.4 Commercial Credit Financing: Building a Risk-Sharing Model for Supply Chain Collaboration and Symbiosis

Existing research shows that commercial credit financing has huge drawbacks due to its scale and circulation constraints. To address the aforementioned issues, this paper proposes establishing a digital supply chain finance platform based on leading industry enterprises. This platform would aggregate upstream and downstream transaction data, accounts receivable vouchers, and credit rating information of core enterprises, achieving the goals of online, transactional, and financing-oriented commercial credit within the supply chain. Core enterprises would extend the credit period for SMEs participating in digital transformation from the traditional 3-6 months to 6-12 months to align with their strategic development plans. Confirmed accounts receivable would be entered into the platform, and enterprises would be issued accounts receivable management system registration certificates. Using backup

vouchers, enterprises could apply for pledge financing online, revitalizing inventory assets and alleviating short-term cash flow pressure.

Based on the results of the above empirical research, the cross-level transmission of supply chain risks exacerbates the financing constraints of enterprises. To address these issues, a risk diversification system needs to be established, centered on core enterprises and outsourced to third-party guarantee institutions and government support policies. It is recommended that core enterprises sign digital transformation cooperation agreements with upstream and downstream small and medium-sized suppliers. To ensure supplier financing, short-term credit guarantees can be provided to alleviate the difficulties and high costs of financing for suppliers. If suppliers fail to fulfill their obligations due to investment in transformation, core enterprises should bear 20%-30% of the performance loss according to the cooperation agreement and enjoy the right to share in the incremental profits from their future operations. The introduction of China International Capital Corporation (CICC) guarantee companies to provide performance liability guarantees, with government departments providing financial support for 50% of the guarantee fees, will strengthen the supply chain risk defense line and prevent the transmission of risks that weaken the effectiveness of commercial credit financing.

6 Conclusion

This paper selects domestic high-end equipment manufacturing listed companies as research samples, sorts out the industry's digital and intelligent transformation and financing status, and builds a model to empirically test the impact of various financing channels on the digital construction of enterprises. The empirical results show that debt and equity financing will inhibit digital investment, subsidies and enterprise scale can promote transformation, and variables such as endogenous capital and fiscal and tax relief have no significant effect. This paper analyzes the practical problems existing in finance, credit, equity, and supply chain financing one by one, and gives targeted optimization paths. High-end equipment digitalization projects have a large investment and a long payback period. There are structural shortcomings in the existing financing system. Only by coordinating and improving the multi-channel financing supporting mechanism can industry companies promote digital upgrades.

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