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Research on the Driving Mechanism and Transformation Path of Digital Transformation of Publishing Groups

Yiwen Wang
School of Publishing, University of Shanghai for Science and Technology, Shanghai 200082, China

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Abstract

Driven by the digital economy and national policies, the digital transformation of publishing groups has been continuously advanced. Most existing studies on the digital transformation of publishing groups adopt qualitative case descriptions or static analysis, lacking clear transformation paths and driving mechanisms. Based on the principles of system dynamics, this study constructs a transformation framework consisting of four subsystems: resource base, empowerment support, value output and environmental regulation, to reveal the internal logic and driving mechanism of the digital transformation of publishing groups. With the annual report data of Phoenix Media from 2020 to 2024 for parameter calibration and empirical simulation, this paper realizes the dynamic simulation and quantitative test of the transformation process. The research finds that the benefits of digital transformation show an accelerated growth trend after the initial investment stage. Through sensitivity analysis, it is identified that digital talent reserve is a more influential key leverage than investment in content assets. Accordingly, this paper puts forward resource optimization strategies for the high-quality transformation of publishing groups from the perspectives of dynamically adjusting resource input, strengthening talent echelons and optimizing organizational collaboration.

Keywords

Digital Transformation; System Dynamics; Driving Mechanism; Publishing Group; Resource Optimization

Introduction

Advancements in digital technology have boosted the development of China's digital publishing industry, and readers' reading habits have gradually shifted from print reading to digital reading, making the transformation from traditional publishing to digital publishing an irresistible trend. In 2021, the National Press and Publication Administration issued the 14th Five-Year Plan for the Development of the Publishing Industry, which takes high-quality development as the core goal for the future, aiming to promote the publishing industry to achieve better quality, higher

efficiency, stronger competitiveness and greater influence. The plan also clearly requires that the proportion of digital business in the publishing industry exceed 30% by 2025. Against this backdrop, exploring the driving mechanism behind the digital transformation of publishing groups is of great practical significance. Adopting the principle of system dynamics, this study explores the driving mechanism of digital transformation in publishing enterprises. It can not only clarify the transformation path for publishing enterprises, but also help them allocate resources more efficiently in the digital transformation process and accelerate the pace of transformation.

1. Literature Review

1.1. Research on the Path and Benefits of Digital Transformation in Publishing Enterprises

With the rapid development of information technology and the formation of users' digital reading habits, the market share of traditional publishing has been continuously squeezed, and publishing groups are facing an increasingly urgent need for digital transformation. Domestic scholars have pointed out that digital transformation is not only a strategic adjustment for enterprises, but also a revolution in thinking mode, which brings a series of reform requirements to enterprises. Compared with domestic counterparts, foreign publishing groups started earlier and moved faster in exploring digital transformation. A case study on Pearson Group conducted by Yu Mingming shows that the group has always enhanced customer service capabilities through digital means. Its transformation practice involves the comprehensive restructuring of technology, personnel and processes, with the goals of improving customer satisfaction, optimizing process efficiency and increasing operational transparency.

Scholars have noted that digital transformation is a systematic project driven by both external and internal factors of enterprises, and its paths are diversified, covering multiple dimensions such as the construction of user service channels, digital innovative technologies, digital platforms and learning ecosystems, as well as the digitalization of internal enterprise management. Focusing on the current development of the cultural industry, Liu Yang and Xiao Yuanping argued that the cultural industry lacks dominant advantages in the digital industrial chain. Therefore, it needs to reshape the industrial value chain and operation mode via digital transformation, promote the integration of diverse applications, and improve the overall operational capacity of enterprises. Xue Jingli held that enterprises have different demands for digital transformation and should formulate transformation paths in accordance with their own conditions. In general, enterprises need to take upstream and downstream suppliers and consumers into consideration, integrate all links of the industrial chain into new platforms, and achieve respective development goals through cooperation.

To sum up, digital transformation has become an inevitable choice for global enterprises and publishing groups in the digital era. Relevant academic research has been carried out, yet most existing studies focus on the current situation of digital transformation of publishing groups, while research on how digital transformation specifically affects enterprise benefits is insufficient. Huang Xiaoxu found that listed publishing companies in China still lag far behind enterprises in other industries in profitability and operational efficiency, especially in indicators such as capital turnover rate and inventory turnover rate, which reflects the efficiency bottleneck of the traditional publishing operation model. According to the industrial report compiled by Feng Shixin, the digital transformation of the publication distribution industry accelerated notably in 2023: the volume of online retail increased by 14.2%, and the sales revenue of digital publications rose by 5.3%. The total profit of publishing and media groups jumped by 26.9%, among which enterprises with early digital transformation and in-depth integrated development delivered outstanding performance. This indicates that digital transformation directly drives the growth of revenue and profits by expanding online channels, optimizing supply chain management and enhancing market responsiveness. Fang Qing pointed out that expanding the digital publishing industry is one of the core tasks. The 14th Five-Year Plan clearly promotes the in-depth integrated development of publishing and improves the scientific and technological innovation system for digital publishing. The above data prove that digital transformation is a key breakthrough for publishing enterprises to improve benefits, and national policies have also taken digital transformation as a strategic measure to enhance the overall efficiency and international competitiveness of the publishing industry.

1.2. Principles and Application of System Dynamics

As a simulation technology, system dynamics provides a convenient approach to test scenarios involving various factors and uncertainties. The construction of a system dynamics model generally includes four steps: conceptualization, formulation, testing and analysis. Tang Shoulong stated that system dynamics is a research method combining qualitative and quantitative analysis. With computer simulation technology as a tool, it builds models reflecting the basic structure of a system to simulate the dynamic characteristics of system behavior over time. In practical application, system dynamics is widely used in industrial simulation. By dividing the system into four subsystems (resources, industry, economy and environment) and constructing key feedback loops such as "industrial development → contribution to GDP → strategic status → investment → industrial development", Tang Shoulong and his colleagues revealed the internal driving forces and policy effects of the growth of China's information resource industry. Ding Xiaodong and other researchers adopted the system dynamics model to verify the mechanism and paths of generative artificial intelligence empowering the development of new productive

forces in the digital content industry, namely technological innovation, factor optimization and industrial upgrading. They also quantitatively analyzed the collaborative effects of digital infrastructure, talent efficiency and industrial upgrading through sensitivity analysis. Based on calibrated parameters and simulation experiments, Zhang Jin'ao and his team simulated the key roles of knowledge socialization, interpretive transformation and human-AI trust in AI-enabled collaborative knowledge innovation, and revealed the threshold constraint effect of AI-based knowledge innovation.

2. System Dynamics Model for Digital Transformation of Publishing Groups

2.1. Framework of Digital Transformation of Publishing Groups

The digital transformation of publishing groups is a dynamic process featuring multi-factor interaction, nonlinear characteristics and feedback time lags. Traditional research methods such as regression analysis can only reveal the correlation between variables, but cannot depict the dynamic feedback loops among various elements. Although case studies can describe the transformation process in detail, they are unable to conduct quantitative verification. Characterized by quantitative simulation, system dynamics can simulate the evolutionary trends of system behavior over time by constructing feedback loops and setting stock-flow relationships, so as to uncover the internal mechanism of the digital transformation of publishing groups.

To establish the system dynamics model, the overall system framework must be defined first. Existing studies indicate that the digital transformation of publishing groups mainly revolves around three core dimensions: technical support, policy guidance and benefit output. Regarded as a complex dynamic system, the digital transformation of publishing groups is divided into four subsystems in this study on the basis of previous research and the actual development of the industry, with the system boundary limited to publishing groups and their core digital business activities.

The resource base subsystem provides core production factors including capital, talents and content for transformation, and its stock and flow serve as the foundation for system evolution. The empowerment support subsystem is responsible for converting resources into transformation capabilities, covering technical platforms and organizational structures. The environmental regulation subsystem acts as an external intervention mechanism, including policies and market conditions. The value output subsystem corresponds to the final benefits and achievements of transformation. Following the logical chain of resource input → capability transformation → environmental regulation → benefit output → feedback optimization, the four subsystems form a complete closed loop.

2.2. Overall Causality Diagram and Analysis of Key Loops

2.2.1. Resource Base Subsystem

The core stocks of the resource base subsystem include digital content assets, digital talent reserves and available cash flow. The core flows cover the investment rate in content digitalization, the recruitment and training rate of digital talents, and the profit reinvestment rate. Two types of core feedback loops, reinforcing loops and regulating loops, are formed within the subsystem.

Capital Investment Reinforcing Loop R1: This loop reflects the virtuous cycle between resource input and benefit output. Improved digital transformation benefits increase corporate profits and available cash flow, enabling the group to raise investment in content digitalization or talent recruitment. The accumulated digital content assets and digital talent reserves in turn further boost the benefits of digital transformation.

Talent Investment Regulating Loop B1: This loop reveals the key constraints in the transformation process. The growth of digital transformation benefits leads to an increase in the quantity and complexity of new projects, which raises the average workload of employees. It may further cause project delivery delays or quality degradation, and restrict the continuous improvement of digital transformation benefits.

Specific paths of key loops are listed as follows:

Loop R1-1: Digital transformation benefits (+) → Corporate profits (+) → Available cash flow (+) → Content digitalization investment rate (+) → Digital content assets (+) → Digital transformation benefits (+)

Loop R1-2: Digital transformation benefits (+) → Corporate profits (+) → Available cash flow (+) → Talent recruitment rate (+) → Digital talent reserves (+) → Digital transformation benefits (+)

3. Simulation Results and Analysis of Digital Transformation

Given the complexity of the model, this study focuses on the core "resource-benefit" reinforcing loop in accordance with the modeling principle of system dynamics, and carries out quantitative simulation based on available data. The model boundary is limited to internal controllable resource factors and their direct benefit outputs, while high-order nonlinear factors such as organizational resistance and policy changes are temporarily excluded to ensure the interpretability of long-term trend simulation.

3.1. Data Source and Processing Procedures

A standardized data processing workflow is established to guarantee the reliability and reproducibility of model parameter calibration and simulation verification. The research collects, cleans, analyzes and visualizes relevant data from the annual reports of Phoenix Media from 2020 to 2024.

3.1.1. Data Collection

The selected time span covers the early stage of the 14th Five-Year Plan, providing sufficient historical data for model calibration and validity testing.

3.1.2. Variable Construction and Data Processing with Python

Python is used to parse PDF versions of annual reports and extract key data from tables and texts related to operating revenue composition, intangible assets, R&D investment and staff profiles. Core research variables are calculated based on cleaned data. Trend charts and comparison charts are drawn by using Matplotlib and Seaborn libraries of Python.

The benefit of digital transformation is calculated as the proportion of revenue from digital publishing and derivative businesses in the total operating revenue, which is extracted or calculated from the operating revenue section of annual reports. Online revenue is adopted as a proxy variable for digital content assets.

3.2. Model Validity Test

The actual and simulated values of digital transformation benefits from 2020 to 2024 are compared to verify the rationality and effectiveness of the model. The absolute error between simulated data and actual data is less than 3%, indicating that the model has a good fitting effect and can be used to predict the development trend and internal logic of digital transformation in publishing enterprises.

The simulation adopts Vensim PLE for discrete simulation with a time step of one year from 2020 to 2024, and key parameters are calibrated by three-year average values. When the content digitalization investment rate fluctuates within ±10% of the benchmark value, the digital transformation benefits change by 7.3%, which proves that the model responds reasonably to policy-oriented capital injection. This simplified model meets the timeliness requirements for policy evaluation during the 14th Five-Year Plan and reserves interfaces for introducing complex scenarios such as organizational behaviors and market changes in follow-up research.

Core computational formulas of the model are as follows:

Talent Reserve = INTEG (Talent Recruitment Rate × 0.003, 0.20176)

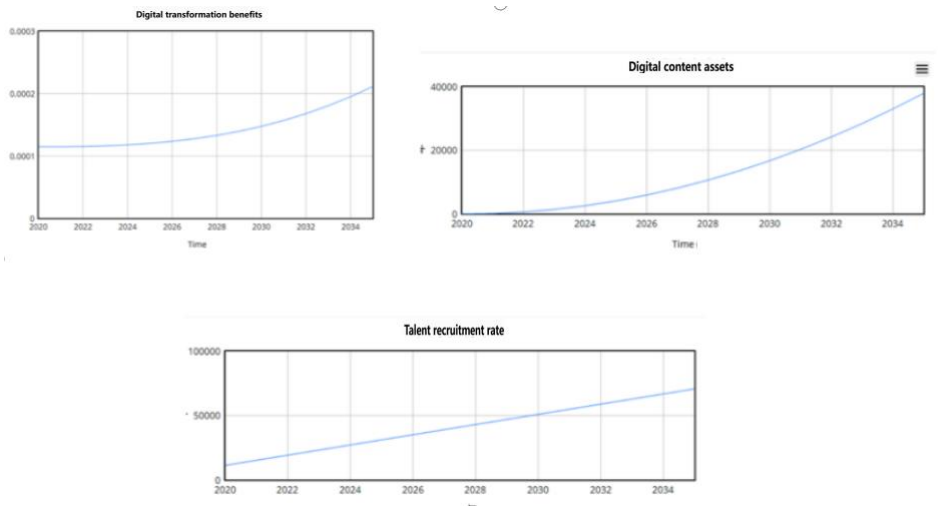
Other Corporate Benefits = 1×10^{8}

Corporate Strategic Determination = 0.0038

Available Cash Flow = INTEG (Corporate Profits, 1×10^{7})

Digital Investment Rate = Corporate Strategic Determination × Available Cash Flow × 0.4

Digital Transformation Benefits = INTEG (Talent Reserve × 2×10^{-10} + Digital Content Assets × 3×10^{-9}, 0.000115)



Picture 1. Simulation Result Diagram

3.3. Analysis of Simulation Results

3.3.1. Progressive Growth with an Obvious Accelerating Trend in Digital Transformation Benefits

The simulation results（picture1） show that the growth of digital transformation benefits was relatively slow from 2020 to 2024. This stage is defined as the initial investment stage, during which a large amount of basic investment is required for the accumulation of digital content assets, construction of technical platforms, and recruitment and training of digital talents. From 2024 to 2030, the growth curve of transformation benefits becomes increasingly steep, entering an accelerated growth stage. This verifies the positive feedback effect of the reinforcing loop R1. The digital content assets and talent reserves accumulated in the early stage continuously create value, increasing digital revenue and optimizing costs. In return, corporate profits and cash flow are improved, supporting larger-scale digital investment and forming a virtuous cycle.

3.3.2. Digital Talent Reserve: the Core Leverage for Digital Transformation of Publishing Groups

Sensitivity analysis reveals that with the same range of fluctuation, the recruitment and training rate of digital talents contributes more marginally to digital transformation benefits than the content digitalization investment rate. It proves that talents are more dynamic core factors than content resources in the digital transformation of publishing groups. Talents with digital competencies can not only efficiently complete the digital processing of content, but also drive product innovation, data operation and platform maintenance, so as to activate content assets and maximize their market value. Simply digitizing and piling up content without attaching importance to talent development cannot achieve high-quality

digital transformation.

The simulation clearly depicts the dynamic characteristics of the digital transformation of publishing groups: a progressive and accelerating process driven by resource input and strengthened by benefit feedback. In this process, digital talents and enterprises' willingness for digital transformation are not only key input factors, but also core levers determining the speed and quality of transformation, as well as potential bottlenecks restricting the depth of transformation.

4. Conclusion

Driven by the digital economy and national policies, the digital transformation of publishing groups has become an irreversible trend. From the perspective of system dynamics, this study constructs a digital transformation framework including four subsystems (resource base, empowerment support, value output and environmental regulation), and reveals the key feedback mechanisms of the transformation process through causality diagrams and simulation.

The main research conclusions are as follows: The digital transformation of publishing groups is a reinforcing loop driven by resource input to generate benefit output, presenting a progressive development trend with slow initial growth followed by accelerated expansion. Digital talent reserve plays a more important role than investment in content assets, and its scale and quality determine the speed and depth of transformation.

Theoretically, this study systematically applies the system dynamics method to the research on digital transformation of publishing groups, establishes a dynamic analysis framework covering four subsystems, and conducts parameter calibration and simulation with real data of Phoenix Media. It enriches the theoretical tools and research approaches for interdisciplinary studies of publishing and management.

Practically, this study identifies digital talent reserve as the more influential core leverage through sensitivity analysis, providing empirical evidence for publishing groups to prioritize resource allocation in the transformation process. Meanwhile, the two-stage characteristic of transformation (initial investment and accelerated growth) summarized from simulation results offers references for publishing groups to formulate phased transformation strategies and arrange investment rhythm, responding to the requirements for the high-quality development of the publishing industry during the 14th Five-Year Plan.

With the in-depth integration of new-generation information technologies such as artificial intelligence and big data, the digital transformation of publishing groups will rely more on data-driven and intelligent decision-making. On the basis of this research, future studies can introduce multi-case comparative analysis and more complex nonlinear parameters, and further explore issues such as the reshaping of the publishing value chain by generative artificial intelligence and other emerging technologies.

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