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DEFICIENCIES IN DIGITAL INTEGRATION PLATFORMS CONCERNING REGIONAL AND DYNAMIC MECHANISMS

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Abstract. *This study examines the role of corporate digital integration platforms in regional economic development. The purpose of this study is to address three main questions: how do digital platforms stimulate regional economies through the triad of technological penetration, institutional synergy, and spatial reorganization; the main factors that contribute to regional heterogeneity and the boundary conditions of their impact; the management tools that take into account various resources to achieve a balance between efficiency and security.*

Keywords: digitalization, digital integration platforms, regional development, balance between efficiency and security.

Based on the theory of the techno-economic paradigm, scholars from the supporting school emphasize that the digital integration platform reconfigures the efficiency of regional economic factor allocation through technological penetration and network effects. This is illustrated by the Cost Compression - Network Effect Diffusion Twin Wheel Drive Model [1]. Its core ideas include:

The transaction cost compression effect refers to the ability of digital platforms to reduce inter-enterprise transaction costs by 23 to 40 percent through the use of standardized interfaces, such as Application Programming Interfaces (APIs), and smart contract technology. For instance, Zhejiang's data from both upstream and downstream segments of the industrial chain, resulting in a 60% reduction in the equipment transformation cycle for small and medium-sized enterprises, as well as a 28% increase in inventory turnover rates (Department of Economics and Information Technology of Zhejiang Province, 2023).

$$\Delta Ct = \alpha \cdot \text{API Standardization rate} + \beta \cdot \text{Data interoperability} (R2 = 0.67)$$

The network effect diffusion mechanism operates through the accumulation of user scale, creating a positive feedback loop for the platform. The case of the G60 Science and Innovation Corridor in the Yangtze River Delta demonstrates that when the access rate of biomedical enterprises surpasses 65%, the efficiency of collaborative research and development (R&D) experiences exponential growth.

The Explanatory Boundaries of Technology-Driven Theory and the Paradox of Regional Heterogeneity

Although the technology-driven theory has been validated in the developed eastern region, it reveals significant limitations in explaining the developmental challenges faced by the central and western regions (table 1).

Table 1 – Comparative analysis of digital integration platforms in China regions

Dimension	Typical performance in the east (Zhejiang)	Typical Performance in the Midwest (Hebei)
Interface standardization rate	94 % (Industrial Internet Platform)	38 % (over 60 % of enterprise systems)
Data interoperability coverage	87 % (cross-industry data sharing)	52 % (within the same industry chain only)
Business participation rate	90 % (enterprise access rate)	38 % (digital coverage of SMEs)

The core finding from the critical perspective highlights the multiplier effect of the infrastructure divide: the intensity of digital infrastructure investment in the central and western regions is only 43 % of that in the eastern region. This disparity contributes to a lag in API standardization. In Hebei, industrial Internet platforms are predominantly at the enterprise level (e.g., private cloud

solutions for the steel industry), which leads to insufficient compatibility of cross-industry data interfaces and results in a of data silos.

Lagging institutional responses exacerbate technological lock-in. While the East enforces standardization through (e.g., Zhejiang's form), the Midwest continues to rely on administrative directives, leading to a lack of motivation for enterprises to undergo transformation. In the case of Hebei Handan Iron and Steel Group, interface adaptation costs accounted for as much as 35 % of the total digital transformation expenses.

The Triple Explanatory Flaw in Existing Theories

Ignoring regional endowment differences, the technology-driven theory implicitly assumes real-world scenarios reveal significant energy endowment constraints. For instance, Guizhou's arithmetic hub achieves a Power Usage Effectiveness (PUE) of 1.2 due to its reliance on 82 % green power. In contrast, Hebei's steel enterprises are limited by their dependence on thermal power, which accounts for less than 15 % of their energy sources, resulting in costs that are 41 % higher for the same arithmetic.

The human capital adaptation gap reveals a significant disparity in talent density between Zhejiang and Hebei. Zhejiang boasts a digital economy talent density of 9.8 individuals per 10,000 people, whereas Hebei has only 3.2 individuals per 10,000 people. This results in a 2.3-fold difference in the algorithm optimization response rate [2].

Simplification of the Dynamic Synergy Mechanism: Existing models predominantly rely on linear conduction assumptions (digital economy → cost reduction and efficiency → economic growth). However, empirical evidence indicates the non-linearity of technology diffusion in the eastern region. Specifically, when the cloud adoption rate among enterprises in the Yangtze River Delta exceeds 75 %, the marginal benefit experiences an inflection point, with the elasticity coefficient decreasing from 0.8 to 0.3. Additionally, there is a threshold effect regarding the transformation in the central and western regions of the country: the digitization coverage rate of enterprises in Hebei must reach 55 % to trigger the network effect, yet the current actual level stands at only 38 %. Reason: Improved clarity and readability by restructuring sentences, enhancing vocabulary, and correcting grammatical errors.

Segregation of Institutional-Technological Synergies: The technology-driven theory does not account for the dynamic adaptability of policy instruments. The policy effectiveness index is calculated as follows: Policy Effectiveness Index = 0.7 × Institutional Elasticity + 0.3 × × Technological Maturity. Zhejiang successfully activated enterprise data flow through the in the Table 2 elasticity of 0.85. In contrast, Hebei was unable to realize the potential of the same policy due to insufficient implementation rules, resulting in an elasticity of 0.32.

Theoretical Revision Direction and Integration Framework: Based on the critique presented above, it is proposed to develop a synergistic institutional-technological evolutionary theory.

Dynamic Adaptation Model

$$\text{Regional Digitalization Effectiveness} = \gamma \cdot \frac{\text{Technology penetration strength}}{\text{Institutional friction coefficient}} + \epsilon$$

Technology Penetration Strength: API Standardization Rate × Data Flow Rate.

The institutional friction factor is comprised of the policy time lag and the implementation attrition rate.

Table 2 – Heterogeneity Governance Toolbox

Area type	Technology penetration priorities	System optimization breakthrough
Eastern predominant region	Cross-industry data pricing mechanisms	Antitrust regulation (e.g., platform binary)
Midwest catch-up region	Subsidies for standardization of base interfaces	Tax incentives for data assets

The technology-focused theory has three primary flaws: it tends to oversimplify complex issues, create uniformity across diverse contexts, and overlook institutional factors when examining regional disparities. Future research should aim to develop a dynamic model that links "technology penetration, institutional adaptation, and resource activation." This model should incorporate

regional resource endowments, innovative policy tools, and the dissemination of digital technology into a cohesive analytical framework. Such an approach will enhance our understanding of the true impact of enterprise digital integration platforms on regional economies.

References

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ИССЛЕДОВАНИЕ КООПЕРАЦИОННЫХ СВЯЗЕЙ ОАО «ВИТЕБСКИЕ КОВРЫ»

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Реферат. *В данной статье проведено исследование кооперационных связей ОАО «Витебские ковры» на предмет готовности к развитию смарт-кооперации и созданию смарт-индустрии для повышения конкурентоспособности предприятия в эпоху цифровизации.*

Ключевые слова: смарт-кооперация, смарт-индустрия, исследование кооперационных связей.

Современная экономика переживает этап глубокой цифровой трансформации, которая затрагивает все сферы промышленности и бизнеса. Одним из ключевых направлений этой трансформации является развитие смарт-кооперации – интеллектуального взаимодействия между предприятиями, основанного на использовании цифровых технологий, автоматизации и обмена данными в реальном времени. Смарт-кооперация становится важным инструментом для создания смарт-индустрии, где предприятия объединяются в цифровые экосистемы, обеспечивая гибкость, прозрачность и устойчивость производственных процессов. В условиях глобализации и усиления конкуренции внедрение таких технологий позволяет предприятиям оптимизировать ресурсы, снижать издержки и повышать конкурентоспособность.

Современные вызовы, включая нестабильность глобальных поставок, ужесточение конкурентной среды и рост требований к скорости принятия решений, обуславливают необходимость пересмотра подходов к организации кооперационных связей. Внедрение смарт-кооперации способно обеспечить предприятию переход к предиктивному управлению ресурсами, автоматизированному взаимодействию с контрагентами и созданию дополнительных конкурентных преимуществ.

Развитие смарт-кооперации как инструмента формирования смарт-индустрии является крайне актуальным направлением в условиях цифровой трансформации глобальной экономики. Традиционные модели промышленной кооперации уступают место интеллектуальным экосистемам, где взаимодействие между участниками строится на принципах открытости данных, автоматизации и взаимовыгодного сотрудничества. Особую значимость эта тема приобретает для производственных предприятий, сталкивающихся с необходимостью адаптации к быстро меняющимся рыночным условиям, нестабильности цепочек поставок и конкуренции.

Использование сети Интернет имеет важное значение для ОАО «Витебские ковры», так как используется для широкого ряда целей. Среди тех, что имеют важность для развития смарт-кооперации можно выделить следующие: отправка и получение электронной почты; осуществление банковских операций; общение в социальных медиа (сетях); дистанционная работа (включая проведение онлайн-совещаний и онлайн-переговоров с деловыми партнерами); получение информации о товарах с зарубежных маркетплейсов; для связи с поставщиками. Все эти цели указывают на значимость вопросов взаимодействия предприятия с внешними субъектами рынка и определяет готовность организации к внедрению иных решений в области автоматизации и цифровизации таких процессов.