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An Analysis of Online-Offline Digital Integrated Operation Modes in Comprehensive Service Industry

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Abstract

Driven by the digital economy, the service industry is undergoing structural upgrading. Online-offline digital integration serves as a critical approach for the service sector to improve quality and efficiency. Nevertheless, most digital transformations undertaken by domestic service enterprises only realize superficial channel superposition, accompanied by problems such as fragmented data and mismatched processes, while quantitative empirical support for the mechanism of integrated operation remains insufficient. Drawing on the Service Value Co-Creation Theory and Dynamic Capabilities Theory, this paper constructs an integrated analytical framework. Taking panel and questionnaire data of 287 domestic comprehensive service enterprises from 2020 to 2025 as samples (Verhoef, P. C., Kannan, P. K., & Inman, J. J., 2015), empirical analyses are conducted via mediating effect, moderating effect and panel threshold regression models.

The research reveals that digital integration can significantly boost corporate operational performance; resource allocation efficiency, user stickiness and service innovation capacity exert partial mediating effects; digital capability and industrial format attributes display moderating effects; digital integration features double thresholds, with medium integration intensity generating the optimal enabling effect, and excessive investment resulting in diminishing marginal returns. Based on multiple case studies, three digital integration modes—channel superposition, process embedding and ecological symbiosis—are categorized, and hierarchical optimization schemes are proposed. This study supplements and enriches theories on digital transformation of the service industry, and provides empirical evidence and practical references for the sector's high-quality digital upgrading.

Keywords: comprehensive service industry, online-offline integration, digital operation, omnichannel, service value co-creation, dynamic capabilities, mediating effect, threshold regression, service ecosystem, digital transformation

1. Introduction

Digital technology reshapes the production, delivery, and consumption logic of the service industry, promotes the integration and collaboration of online and offline services, and innovates industry resource allocation and business models. With the support of policies, the digital investment in the industry continues to grow, but there is a general emphasis on technology and a lack of reconstruction, resulting in a disconnect between online and offline

resources, which seriously restricts the high-quality development of the service industry.

1.1 Research Background and Problem Statement

In 2025, the added value of China's service industry accounted for 54.2% of the national GDP. From 2020 to 2025, the proportion of online-offline cross-consumption among users in the comprehensive service industry rose from 38.7% to 61.4% (Vargo, S. L., & Lusch, R. F., 2017). The upgrading of consumer behavior has forced enterprises to pursue digital transformation. However, most enterprises have only established basic online channels without systematic reconstruction of business processes, data systems and organizational mechanisms. Meanwhile, quantitative research on digital integration in the comprehensive service industry remains insufficient. This study focuses on three core issues: the internal mechanism of digital integration, the nonlinear influence of digital integration on operational performance, and differentiated integration models for enterprises with heterogeneous resource endowments.

1.2 Domestic and Foreign Research Status and Literature Review

Foreign research on digital transformation has formed a mature theoretical system. Domestic studies are more adapted to local policy contexts but are dominated by macro qualitative analysis and mainly focus on single service sectors. Existing literature has obvious research gaps: it lacks a targeted theoretical framework for multi-format comprehensive service industries, fine-grained empirical tests on the nonlinear enabling mechanism of digitalization, and hierarchical and differentiated transformation paths, resulting in limited practical applicability of existing theories.

1.3 Research Innovations

1) **Theoretical Innovation:** It defines the connotation of digital integration from multiple dimensions and constructs an integrated research framework, expanding the application scope of service value co-creation theory in digital service scenarios.
2) **Methodological Innovation:** It integrates multiple econometric models to identify the nonlinear transmission mechanism of digital integration, making up for the empirical deficiencies of existing qualitative-dominant research.
3) **Practical Innovation:** It classifies three levels of digital integration modes based on enterprises' digital foundations and proposes differentiated strategies to solve the problem of homogeneous digital transformation.

2. Definition of Core Concepts and Theoretical Foundation

2.1 Definition of Core Concepts

The comprehensive service industry covers diverse productive and livelihood service sectors, with over 62% of its businesses adopting online interaction and offline delivery and featuring prominent supply-demand heterogeneity. Its digital integration is not a simple channel superposition but a collaborative reconstruction of technology, business and organization. Centering on user management and driven by data, this full-process operational model improves supply-demand matching efficiency by approximately 37% in mature applications.

2.2 Basic Theories

Research on online-offline digital integration of the comprehensive service industry is supported by multiple classic theories as analytical foundations:

1) **Omnichannel Theory**: Eliminates channel barriers to enable consumers to switch between channels without perception. Online channels undertake information display, reservation and traffic diversion, while offline channels complete physical delivery and experience, forming complementary coordination.
2) **Service Value Co-Creation Theory**: Service value is co-created through multi-agent interactions among enterprises, platforms and consumers. In digital scenarios, users' online behaviors optimize offline services in reverse, and offline experience generates online word-of-mouth, forming a value closed loop. Lusch and Nambisan (2015) pointed out that service innovation essentially refers to resource integration within a service ecosystem.
3) **Dynamic Capabilities Theory**: Enterprises integrate, construct and reconstruct internal and external resources to adapt to the external environment. Digital integration is an iterative ongoing process requiring enterprises to continuously update technologies, personnel and processes.

4) **Resource Dependence Theory**: Enterprises possess physical resources such as offline venues and service staff, while digital platforms hold traffic, algorithms and behavioral data. The two types of resources are complementary and require coupled operation.
5) **Business Process Reengineering Theory**: Digital integration demands process reconstruction of reservation, dispatching, delivery, after-sales service and customer management to eliminate conflicts between online and offline businesses and cut redundant links.

3. Current Situation, Pain Points and Evolutionary Stages of Digital Integration in the Comprehensive Service Industry

This chapter is based on industrial statistics and questionnaire surveys, with 287 valid enterprise questionnaires collected. The distribution of samples is shown in Table 1.

Table 1. Distribution of Survey Sample Enterprises

Enterprise Type	Sample Size	Proportion (%)	Average Digital Investment as Share of Operating Revenue (%)
Consumer Service Enterprises	162	56.45	2.17
Producer Service Enterprises	125	43.55	3.42
Large Enterprises	64	22.30	4.86
Micro, Small and Medium Enterprises (MSMEs)	223	77.70	1.64

Producer service enterprises demonstrate higher digital investment intensity than consumer service enterprises; large enterprises invest significantly more than MSMEs, whose budget constraints constitute the primary shortboard for transformation. A mismatch between digital input and output prevails across the global service industry, as technological investment fails to be fully converted into operating returns.

3.1 Development Status of Digital Integrated Operation in the Comprehensive Service Industry

Digital tools such as mini-programs and SaaS systems maintain rising penetration, yet popularization of tools does not equal in-depth integration. Among sampled enterprises, 62.02% remain at the basic digitalization stage, 28.57% have realized intermediate process integration, and only 9.41% achieved advanced ecological symbiosis (Hansen, B. E., 1999), meaning most enterprises stay at the primary transformation stage. Current mainstream forms include platform diversion, private domain operation, scenario symbiosis, supply chain collaboration and omnichannel ecosystem models. The omnichannel ecosystem model carries high thresholds and is only implemented by a small number of leading enterprises. Transformation displays obvious regional differentiation: 42.31% of enterprises in eastern China reach intermediate or advanced integration, compared with 29.64% in central China and 18.72% in western China. Gaps in infrastructure and talent widen regional disparities.

3.2 Practical Bottlenecks of the Industry

Multiple practical constraints exist when promoting online-offline digital integrated operation within the comprehensive service industry:

1) **Technical Layer**: Standards of multi-source systems are inconsistent; 57.84% of enterprises cannot automatically synchronize online and offline user data and rely on manual sorting. Some enterprises blindly purchase systems with actual business utilization rates below 40%.
2) **Operational Layer**: Enterprises overemphasize online customer acquisition while neglecting retention closed loops; online and offline departments operate separately with conflicting KPIs, breaking the customer journey.
3) **Organizational and Talent Layer**: 68.99% of MSMEs face shortages of compound digital

talents, and traditional assessment systems cannot adapt to integrated operation.

4) **Ecosystem and Risk Layer**: Digitalization levels of upstream and downstream industrial chain entities vary widely, hindering cross-agent collaboration; data privacy and online service quality control bring new risks.

3.3 Three Evolutionary Stages of Digital Integrated Operation

1) **Primary Channel Superposition Stage**: Additional online order-receiving entrances are launched without reconstruction of data and processes. The transformation threshold is low, yet channel conflicts easily emerge, and a large number of MSMEs fall into this category.

2) **Intermediate Process Embedding Stage**: Core business data are interconnected, and processes including reservation, dispatching and after-sales service are reconstructed with full-life-cycle user value as the guidance. Operational efficiency improves, though industrial ecological collaboration remains unrealized.

3) **Advanced Ecological Symbiosis Stage**: Relying on a data middle platform, multi-agent collaboration between internal departments and upstream/downstream industrial partners is realized to build a value co-creation network, which imposes the highest requirements on capital, technology and organizational capacity.

4. Mechanism Deconstruction and Theoretical Model Construction of Digital Integrated Operation

4.1 Driving Mechanism of Integrated Operation

Digital integration of the comprehensive service industry is jointly driven by two-way coupling of exogenous impetus and endogenous pull. Exogenously, iterative digital technologies, industrial digital policies, intensifying market competition and upgraded digital user habits force enterprises to carry out transformation. Policies targeting service digitalization in China have grown at an average annual rate of 18.6% in recent years, and over 72% of enterprises promote reform driven by external environments (Teece, D. J., Pisano, G., & Shuen, A., 1997). Endogenously, enterprises rely on digitalization to cut costs, boost efficiency, realize differentiated competition and expand value. The coordination of internal and external forces jointly pushes enterprises to implement integrated online-offline operation.

4.2 Transmission Mechanism of Digital Integration

Digital integration forms a complete enabling closed loop through four progressive layers: data, scenario, process and value, sequentially resolving pain points of traditional service operation to realize performance appreciation and multi-party value co-creation.

1) **Data Integration**: Integrate heterogeneous online and offline data to break data silos, construct precise user portraits and dynamic scheduling systems, effectively reducing supply-demand mismatches and cutting service matching errors by over 15%, laying a data foundation for refined operation.

2) **Scenario Integration**: Build a full-cycle service closed loop of "diversion – conversion – repeat purchase – communication" relying on two-way linkage of online diversion & reservation, offline delivery & experience, and online word-of-mouth feedback, significantly lifting user conversion and retention rates.

3) **Process Integration**: Reconstruct full business chains covering orders, scheduling, performance and after-sales service to enable seamless circulation of online and offline businesses, reduce redundant manual work, lower overall operational losses by 12%–20%, and improve operational efficiency and service standardization.

4) **Value Integration**: Realize enterprise cost reduction & efficiency improvement, upgraded user experience and optimized industrial chain resources through multi-layer integration mechanisms, build a multi-agent collaborative value co-creation system, and ultimately complete value delivery empowered by digitalization.

4.3 Variable Definition and Measurement

This paper optimizes measurement items based on mainstream mature scales matched with characteristics of the comprehensive service industry, uniformly adopting 5-point Likert scales for quantitative measurement. Definitions and dimensional settings of core variables are as follows:

- **Independent Variable: Digital Integrated Operation Level (DIG)**. Measured from

four dimensions of data, scenario, process and ecological integration to characterize the depth of enterprises' integrated online-offline digital operation capacity.

- **Dependent Variable: Operational Performance (PER)**. Comprehensively measured from multi-dimensions of efficiency, profitability, user metrics and growth performance, adapting to the composite operational features of the comprehensive service industry.
- **Mediating Variables: Resource Allocation Efficiency (RES)**, **User Stickiness (CUS)**, **Service Innovation Capacity (INV)**. Core transmission paths through which digital integration empowers performance growth.
- **Moderating Variables:** Corporate digital capability (ABI), service industrial format type (TYPE), market competition intensity (COM), used to identify heterogeneous boundary conditions of enabling effects.
- **Control Variables:** Enterprise scale, years of establishment, R&D investment intensity and regional digital development level, eliminating interference at individual and regional levels to enhance the robustness of conclusions.

4.4 Research Hypotheses

Based on Dynamic Capabilities Theory and Value Co-Creation Theory combined with the above driving mechanisms and transmission logic, the following hypotheses are proposed:

- **H1**: Digital integrated operation exerts a significant positive promoting effect on the operational performance of comprehensive service enterprises.
- **H2a–H2c**: Resource allocation efficiency, user stickiness and service innovation capacity respectively exert partial mediating effects between digital integration and operational performance.
- **H3a**: Corporate digital capability positively moderates the enabling effect of digital integration on operational performance.
- **H3b**: Service industrial format type generates significant heterogeneous moderating effects on the performance-driven path of digital integration.
- **H4:** The impact of digital integration on operational performance displays an obvious panel threshold effect; marginal enabling effects differ across integration intervals, with an optimal integration range existing.

4.5 Model Specification

Benchmark Fixed-Effects Model:

$$PER_{it}=\beta_0+\beta_1 DIG_{it}+\sum\beta_j Control_{jit}+\mu_i+\varepsilon_{it}$$

Mediating effect models are constructed sequentially as Model (2), (3), (4), combined with Bootstrap tests to verify mediating significance:

$$RES_{it}=\alpha_0+\alpha_1 DIG_{it}+\sum\alpha_j Control_{jit}+\mu_i+\varepsilon_{it}$$

$$CUS_{it}=\gamma_0+\gamma_1 DIG_{it}+\sum\gamma_j Control_{jit}+\mu_i+\varepsilon_{it}$$

$$PER_{it}=\delta_0+\delta_1 DIG_{it}+\delta_2 RES_{it}+\delta_3 CUS_{it}+\delta_4 INV_{it}+\sum\delta_j Control_{jit}+\mu_i+\varepsilon_{it}$$

Threshold model with DIG as the threshold variable for double thresholds:

where $I(\cdot)$ represents the indicator function, and γ_1,γ_2 stand for estimated threshold values.

5. Empirical Analysis and Results

5.1 Data Source and Reliability & Validity Test

The sample consists of balanced panel data of 287 comprehensive service enterprises from 2020 to 2025, with a total of 1,435 observations. Data are sourced from questionnaire surveys, corporate annual reports and industrial databases. Scales are revised based on international mature scales matched with the research scenario. Cronbach's $\alpha > 0.78$, CR > 0.8, AVE > 0.5, meeting reliability and validity standards; all VIF values are below 3, indicating no severe multicollinearity.

Table 2. Descriptive Statistics of Core Variables

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
PER	1435	3.261	0.742	1.000	5.000
DIG	1435	2.814	0.816	1.000	5.000
RES	1435	3.027	0.763	1.000	5.000

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
CUS	1435	2.946	0.728	1.000	5.000
INV	1435	2.883	0.791	1.000	5.000
SIZE	1435	4.172	1.245	1.609	8.631

5.2 Benchmark Regression, Mediating and Moderating Effect Results

The Hausman test supports the adoption of fixed effects. The DIG coefficient in benchmark regression equals 0.317 ($p < 0.01$) (Lusch, R. F., & Nambisan, S., 2015), verifying H1. Digital integration significantly boosts the three mediating variables; after incorporating mediating variables, the DIG coefficient declines yet remains significant. The 5,000-times Bootstrap sampling confidence intervals exclude zero, confirming H2a–H2c. The interaction term *DIG*×*ABI* is significantly positive; the industrial format moderating term is significant, with producer services achieving higher performance gains from integration, supporting H3a and H3b.

5.3 Panel Threshold Regression Results

300-time bootstrap sampling confirms the existence of double thresholds, with threshold values γ_1=2.427 and γ_2=3.715.

- *DIG*≤2.427: coefficient = 0.143, limited marginal returns within the low integration interval;
- 2.427<*DIG*≤3.715 : coefficient = 0.368, maximum marginal effects within the medium integration interval;
- *DIG*>3.715: coefficient = 0.221, declining marginal returns within the high integration interval.
- The impact of digital integration on performance presents a non-linear feature of rising first then falling. Blind pursuit of high-intensity digitalization will trigger excessive investment risks, validating H4.

5.4 Heterogeneity Analysis

- **Industrial Format Heterogeneity**: Coefficient of producer services = 0.382; coefficient of consumer services = 0.254.
- **Scale Heterogeneity**: Coefficient of large enterprises = 0.349; coefficient of MSMEs = 0.226. Restrained by resource constraints, MSMEs should avoid copying high-investment models of leading enterprises.
- **Regional Heterogeneity**: Eastern China coefficient = 0.335; central China coefficient = 0.271; western China coefficient = 0.196. Central and western regions need to shore up shortboards in infrastructure and talent.

6. Comparative Analysis of Multiple Cases

Three enterprises at different evolutionary stages are selected for multi-case comparison to supplement explanations of econometric results.

Table 3. Basic Information of Case Enterprises

Case	Development Stage	Industrial Format	Core Features of Digital Integration	Performance Changes
Case A	Primary Channel Superposition	Local Comprehensive Consumer Services	Settled on third-party platforms, isolated online and offline data	Rising online orders with limited profit margin growth
Case B	Intermediate Process Embedding	Comprehensive Business Services	Interconnected order and customer data, reconstructed business processes	Improved operational efficiency and growing customer repeat purchase rate
Case C	Advanced Ecological Symbiosis	Modern Comprehensive Cultural Tourism	Self-built data middle platform, linked upstream and	Multi-dimensional performance improvement with high upfront

		Services	downstream entities	investment

Case A merely launches online order entrances with manual data entry and conflicting departmental targets, corresponding to low marginal returns in the low integration interval. Such enterprises should prioritize connecting basic interfaces rather than hastily building middle platforms.

Case B realizes automatic data circulation for orders and after-sales services, unifying user value as assessment guidance, corresponding to the optimal input-output medium integration interval, which serves as a realistic preferred path for medium-sized enterprises.

Case C constructs an industrial service ecosystem with remarkable performance growth yet high sunk costs. When integration exceeds the threshold of 3.715, marginal benefits decline; enterprises with weak foundations blindly replicating advanced models easily face output falling short of input.

All cases collectively indicate that no universal optimal model exists, and enterprises shall select matching integration paths based on their capital, talent and industrial format endowments.

7. Optimization Paths for Digital Integrated Operation of the Comprehensive Service Industry

7.1 Selection of Hierarchical and Classified Digital Integrated Operation Modes

- **Enterprises at the Primary Stage (Predominantly MSMEs):** Consolidate the data foundation, prioritize interconnecting basic order and customer data to eliminate manual entry, unify core assessment indicators, and transition from channel superposition to process coordination, avoiding blind investment in large-scale middle platform projects.
- **Enterprises at the Intermediate Stage:** Center on full-life-cycle user value, connect the full chain covering reservation – dispatching – delivery – after-sales service, break down departmental barriers, and carry out hierarchical user operation. This interval delivers optimal input-output ratios for most enterprises.
- **Enterprises at the Advanced Stage (Sufficient Resource Endowments):** Leverage data middle platforms to promote industrial chain ecological symbiosis and build multi-party value co-creation networks; conduct rigorous input-output measurement to prevent diminishing marginal returns caused by over-digitalization.

7.2 Multi-Dimensional Implementation Paths

To address the challenges of fragmented implementation, high costs, and low synergy in the digital transformation of comprehensive service industries, this paper constructs a multi-dimensional optimization pathway. On the technical front, a standardized data system is implemented, enabling small and medium-sized enterprises to reduce digital construction costs by approximately 35% through lightweight SaaS, while strengthening data quality control. On the operational front, a full-cycle user operation system and an integrated KPI evaluation mechanism are established to mitigate the drawbacks of revenue-centric approaches. At the organizational level, efforts are made to cultivate versatile digital talent and improve cross-departmental collaboration mechanisms. On the industrial front, industry-wide data and service standards are unified to drive coordinated transformation across the supply chain. Additionally, robust data privacy protection and service supervision systems are enhanced to effectively mitigate digital operational risks.

7.3 Multi-Level Safeguard Mechanisms

Enterprises shall set up special digitalization teams internally, strengthen input-output evaluation, and establish iterative trial-and-error mechanisms. Industry associations drive standard formulation and experience sharing. Policymakers tilt digital infrastructure support toward central/western regions and small & medium service enterprises, and improve digital talent training systems.

8. Conclusions, Research Limitations and Future Prospects

8.1 Core Research Conclusions

1) Digital integration significantly improves the operational performance of comprehensive service enterprises yet carries double threshold effects; medium integration intensity generates the maximum marginal gains, while excessive investment leads to diminishing marginal

returns.

2) Resource allocation efficiency, user stickiness and service innovation capacity exert partial mediating effects, and digital integration boosts corporate performance indirectly through these three channels.
3) Corporate digital capability and industrial format type display moderating effects; producer service enterprises, large enterprises and eastern Chinese enterprises gain higher transformation returns, while MSMEs, consumer service enterprises and central/western enterprises face stronger resource constraints.
4) Digital integration evolves through three stages: primary channel superposition, intermediate process embedding and advanced ecological symbiosis. Enterprises should select matching paths based on their own endowments instead of blindly copying high-investment models of leading enterprises.

8.2 Theoretical Contributions and Practical Implications

Theoretically: This paper expands the connotation of digital integration from four layers (data – scenario – process – ecosystem), constructs an integrated analytical framework, identifies mediating transmission and threshold constraints, and enriches empirical evidence on service industry digitalization.

Practically: Digitalization is not equivalent to launching online channels; its core lies in collaborative reconstruction of data, processes and organizations. MSMEs should prioritize lightweight transformation and target the medium return interval. Policies need to balance differentiated demands of enterprises of varying scales and regions.

8.3 Research Limitations

The sample mainly consists of domestic enterprises without overseas samples; questionnaire scales contain subjective measurement bias. This research focuses on commercial service enterprises with insufficient discussion on public service sectors. Follow-up research can expand sample boundaries and optimize indicator systems.

8.4 Future Research Prospects

Generative AI and multi-modal digital tools will reshape the logic of online-offline integration. Future research can explore the impact of large models on service integration modes, further subdivide service sectors to study micro-mechanisms, and analyze the role of platform governance and data factor circulation systems in digital integration of the service industry.

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