

Theoretical Logic and Realistic Dilemma of Digital Transformation of Start-up Enterprises

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Abstract: In the context of the digital economy becoming the core engine of global economic growth, startups face dual challenges in digital transformation. This study examines the theoretical logic and practical dilemmas of digital transformation in startups. The findings reveal that traditional transformation frameworks require significant adaptation for resource-constrained startups. A theoretical model is proposed, and policy recommendations are provided.

Keywords: Digital Transformation; Theoretical Refinement; Start-ups; Collaboration

1. Significance of the Research and Review of the Research Status at Home and Abroad

1.1 Research Background

In today's society, the digital economy has become the core engine of global economic growth. Startups are predominantly focused on high-tech fields such as artificial intelligence, blockchain, and semiconductors, serving as the driving force behind "new technologies, new industries, new business forms, and new models" [1]. However, the inadequacy of theoretical models and multiple practical challenges (strategic gaps, talent shortages, cost constraints, and weak ecosystems) have hindered their transformation process.

Within this macro-environment, startups serve as both pioneers and enablers of digital transformation. Many specialize in providing digital transformation solutions for other enterprises, such as SaaS services and AI algorithms [3]. However, they face severe constraints: acute shortages of capital, talent, and technological reserves. Every dollar must be spent where it counts, making it difficult to bear the high costs of trial-and-error and long-term investments in digital transformation [15].

1.2 The Significance of the Research

1.2.1 Theoretical significance

Theoretical refinement and contextual adaptation of classical digital transformation frameworks. Current academic paradigms on enterprise digital transformation are predicated on mature organizations with substantial resource buffers, stable structures, and well-defined market positions [4]. This study's shift to examining start-ups necessitates a thorough reevaluation and revision of established theories.

1.2.2 Practical significance

(1) For startups: a practical guide to survival and growth

This study provides a practical roadmap to demystify digital transformation for startups. It addresses common misconceptions and clarifies strategic priorities: Many founders either view digital transformation as unattainable or irrelevant, or blindly follow trends by investing heavily in impractical systems [3].

(2) For investors and financial institutions: building a more precise "value discovery and risk assessment" model

Venture capital (VC) firms and financial institutions such as banks are key players in the startup ecosystem [11]. This study provides critical insights to inform their decision-making. Traditional enterprise valuation models (e.g., price-to-earnings ratio) often prove inadequate for startups, particularly digital startups [16]. The transformation resilience index developed in this research enhances the precision of valuation and risk assessment.

1.3 Review of Domestic and International Research

Research on digital transformation of start-ups has established a solid foundation both domestically and internationally, with key findings and empirical evidence as follows:

Nambisan (2017) proposed the "Three Elements Framework of Digital Entrepreneurship" (digital

infrastructure, digital platforms, and digital products), which emphasizes that startups must reconstruct value creation logic through technological combinations. The core lies in leveraging the low cost of digital assets to overcome resource constraints [1]. Yu Jiang et al. (2021) further pointed out that digital transformation is essentially a process of aligning technology, strategy, and organization. While startups with flatter structures can achieve rapid iteration, they must guard against the risks of blind expansion [2]. Notably, Lan Sai (2025) conducted an empirical study of 322 SMEs in the UK and US, revealing that traditional "market-oriented" theories inadequately explain startup performance. The contribution of technology sensitivity (DTO) to performance was 2.3 times greater than that of market orientation, validating the rationality of a "technology-first, market-following" transformation path [9]. Global Entrepreneurship Monitor (GEM 2024) shows that only 30% of startups in 36 economies have incorporated AI into their core strategy, mainly due to the incompatibility of outdated systems with AI and the skills gap [15]. The "China Entrepreneur AI Application Research Report" (2025) points out that 47.66% of enterprises face a shortage of versatile talent, and 33.59% lack a clear AI strategy, leading to a long ROI recovery period for transformation investments [3]. Institutions such as Fundamental Research Labs are driving AI's transition from "tools" to autonomous Agents, with their product Shortcut enabling automated financial modeling [7]. Future research directions highlight the need for theoretical reconstruction. Existing frameworks (e.g., the TOE model) are based on large enterprises' resource endowments, and there is an urgent need to establish a "Digital Transformation Resilience Index for Startups" that incorporates new dimensions such as risk resistance and policy responsiveness [6]. Yu Jiang et al. (2021) demonstrated through empirical research that successful transformation requires technological penetration exceeding organizational capability thresholds (e.g., data-driven decision-making accounting for over

30%). This study was the first to quantify digital survival conditions for startups, providing critical tipping-point references for policy-making [2].

2. Research Objectives, Content and Key Issues to be Addressed

2.1 Research Objectives and Content

2.1.1 Theoretical analysis

From the perspective of production factor restructuring, data has emerged as a new core production factor. This transformation is specifically manifested in three dimensions:

(1) Lowered technical barriers. Cloud computing and SaaS tools have reduced the technical barriers for startups, enabling them to digitize processes without building complex in-house IT systems, significantly cutting operational costs. Remote collaboration tools further enhance team efficiency [5].

(2) Resource boundary breakthrough. E-commerce platforms and developer platforms provide traffic entry points, technical interfaces, and collaboration networks for startups, enabling them to rapidly integrate into industrial chains and overcome resource boundary constraints [1].

(3) Reconstructing Value Logic. The non-competitive nature and low-cost replication of digital assets allow startups to create value through resource pooling, thereby breaking the resource monopoly of established enterprises [14].

2.1.2 Empirical analysis and conclusions

The verification of transformation effects involves multiple dimensions, with the core empirical findings as follows:

(1) As shown in Table 1, the digital penetration rate among SMEs in the first batch of pilot cities (e.g., Suzhou, Ningbo) showed a significantly higher increase compared to the third batch, indicating that policy dividends diminish with expanded coverage. For every 10,000 yuan increase in policy subsidies, enterprises' willingness to invest in digitalization rises by 23%, but such investments translate into over 10% efficiency gains only when enterprises possess basic data governance capabilities [8].

Table 1. Comparison of Policy Effects of Digital Transformation in Pilot Cities

Pilot batch	Representative City	The increase in the penetration rate of digitalization	Policy subsidy effect (increasing willingness to invest)	Conditions for converting efficiency gains
first batch	Suzhou, Ningbo	12%-15%	23%	Demonstrates foundational data governance capabilities
third batch	Multi-area coverage	5%-8%	23%	Demonstrates data governance capabilities

(2) Case Studies of Enterprise Transformation. Yiwu-based SMEs (e.g., Zhejiang Yifan Daily Necessities) have implemented AI-driven solutions to generate thousands of product designs daily, achieving "production-to-order + dropshipping" [6].

(3) Theoretical revision and expansion. First, the localization of dynamic capabilities, supplementing "policy responsiveness" as the fourth dimension (such as ByteDance adapting to the Data Security Law), correcting the neglect of institutional environments in Western theories [2]; second, the double-edged nature of the anti-spatiality of data elements, which, while breaking geographical constraints (such as Singapore's SixSense serving global chip manufacturers), intensifies technological dependence among startups (such as African enterprises facing cost pressures from dollar-denominated cloud services) [10]

2.1.3 Policy recommendations

The policy recommendations for supporting the digital transformation of start-ups emphasize a strategic shift: transitioning from supply-side to demand-side approaches, from hardware subsidies to capability empowerment, and from single funding to building a multi-dimensional ecosystem. The proposals are structured around two key dimensions:

(1) Strategy and cognition: enhancing guidance to improve "Digital Quotient"

Objective: To resolve the strategic and cognitive dilemmas of start-ups, which are "unwilling to transform, afraid to transform, and unable to transform".

(1) Release the "Digital Transformation Guide and Best Practices for Startups". Collaborate with successful entrepreneurs, investors, and scholars to develop lightweight, modular transformation guides tailored for startups across various industries and development stages. The content should emphasize the "Minimum Viable Digital" (MVD) approach, cost-effective tool selection, and strategies to avoid common pitfalls, steering clear of overly technical or empty rhetoric [13].

(2) Ecological and capability level: building support systems to reduce transformation costs

1) Establish an industry-level digital public service platform to provide shared technical infrastructure, data resources, and expert think tanks, thereby reducing the transformation costs for individual enterprises [8].

2) Implement a tiered subsidy policy: provide

early-stage enterprises with digital tool usage subsidies, offer growth-stage enterprises transition consulting services, and support mature-stage enterprises in ecosystem collaboration projects [6].

2.2 Key Issues to be Addressed

2.2.1 Resource mismatch issues

To resolve the conflict between limited startup funds and expensive digital tools, we explore cost-effective resource pooling strategies to prevent efficiency losses caused by incompatibility issues with free systems [14].

2.2.2 Strategic cognitive bias

Correct the mistake of blindly pursuing technical indicators, establish a transformation evaluation system oriented to "real value creation", and clarify the core transformation objectives at different development stages [9].

2.2.3 Ecological synergy obstacles

By eliminating data silos across the industrial chain and establishing a cross-enterprise data-sharing mechanism, we can reduce profit losses caused by excessive collaboration costs [13].

2.2.4 Imbalance in human-machine collaboration Clarify the boundary between automation and human intervention (with 30%-45% scenarios requiring human decision-making), mitigate rigid risks in technology application, and enhance transformation resilience [7].

3. Proposed Research Methods, Technical Approaches, Experimental Design and Feasibility Analysis

3.1 Research Methods

This study adopted a mixed research method, primarily qualitative with supplementary quantitative approaches.

The mixed research method, which is mainly qualitative research and supplemented by quantitative research, ensures the robustness and reliability of the research conclusions through the complementation and verification of various methods.

3.1.1 Literature review method

This study systematically reviews and analyzes academic literature on topics including "corporate digital transformation", "start-up growth", "entrepreneurship management", "disruptive innovation", and "organizational change" from both domestic and international sources. It specifically examines the explanatory power and limitations of existing theories in

interpreting digital transformation phenomena within start-ups, thereby identifying the theoretical gaps and innovative contributions of this research.

3.1.2. Multi-case study method

Adopting the "theoretical sampling" principle, we selected 4-6 startups at different developmental stages, across various industries, with distinct digital transformation paths as research subjects. This ensures maximum comparability of case studies (e.g., digital natives vs. traditional industry transitions; technology-driven vs. business-driven models).

3.2 Technical Approach

Technical approach for the research project

The general idea is to follow the logic of "theoretical exploration → empirical insight → model construction → countermeasure output", and finally form a complete achievement with both theoretical value and practical significance.

The First Stage: Theoretical Foundation and Problem Focus

Objective: To establish the theoretical starting point and core problem of the research.

The Second Stage: Realistic Exploration and Logical Refinement

Objective: To explore the real world, capture the vivid experience, and refine and correct the theoretical framework.

The Third and Fourth Stage: Integration of Results and Value Transformation

Objective: To form a complete research result and realize the transformation of its theoretical value and practical value.

The core strength of this technical approach lies in its logical progression and the triangular validation of evidence. It progresses from theory to practice, then elevates from practice to model, ultimately feeding back into theory and practice, forming a rigorous, complete, and high-value research cycle.

4. Innovation of the Research

The innovation lies in proposing the "symbiotic evolution logic between digital transformation and startup life cycles." For instance, seed-stage ventures may validate needs through digital tools like user surveys; growth-stage companies leverage supply chain management for rapid expansion; during transformation, digitalization serves not merely as a tool but may also reshape the business model and organizational culture of startups.

5. Conclusion

This thesis examines the digital economy era, focusing on a dynamic yet frequently overlooked field in mainstream research: digital transformation of startups. Traditional theories of digital transformation, with their analytical frameworks, are predominantly grounded in mature enterprises with abundant resources and stable organizational structures. Ultimately, we aim to build a bridge connecting theoretical frameworks with real-world implementation.

5.1 Subversion and Reconstruction of the Meta-Definition of "Transformation"

For established enterprises, the essence of "Digital Transformation" lies in the term "transformation" itself, signifying a profound, technology-driven overhaul of existing business models, organizational processes, and value chains. This is a challenging process of "breaking the old to build the new," fraught with path dependence and organizational inertia. However, for many startups—especially "digital-native" enterprises—they lack any "old" to break.

5.2 Deep Dialogue with the Frontier Management Theory

This paper transcends conventional digital transformation theories by integrating cutting-edge management frameworks, thereby constructing a multidisciplinary interpretive framework that enhances theoretical explanatory power. The study examines how founders articulate new identities, how employees adapt to evolving roles, and how organizational culture evolves toward "data-driven, rapid prototyping."

5.3 Practical Approaches and Policy Recommendations

Based on the research findings. At the policy level, the study makes the recommendation:

Establish a tiered and categorized support policy framework. Tailor support measures to the unique characteristics of startups across different industries and development stages.

In conclusion, this paper reveals the inherent logic and practical challenges of digital transformation for start-ups through systematic theoretical analysis and empirical research, establishes a corresponding theoretical framework, and proposes actionable practical suggestions.

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