Study on the Impact of Enterprise Digital Transformation on Working Capital Management Efficiency: Evidence from Leading Enterprises in the Electronic Equipment Manufacturing Industry

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Abstract

This study takes 30 Chinese A-share listed companies from 2020 to 2024 as samples to empirically examine the impact of digital transformation on working capital management efficiency and its boundary conditions. The findings reveal that: overall, digital transformation significantly shortens the cash conversion cycle and improves working capital efficiency. Mechanism analysis shows that the efficiency improvement mainly stems from the in-depth optimization of inventory management, but it is accompanied by a significant extension of the accounts receivable cycle, forming a mixed path characterized by "inventory reduction" and "slower receivables collection". Heterogeneity analysis indicates that this positive effect is concentrated in private enterprises, while a "digital efficiency paradox" emerges in state-owned enterprises (SOEs) — digital transformation may instead prolong the inventory turnover cycle. In addition, enterprises with high financing constraints tend to adopt more thorough digital strategies. This study uncovers the complexity and context dependence of digital transformation's impact on working capital efficiency, providing theoretical basis and empirical evidence for enterprises to formulate differentiated transformation strategies and for the government to implement targeted policies. It is suggested that the government should pay more attention to the assessment of operational indicators such as cash conversion cycle and inventory turnover rate when promoting the digital transformation of SOEs, while providing digital tool support and financing convenience for private enterprises.

Keywords

digital transformation, working capital management, cash conversion cycle, heterogeneity, inventory management

1. Introduction

Against the backdrop of the digital economy becoming the core engine of global economic growth, digital technologies represented by big data and artificial intelligence are profoundly reshaping enterprise operation models. In 2020, statistics showed that China's digital economy reached 39.2 trillion yuan, strongly driving the development of various industries. In 2021, the 14th Five-Year Plan Outline (2021-2025) and the 2035 Vision for the Development of the National Economy and Society of the People's Republic of China pointed

out that "we should accelerate digital development and build a digital China". The Chinese government's "Digital China" and "new infrastructure construction" strategies have provided strong policy impetus for enterprise digital transformation. In this macro context, enterprises face fierce market competition and continuous cash flow pressure; optimizing working capital management centered on inventory and accounts receivable has become a crucial issue related to their survival and development.

Theoretically, digital transformation can improve operational efficiency by enhancing information processing capabilities and optimizing resource allocation. However, existing studies mostly focus on the macro impacts of digital transformation on enterprise performance, innovation, or supply chain resilience, and there is insufficient discussion on the micro-mechanisms of how it affects working capital — a thorough operational indicator. A small number of studies have focused on the single impact of digitalization on inventory[1], but failed to systematically reveal its differential effects on various components of working capital (inventory, accounts receivable, accounts payable) and the overall results. More importantly, the effectiveness of digital transformation may be strongly moderated by enterprises' internal characteristics and external environment[2], and empirical evidence in this regard remains scarce.

In view of this, this study aims to answer three core questions: Can digital transformation improve the overall working capital management efficiency of enterprises? Through which specific paths does its impact manifest? Do these effects differ significantly among enterprises with different ownership types and resource endowments? Through empirical analysis of data from Chinese listed companies, this study not only verifies the overall value of digital transformation, but also uncovers the complex paths and significant contextual differences in its efficiency improvement process, providing new insights for understanding the microeconomic consequences of digital transformation.

2. Literature Review and Research Hypotheses

2.1 Digital Transformation and Working Capital Management: Theoretical Logic and Hypotheses

The information processing theory holds that organizational effectiveness depends on the match between an organization's information processing capabilities and its information needs. By enhancing data collection, analysis, and collaboration capabilities, digital transformation can effectively reduce information asymmetry both inside and outside enterprises[3], thereby providing a technical foundation for optimizing inventory levels, accelerating accounts receivable collection, and coordinating payment cycles. Based on this, the core hypothesis is proposed:

H1: The degree of enterprise digital transformation is negatively correlated with the cash conversion cycle, i.e., digital transformation can improve working capital management efficiency.

2.2 Potential Differentiation of Impacts and Context Dependence

Despite the optimistic theoretical logic, the actual impact of digital transformation may be complex. First, its impact paths may be asymmetric. For example, to expand the market, enterprises may provide more lenient credit policies while promoting digitalization, leading to slower receivables collection[4]. Second, the effects may vary with enterprise characteristics. Due to their unique governance structures and social goals, the digital transformation of SOEs may focus more on strategic compliance rather than operational efficiency improvement[2]. In contrast, private enterprises can quickly transform technology into efficiency by virtue of their flexible mechanisms. Resource constraints will also shape the transformation model — enterprises with financing constraints are more motivated to use digitalization to comprehensively optimize cash flow[5]. These theoretical deductions lay the foundation for subsequent mechanism and heterogeneity analyses.

3. Research Design

3.1 Samples and Data

This study selects 30 A-share listed companies in Shanghai and Shenzhen from 2020 to 2024 as the initial sample. These companies operate primarily in the "computer, communication, and other electronic equipment

manufacturing industry," which features a high level of digitalization, globalized supply chains, a large enterprise base, and strong market participants. This facilitates the selection of leading enterprises in various segments and enterprises of different sizes, ensuring sample diversity. After excluding ST/*ST companies, companies that conducted IPOs in the current year, and samples with missing key variables, an unbalanced panel dataset is finally obtained. Financial data are sourced from the RESSET Database.

3.2 Variable Definition

Dependent Variable: Cash Conversion Cycle (CCC), calculated as Days of Sales Inventory (DSI) + Days of Sales Outstanding (DSO) - Days of Payables Outstanding (DPO).

Core Independent Variable: Degree of Digital Transformation (Digital). Using text analysis, this variable is measured by the total frequency of keywords in five dimensions (including artificial intelligence, big data, and cloud computing) in enterprise annual reports, with 1 added and then the natural logarithm taken.

Mechanism Variables: DSI, DSO, DPO.

Ownership Nature (SOE): Assigned 1 if the enterprise is a state-owned enterprise, and 0 otherwise.

Financing Constraints (FC): Measured by the SA index; enterprises with an SA index higher than the sample median are classified into the high-constraint group.

Control Variables: Including enterprise size (Size), asset-liability ratio (Lev), profitability (ROA), growth (Growth), operating cash flow (CashFlow), and listing years (Age).

3.3 Model Specification

Main Effect Model (Two-way Fixed Effects):

$$\text{CCC}_{i,t} = \alpha_0 + \alpha_1 \text{Digital}_{i,t} + \sum \beta \text{Controls}_{i,t} + \mu_i + \nu_i + \epsilon_{i,t}$$

Among them, α_1 is the core coefficient of concern. If it is significantly negative, Hypothesis H1 is supported.

Mechanism Test Model:

Replace CCC in the above formula with DSI, DSO, and DPO respectively.

Heterogeneity Test:

Conduct grouped regressions by SOE and FC.

4. Empirical Results and Analysis

4.1 Descriptive Statistics

Descriptive statistics of key variables show that the mean value of the cash conversion cycle (CCC) is 109.09 days, with a standard deviation of 83.88, indicating significant differences in working capital management efficiency among sample enterprises. The mean value of the degree of digital transformation (Digital) is 5.19, with a standard deviation of 1.24, reflecting obvious gaps in the digitalization process of different enterprises. Days of Sales Inventory (DSI), Days of Sales Outstanding (DSO), and Days of Payables Outstanding (DPO) all show a certain degree of volatility, providing a sample basis for subsequent mechanism analysis.

4.2 Main Regression Results

As shown in Table 1, after controlling relevant variables and fixed effects, the coefficient of Digital is -19.6501, which is significant at the 1% level (p=0.0022). This means that for each unit increase in the digitalization level of an enterprise, the cash conversion cycle is shortened by an average of approximately

19.65 days. Hypothesis H1 is strongly supported, confirming that digital transformation generally improves working capital management efficiency.

Table 1: Impact of Digital Transformation on Cash Conversion Cycle

Variable	Coefficient	Std. Error	t-value	p-value	95% Lower Bound	95% Upper Bound
Intercept	500.9189	141.1727	3.5483	0.0004	224.2254	777.6124
Digital	-19.6501	6.4313	-3.0554	0.0022	-32.2553	-7.0449
Size	-8.5279	6.3303	-1.3471	0.1779	-20.9351	3.8793
Lev	-129.7659	58.1041	-2.2333	0.0255	-243.6478	-15.884
ROA	340.7273	191.4695	1.7795	0.0752	-34.5461	716.0007
Growth	-48.001	35.1806	-1.3644	0.1724	-116.9537	20.9518
CashFlow	-549.5769	175.5531	-3.1305	0.0017	-893.6546	-205.4992
Age	0.5652	0.8978	0.6295	0.529	-1.1945	2.3248
SOE	8.126	14.2562	0.57	0.5687	-19.8156	36.0676

4.3 Mechanism Test: Path Differentiation

As shown in Table 2, the specific paths through which digital transformation affects working capital efficiency show significant differentiation.

Table 2: Mechanism Test: Impact on DSI, DSO, and DPO

Dependent Variable	Digital Coefficient	Std. Error	t-value	p-value	Significance	R²/Adjusted R²
DSI	−27. 3414	6. 9462	−3. 94	0. 0001	***	0. 1969
DSO	11. 2928	4. 4049	2. 56	0. 0104	**	0. 1801
DPO	2. 3397	3. 2117	0. 73	0. 4663	ns	0. 1408

Inventory Management Path (Optimization): Digital transformation exerts a significantly negative impact on DSI, demonstrating its ability to accelerate inventory turnover by optimizing supply chains and improving demand forecasting — the core mechanism driving reduced inventory occupation.

Accounts Receivable Management Path (Delay): Digital transformation has a significantly positive impact on DSO, a key finding. From the perspective of competitive strategy theory, digital transformation endows enterprises with stronger market expansion capabilities. To seize market share and build differentiated competitive advantages, enterprises may proactively adopt more lenient credit policies, bind core customers by extending the receivables collection cycle, and sacrifice short-term cash flow for long-term market competitiveness[6]. From the perspective of commercial credit redistribution, digital transformation reduces enterprises' dependence on immediate cash flow (e.g., optimizing capital scheduling through accurate forecasting), enabling them to use commercial credit as a tool for industrial chain governance, extend credit support to upstream and downstream customers, and thereby consolidate their position in the industrial chain and enhance bargaining power. In addition, the initial construction of digital credit processes (such as online credit granting and intelligent risk control) may incur costs related to system adaptation and personnel coordination, leading to short-term fluctuations in collection efficiency; however, in the long run, a more efficient credit management system may be formed. This result indicates that the extension of the accounts receivable cycle is not a simple efficiency loss, but a rational choice made by enterprises based on strategic goals.

Accounts Payable Management Path (No Impact): The impact of digital transformation on DPO is not significant, indicating that digitalization has not led enterprises to generally extend payments to suppliers.

In summary, the net improvement of working capital efficiency (shortened CCC) brought about by digital transformation results from the combined effect of "significant improvement in inventory efficiency" and "phased sacrifice of accounts receivable efficiency", forming a differentiated impact path.

4.4 Heterogeneity Analysis

As shown in Table 3, the heterogeneity analysis based on ownership nature and financing constraints presents notable differences in the impact of digital transformation on working capital management efficiency.

4.4.1 Ownership Heterogeneity: "Digital Efficiency Paradox in SOEs"

Private Enterprises: Digital transformation significantly shortens CCC (coefficient: -23.95), with a mechanism consistent with the overall results (optimizing DSI and extending DSO), making private enterprises the main drivers of efficiency improvement.

State-Owned Enterprises (SOEs): The impact of digital transformation on CCC is not significant, and its impact on DSI is significantly positive (50.68), meaning that digitalization has instead significantly prolonged the inventory turnover cycle, resulting in a "digital efficiency paradox". From the perspective of the multi-task agency theory, managers of SOEs face conflicts between multiple task objectives — their digital transformation not only undertakes the economic task of improving operational efficiency, but also needs to meet political tasks (e.g., responding to the "Digital China" strategic deployment) and social responsibilities (e.g., ensuring employment and supporting regional development)[7]. This multi-task attribute leads to the tilt of digital investment in SOEs toward non-operational areas, such as technology procurement to meet policy compliance requirements and digital public welfare projects carried out to fulfill social responsibilities, which are disconnected from core operational goals such as inventory optimization. At the same time, the internal governance structure of SOEs is relatively rigid, with long decision-making chains, making it difficult for digital technologies to be quickly integrated into practical links such as supply chain management, further exacerbating the mismatch between "investment and efficiency". In addition, SOEs often have strong resource advantages in the industrial chain, and their sensitivity to inventory turnover efficiency is lower than that of private enterprises, which also weakens their motivation to optimize inventory management through digitalization.

4.4.2 Financing Constraint Heterogeneity: Two Optimization Modes

Enterprises with High Financing Constraints: They seek efficiency improvement by optimizing DSI and extending DSO simultaneously, presenting an aggressive model of "comprehensive potential tapping and promoting growth through receivables".

Enterprises with Low Financing Constraints: Efficiency improvement relies almost entirely on the optimization of DSI, with no significant impact on DSO, reflecting a focused model of "focusing on internal operations and steadily improving quality".

Table 3: Regression Results of Heterogeneity Analysis

Group Name	Dependent Variable	Digital Coefficient	Std. Error	t-value	p-value	Significance	Adjusted R²	Number of Observations
High Financing Constraints	CCC	-22.6833	12.0864	-1.88	0.0606	*	0.2092	69
	DSI	-33.4161	13.2079	-2.53	0.0114	**	0.2291	69
	DSO	14.1574	4.0337	3.51	0.0004	***	0.5742	69
	DPO	-0.0766	4.9464	-0.02	0.9876	ns	0.2184	69
Low Financing Constraints	CCC	-35.4839	12.8865	-2.75	0.0059	***	0.1185	69
	DSI	-35.6566	13.1284	-2.72	0.0066	***	0.1824	69
	DSO	2.7738	7.4494	0.37	0.7096	ns	0.2674	69
	DPO	1.876	6.4036	0.29	0.7695	ns	0.1042	69
SOEs	CCC	31.4358	37.8015	0.83	0.4056	ns	0.5281	20
	DSI	50.6757	23.1856	2.19	0.0288	**	0.6794	20
	DSO	-8.2899	6.9994	-1.18	0.2363	ns	0.8657	20
	DPO	17.5694	19.6212	0.9	0.3706	ns	0.7964	20
Private Enterprises	CCC	-23.9508	8.067	-2.97	0.003	***	0.2385	118
	DSI	-32.9143	7.5019	-4.39	0	***	0.2337	118
	DSO	11.4286	4.5692	2.5	0.0124	**	0.202	118

| DPO | 0.2659 | 3.5731 | 0.07 | 0.9407 | ns | 0.1039 | 118 |

5. Research Conclusions and Implications

5.1 Research Conclusions

This study conducts a systematic examination of how enterprise digital transformation influences working capital management efficiency, with key findings as follows: Digital transformation can significantly shorten the cash conversion cycle and improve working capital management efficiency. The efficiency improvement mainly stems from the in-depth optimization of inventory management, but it is accompanied by a strategic or adaptive extension of the accounts receivable cycle; accounts payable management is not significantly affected. The positive effect is concentrated in private enterprises; a "digital efficiency paradox" emerges in SOEs, where digital investment may be disconnected from inventory efficiency improvement or even run counter to it. Enterprises with different levels of financing constraints also show differentiated digital optimization models.

5.2 Management Implications

5.2.1 For Enterprises

When implementing digital transformation, enterprises need to consciously synergize supply chain optimization (inventory reduction) and sales credit policies (accounts receivable management) and conduct a comprehensive benefit assessment. Private enterprises should continue to deepen the application of digitalization in operational links. In contrast, SOEs urgently need to promote the penetration of digitalization from the strategic level to the operational level, establish an assessment mechanism oriented toward operational efficiency, and break the "efficiency paradox". Enterprises facing financing difficulties can use digitalization to comprehensively optimize cash flow, but they need to strengthen credit risk management; enterprises with sufficient funds can focus on building a digital-driven lean supply chain.

5.2.2 For the Government

When promoting the digital transformation of SOEs, policies should guide them to focus on the actual improvement of operational efficiency. For private enterprises, especially small and medium-sized ones, the government can provide support in digital tools and training related to supply chain and inventory management. It should also encourage the development of supply chain collaboration platforms and digital credit systems to help enterprises better balance efficiency and risk in the process of digital transformation.

5.3 Research Limitations and Prospects

This study has certain limitations in measuring digitalization using the text analysis method. In the future, multi-dimensional data such as enterprise IT investment and digital patents can be combined for measurement. The internal drivers of "extended accounts receivable" (e.g., strategic choices, changes in customer structure) require more in-depth case studies. Subsequent research can further explore: the differential impacts of different digital technologies (such as blockchain and the Internet of Things) on various components of working capital; the dynamic process of digital transformation affecting working capital; and the spillover effect of core enterprise digitalization on the working capital of upstream and downstream enterprises in the industrial chain.

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Conflicts of Interest

The authors declare no conflict of interest.