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Research on the Evaluation Index System of Social Responsibility of Small and Medium-Sized Enterprises

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Abstract: The social responsibility of small and medium-sized enterprises (SMEs) is very important for themselves and the whole society. The concept and connotation of social responsibility of SMEs have been defined and explained. The research dimensions of previous scholars on corporate social responsibility (CSR) have been reviewed, and an evaluation index system for social responsibility of SMEs has been constructed based on their characteristics, including four key indicators: community, customers, employees, and environment.

Keywords: Corporate social responsibility; SMEs; Evaluation

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1. Introduction

Corporate social responsibility (CSR) has always been a key “tool” for balancing the economic, social, ethical, and environmental impacts of businesses, and is one of the most dynamic and demanding areas of their business operations^[1]. CSR is a channel through which businesses, including small and medium-sized enterprises (SMEs), contribute to achieving social goals. Researchers have proposed the enormous significance of CSR, as it has some advantages for society as well as for businesses and external stakeholders^[2]. With the increasing social awareness and attention to CSR worldwide, more and more companies are expected to demonstrate CSR and create shared value, and these expectations are no longer limited to large or multinational corporations^[3]. In the discourse of CSR, there is often a misconception that CSR activities are only carried out by large and high-profit enterprises^[4]. The reality is that SMEs also play an important role in the global CSR field. The role of CSR in SMEs has received little research attention^[5].

Until recent years, research on international entrepreneurship has only begun to evaluate the importance of CSR from the perspective of SMEs^[6]. However, in the measurement of corporate responsibility, many studies have analyzed and proposed scales for measuring the social responsibility of large corporations^[7].

Jamali and Karam reviewed CSR literature spanning 25 years (1990–2015) and found that 51% of studies focused on an organizational level, 13% on an institutional level, and 9% on an individual level. The remaining

27% involves analysis at two or more levels ^[8]. There are significant differences in CSR between SMEs and large corporations. Therefore, in CSR research, the research results of large corporations should not be generalized to SMEs, and theoretical models based on CSR research of large corporations may not fully explain the CSR of SMEs ^[9].

Therefore, researchers, regulatory agencies, and other stakeholders must pay more attention to the implementation of CSR in SMEs. Similarly, there is still a problem with the research on the dimensions of CSR. This article attempts to find key indicators of social responsibility for SMEs based on their characteristics.

2. Review of corporate social responsibility

2.1. Concept of CSR

As an economic entity, the role of an “economic man” in a company requires that it must pursue profit to achieve maximum profit. However, maximizing profits is not the only goal of corporations. As a social corporation, there is also a goal of maximizing value.

The social responsibility of a corporation and the legal responsibility it undertakes are different concepts and should be distinguished. According to Ethos Institute (2021), corporate social responsibility can be defined as follows: CSR is a form of management defined as the ethical and transparent relationship between a company and all relevant audiences (whether employees, customers, suppliers, shareholders, media, communities, governments), as well as the establishment of target corporates that promote social sustainability, protect the environment and culture, provide resources for future generations, respect diversity, and promote the reduction of social inequality ^[10].

The social responsibility of SMEs does not have broad social characteristics like large corporations. They are more focused on solving key social problems that core stakeholders hope to solve. Due to the lack of resources to fulfill their responsibilities, SMEs are more inclined to solve immediate survival and development problems. The social responsibility of SMEs is greatly influenced by their regional culture and industry characteristics, and is less constrained by various international or domestic social responsibility standards ^[11].

Social responsibility of SMEs refers to a series of policies and practical processes in which enterprises fulfill voluntary responsibilities beyond legal provisions to core stakeholders, communities, and the environment to achieve dual economic and social goals ^[12].

2.2. Dimensions of CSR

CSR is of interest to various stakeholder groups, including employees, shareholders, financial partners, consumers, suppliers, society, government, and the environment ^[13]. CSR can be measured using different scales. Some of the dimensions used to measure CSR in the literature are presented in **Table 1**.

There have been many studies analyzing and proposing scales for measuring the CSR of large companies ^[17], even from the perspective of consumers or brands ^[22]. However, few have provided a measurement tool that considers all stakeholders for the specific situation of SMEs, and their participation in CSR may differ qualitatively ^[23]. Overall, CSR can be roughly divided into two, three, four, and five dimensions from the perspectives of sustainable development, the unity of legal and moral obligations, and stakeholders.

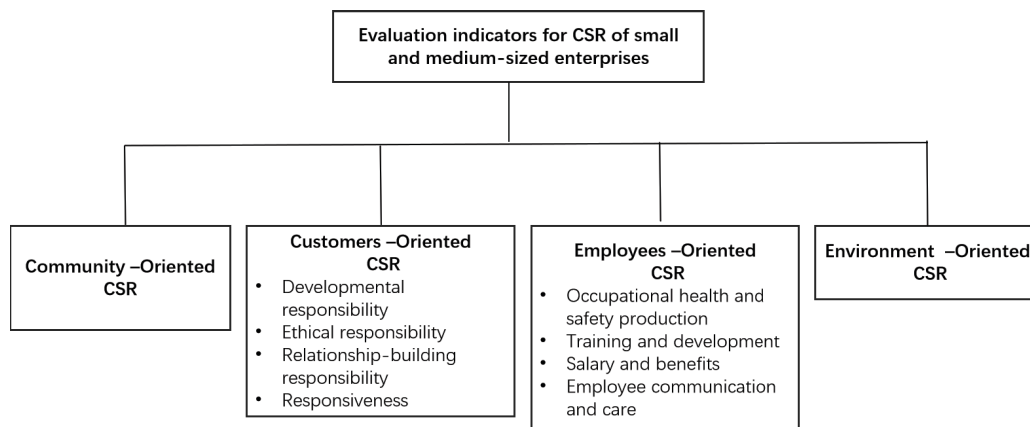
Table 1. Dimensions used for corporate social responsibility studies

Author	CSR dimensions	Is it for SMEs
Lechuga Sancho <i>et al.</i>	Customers, suppliers, employees, the environment, local community, and corporate governance ^[14] .	NO
Perrini <i>et al.</i>	Environmental management, employment, the supply chain, local community, monitoring and reporting, community volunteerism ^[15] .	YES
Cooper <i>et al.</i>	Shareholders, customers, employees, and the environment ^[16] .	NO
Oduro <i>et al.</i>	Economic-oriented, environment-oriented, and social-oriented ^[17] .	YES
Crane <i>et al.</i>	Workplace, marketplace, ecological environment, and the community ^[18] .	NO
Commission of the European Communities	Internal and external dimensions ^[19] .	NO
Marrewijk	Finance, Environment and Ethics ^[20] .	NO
Gulbrandsen	Stakeholder, social, economic, voluntary, and environmental ^[21] .	NO

3. Evaluation indicators for social responsibility of SMEs

Sen and Cowley argued that social capital theory is more suitable for explaining the characteristics of social responsibility of SMEs compared to stakeholder theory ^[9]. Based on summarizing the unique characteristics of informal organizational structure, rapid market response ability, low market negotiation power, and low policy influence of SMEs, they pointed out that the characteristics of social responsibility of SMEs include paying attention to employee welfare and funding vocational skills training, supporting and participating in community activities, maintaining good cooperative relationships with customers and suppliers, etc. These social responsibility characteristics play an important role in gaining community trust, establishing good market relationships, and increasing extensive social capital for SMEs. Because the CSR actions of SMEs usually target smaller stakeholder groups, Soundarrajan *et al.* call for the use of small enterprise-specific methods and measurement standards to conduct background and scale awareness research on small enterprises' social responsibility ^[24].

Based on this, this article adopts the perspective of Lechuga (2021) to analyze the social responsibility of SMEs from four dimensions: community-oriented CSR, customer-oriented CSR, employee-oriented CSR, and environment-oriented CSR. See **Figure 1** for details.

**Figure 1.** Evaluation index system

3.1. Community-oriented CSR

Community is one of the most important stakeholders of enterprises, and the survival and development of enterprises are based on the community. The role and impact of SMEs are increasing, which only means that their role and importance in increasing employment, innovation, and living standards in social-related issues are becoming increasingly difficult to ignore in terms of community care ^[25]. Community-oriented CSR refers to the principle that business organizations must participate in social welfare activities in addition to their primary purpose ^[26].

Small companies are usually located close to their local communities and have close connections with them. SMEs are often dynamic, persistent, and active participants in the local communities they operate in ^[11]. Due to these strong connections, they are eager to participate in charitable activities ^[27]. These companies are increasingly discovering the enormous benefits of building good relationships with the communities in which they operate ^[15]. Turyakira *et al.* also point out that from the perspective of SMEs, CSR can be equated with the concepts of giving back to the community, treating employees fairly, and providing quality products and services ^[28].

Therefore, community-oriented CSR is an important indicator for evaluating the implementation of social responsibility in SMEs.

3.2. Customer-oriented CSR

CSR towards customers is referred to as a voluntary and ongoing commitment by a company to conduct itself ethically and make business decisions related to building strong relationships with customers by respecting them and complying with their requirements ^[29]. Companies must consider the importance of external stakeholders, such as customers and social interests, and customers may view social interests at a personal level ^[30]. Consumers are considered the main stakeholders of businesses and are more concerned about organizational behavior. Focusing on customer social responsibility activities positively affects satisfaction and repurchase behavior ^[31]. Although SMEs have their characteristics, from a business perspective, building good relationships with customers is important for all stakeholders, and customers are increasingly valuing the company's provision of social responsibility to them.

This article discusses developmental responsibility, Research will be conducted on four aspects: ethical responsibilities, relationship-building responsibilities, and responsiveness.

Developmental responsibility refers to the action of improving products/services by investing in innovation, leveraging customer satisfaction, providing high-quality products/services, and meeting industry standards. Ethical responsibility refers to a company's ability to act fairly, fulfill obligations by providing fair products/services, and develop comprehensive codes of conduct that include customer concerns.

Relationship building responsibility refers to building more cohesive and lasting relationships with customers by researching and understanding their needs. Responsiveness refers to the willingness to solve customer problems and provide products/services promptly ^[32]. Therefore, customer-oriented CSR is an important indicator for evaluating the implementation of social responsibility in SMEs.

3.3. Employee-oriented CSR

Employee-oriented CSR refers to the responsibility that a company should bear towards its employees in the CSR system based on stakeholder theory. CSR for employees includes employee training programs, continuing education opportunities, safe working environments, diversity and inclusivity policies, parental daycare programs,

and other similar programs ^[33].

SMEs are more concerned with their direct stakeholders rather than secondary stakeholders ^[11], with one priority area being employee well-being ^[27].

Some scholars believe that employees are the most important stakeholders for SMEs to handle CSR strategies ^[15]. Employee support is a key factor in ensuring the participation of SMEs in CSR. Several studies have shown that investing in employees, such as balancing work and life at home, can bring direct benefits to companies. Perrini (2007) found that ^[34], When effective and appropriate communication is conducted, social responsibility activities of SMEs can help enhance the company's attractiveness to future or potential employees (i.e. potential recruiters). The higher the importance that employees attach to ethical issues, the stronger the relationship between SMEs' social responsibility activities and related outcomes ^[15].

Pfajfar *et al.* found through a survey of 1568 local companies in Poland that the expected benefits of employee-oriented CSR are both direct and indirect, and have a positive impact on relationship quality. Fulfilling employee responsibilities can bring internal and external value to the corporation and establish a good corporate image ^[35]. Therefore, employee-oriented CSR is an important indicator for evaluating the implementation of social responsibility in SMEs.

This study is conducted from four dimensions: occupational health and safety production, training and development, salary and benefits, and employee communication and care ^[36].

The definition of occupational health and safety production is to implement organizational occupational health and safety production, ensure the development of scientific and effective occupational health and health management system guidelines, and promote the implementation of occupational health and safety regulations and systems ^[37]. Shao (2019) proposed that education is the driving force for employees to fulfill their responsibilities, and the education mechanism is oriented towards corporate strategy. It not only emphasizes training that meets current needs, but also places greater emphasis on development to meet future needs, and focuses on establishing a scientific training and development system ^[38]. Bocean *et al.* proposed that a company that fulfills its social responsibility to its employees should focus on the core of "continuously motivating people" in the process of establishing a management system, and develop a scientific assessment and compensation system ^[39]. Employee communication and care are important ways to effectively maintain and motivate human capital ^[40].

3.4. Environment-oriented CSR

The concept of CSR began with increasing attention to social and environmental degradation. Although CSR represents a corporation's responsibility to society, it also means that corporations that provide products and services to consumers are becoming increasingly sensitive to taking on more social welfare responsibilities and maintaining environmental and ecological balance ^[41]. CSR is considered a green organizational strategy. Bae and Kim define corporate environmental responsibility as the company's activities in addressing any environmental-related issues, such as pollution, recycling, clean energy, etc ^[42].

Environment-oriented CSR refers to the social responsibility that enterprises undertake in the pursuit of maximizing their own profits and shareholder interests for ecological environment protection and sustainable social development. Environment-oriented CSR includes the legal and moral responsibilities that enterprises undertake in protecting the environment.

Nowadays, the importance of SMEs is increasing, which has led people to realize their impact on the environment and society ^[43]. SMEs are considered to have a greater impact on the unit environment than large

companies, and are the largest contributors to pollution, carbon dioxide emissions, and commercial waste ^[44]. CSR activities ultimately contribute to sustainable environmental development by protecting natural resources. In developed Western countries, governments have been promoting engagement with SMEs on CSR and environmental issues, citing that SMEs together have a significant impact on the environment and society, and are often in a favorable position to engage with communities ^[45].

A historical review of literature indicates that in this regard, the responsibility of companies, especially SMEs is not only focused on how to avoid damaging the natural environment, but also on protecting and improving it. The environment is seen as a business issue and an important stakeholder to be considered in the strategy of small and medium-sized enterprises. Therefore, environment-oriented CSR is an important indicator for evaluating the implementation of social responsibility in SMEs.

4. Conclusion

SMEs are a collection of stakeholders, and their survival and development cannot be separated from the stakeholders who are most closely related to them. Different stakeholders have different interests and demands for different dimensions of CSR. Therefore, this article selects the core stakeholders and constructs an evaluation index system for the social responsibility of SMEs, which is more in line with the actual situation of SMEs. It helps to improve the awareness of social responsibility among SME entrepreneurs, has guiding significance for enterprises to correctly fulfill their social responsibility, provides a more rational judgment basis for them to make social responsibility management decisions, and also provides a tool for society to judge the social responsibility behavior of SMEs.

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Full Cost Accounting and Performance Evaluation in Financial Management of Public Hospitals

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Abstract: Full cost accounting, as a comprehensive cost measurement method, integrates direct and indirect costs to reallocate costs across departments. Performance evaluation serves as a method to assess a hospital's overall performance and management capabilities. Both full cost accounting and performance evaluation are critical tools in the financial management of public hospitals, playing pivotal roles in accounting practices. The concepts of full cost accounting and performance evaluation were investigated in this study, and the existing challenges and the theoretical basis for their integration were analyzed. An integrated model was constructed, and its application cases and effectiveness in the financial management of public hospitals were discussed. Finally, measures to integrate full cost accounting and performance evaluation were proposed, including improving full cost accounting mechanisms, standardizing accounting practices, optimizing cost allocation methods, establishing a unified management platform, and fostering collaboration among stakeholders. This study provides new insights to enhance the quality and efficiency of financial management in public hospitals, laying a foundation for their sustainable development.

Keywords: Public hospitals; Full cost accounting; Performance evaluation; Financial management

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1. Introduction

High-quality financial management in public hospitals is crucial for their sustainable development. Full cost accounting can comprehensively refine hospital costs, providing precise data support for decision-making. Performance evaluation effectively assesses hospital performance levels. Both play crucial roles in the financial management of public hospitals^[1]. However, the research on integrating full cost accounting and performance evaluation in public hospital financial management remains limited. Therefore, the role of integrating full cost accounting and performance evaluation in public hospital financial management was discussed in this study, aiming to support financial decision-making, improve the efficiency and scientific rigor of financial management^[2].

2. Full cost accounting and performance evaluation

2.1. Full cost accounting in public hospitals

2.1.1. Characteristics of full cost accounting

Full cost accounting involves the comprehensive and accurate calculation and allocation of all hospital costs. Through full cost accounting, public hospitals can better analyze cost structures and cost drivers, providing accurate and holistic cost information for strategic decision-making. Full cost accounting is characterized by comprehensiveness, inclusiveness, precision, and transparency.

Comprehensiveness refers to the integration of both direct and indirect costs to ensure all costs are included in calculations. This not only enables more accurate measurement of total departmental costs but also enhances understanding of how different medical activities impact costs ^[3]. Inclusiveness requires incorporating all department-related costs into calculations, such as direct material costs, direct labor costs, allocated indirect labor costs, and indirect material costs. This ensures that calculated costs are exhaustive, omitting no critical cost factors. Precision is achieved through meticulous cost analysis and rational allocation methods, allowing for highly accurate departmental cost calculations. This provides reliable foundational data to support informed managerial decisions. Transparency demands that the processes and methodologies of cost allocation be clear and verifiable, ensuring that cost calculations are understandable and auditable by stakeholders ^[4].

2.1.2. Significance and limitations of full cost accounting

The implementation of full cost accounting in public hospitals holds significant importance. Firstly, it enables the acquisition of accurate cost information, allowing managers to understand the actual costs of hospital activities and providing a basis for informed decision-making. Secondly, full cost accounting comprehensively incorporates indirect costs, thereby avoiding decision-making errors that may arise from focusing solely on direct costs. Lastly, it helps public hospitals identify opportunities to optimize cost performance evaluation goals, enhance resource utilization efficiency, and facilitate cost control and expense reduction.

However, full cost accounting in public hospitals also has limitations ^[5]. For instance, it requires the collection of extensive data and complex allocation calculations, placing high demands on hospital information systems and data quality. Additionally, in certain scenarios, full cost accounting may involve ambiguities and subjectivity, necessitating careful attention to data accuracy and rationality in practical applications.

2.1.3. Application of full cost accounting in financial management of public hospitals

The application of full cost accounting in financial management has gained increasing attention in public hospitals. A growing number of public hospitals now utilize full cost accounting to understand the true costs of medical services and provide accurate data-driven support for decision-making.

In public hospitals, full cost accounting is primarily applied to evaluate the cost-effectiveness of medical services, optimize resource allocation, and assess the contributions of departments and projects. By applying full cost accounting, hospitals analyze the cost composition of various services, identify high-cost and low-efficiency projects, and implement optimization measures. Additionally, public hospitals benchmark their performance against other institutions through full cost accounting, identifying weaknesses in financial management and making targeted improvements. This practice enhances their competitiveness and elevates performance management standards ^[6].

2.2. Performance evaluation in public hospitals

2.2.1. Objectives of performance evaluation

Performance evaluation is a process of assessing hospital performance, aiming to measure financial and non-financial outcomes through quantifiable indicators. The objectives of performance evaluation include enhancing performance transparency, motivating hospital staff, and improving hospital operations and management.

A key objective of performance evaluation is to increase transparency. By publicly disclosing evaluation results, both internal and external stakeholders gain insight into the hospital's performance, prompting management to prioritize performance improvement. Another critical objective is to motivate employees. Through performance evaluation, hospitals can reward and promote staff based on their performance, fostering motivation and engagement. This incentive mechanism helps hospitals retain top talent while boosting job satisfaction and employee loyalty.

In addition, performance evaluation also facilitates operational and managerial improvements. By analyzing evaluation outcomes, hospitals can promptly identify challenges and opportunities, enabling the formulation of targeted strategies. For example, if excessive medication inventory is detected, control measures can be implemented to reduce stock levels and lower costs. Similarly, evaluation results revealing low patient satisfaction can guide hospitals to address root causes and enhance service quality, thereby improving patient satisfaction ^[7].

2.2.2. Selection and construction of performance evaluation indicators

In the financial management of public hospitals, selecting and constructing appropriate performance evaluation indicators is crucial. These indicators should align with the hospital's strategic objectives and key operational metrics, while also being measurable, comparable, and actionable. Commonly used performance evaluation indicators include medical service quality, operational efficiency (i.e., revenue-expenditure structure, cost control, and economic management), and patient satisfaction.

Medical service quality is a critical indicator, measured through metrics such as medical error rates, surgical success rates, and infection control effectiveness. Patient satisfaction, assessed via surveys, reflects service quality and patient experience. Financial indicators include revenue, expenditure, surplus/deficit balance, asset-liability ratios, and cost control metrics such as per-visit outpatient and inpatient cost growth rates. Resource utilization efficiency indicators evaluate how effectively the hospital utilizes its resources (e.g., bed occupancy rates, equipment usage efficiency).

2.2.3. Application of performance evaluation in public hospital financial management

Performance evaluation is widely applied in public hospitals. Through performance evaluation, public hospitals can comprehensively assess the quality and efficiency of medical services, monitor resource utilization, and implement targeted management for underperforming departments and individuals. In practice, performance evaluation is commonly used to assess departmental performance, physicians' clinical skills and treatment outcomes, and nurses' service quality. By leveraging performance evaluation, public hospitals can motivate staff, enhance service quality, and improve clinical effectiveness ^[7]. However, challenges persist in its application to financial management.

Firstly, the selection of indicators lacks scientific rigor and comprehensiveness, constrained by technical limitations. The design of performance evaluation indicators must align with hospital characteristics and development goals. In practice, selected indicators often fail to fully or accurately reflect overall performance.

Additionally, the construction of indicators is limited by data collection capabilities and statistical methodologies.

Secondly, the complexity and diversity of healthcare services increase evaluation difficulty. The hospital offers a wide variety of services, including different departments and professional fields. Therefore, establishing a scientific and reasonable evaluation system, which can comprehensively assess the performance of hospitals and take into account the characteristics of various fields, is a complex and crucial issue.

Thirdly, performance evaluation and incentive mechanisms are inadequately integrated. Effective performance evaluation should synergize with incentives to stimulate employee initiative and creativity. However, existing incentive mechanisms often lack robustness, failing to sufficiently motivate staff and drive performance improvements. Thus, scientifically designed incentives should be implemented to complement evaluation systems and elevate overall hospital performance.

Fourthly, performance evaluation lacks alignment with strategic objectives. To ensure relevance, evaluation systems should be closely tied to a hospital's strategic goals and development plans. However, the connection between performance assessment and strategic goals is not close enough in practice, resulting in the results of performance assessment being inconsistent with the overall development needs of the hospital.

2.3. Relationship between full cost accounting and performance evaluation

In full cost accounting, hospitals account for both direct and indirect costs, ensuring accurate cost allocation and measurement. This process clarifies the cost structures of departments and medical activities, providing foundational data for performance evaluation. Performance evaluation, in turn, assesses the quality, efficiency, and effectiveness of departments and activities, guiding the formulation of improvement strategies. Evaluation results can be fed back into full cost accounting to identify departments or activities with low cost-effectiveness.

For example, a department with low performance may still be deemed inefficient despite having low costs. Hospitals can optimize such departments based on evaluation outcomes to enhance overall performance. Thus, full cost accounting and performance evaluation are mutually reinforcing:

Full cost accounting supplies precise cost data to inform performance metrics. The results of performance assessment can be fed back to the full cost accounting personnel, helping the hospital identify departments with lower cost-effectiveness and make optimizations and adjustments. Through this interplay, hospitals achieve rational resource allocation and improved comprehensive performance^[8].

3. Challenges in full cost accounting and performance evaluation in public hospital financial management

3.1. Challenges in full cost accounting

Public hospitals have adopted full cost accounting in financial management, but significant shortcomings remain, undermining its effectiveness.

Firstly, the management framework for full cost accounting is incomplete. The competition for market medical resources in public hospitals is extremely fierce. If full cost accounting management cannot be effectively carried out, it will increase the difficulty of expenditure control and have an adverse impact on the survival of public hospitals. However, current systems fail to fully integrate practical needs. Although the sales difference of drug prices can be effectively controlled through the full cost accounting method, it fails to control it in combination with the actual full cost accounting requirements. In the absence of a complete accounting system, it is very difficult to complete one's tasks. Especially in the work of full cost accounting, it has not been integrated

with performance management, and a good coordination between the two cannot be ensured, resulting in an unsatisfactory working effect of full cost accounting ^[9].

Secondly, the full cost accounting system and working standards have not been unified. In specific work, the purpose of full cost accounting is to distribute bonuses reasonably and calculate the expenditures in the hospital. Most of the work is operated manually without setting specific standards. Moreover, the costs related to human resources are very complex, which increases the difficulty of full cost accounting work.

Thirdly, due to the uneven professional qualities of the relevant financial personnel, they have not yet fully mastered the working skills and methods in full cost accounting, which hurts the effective implementation of full cost accounting work.

3.2. Challenges in performance evaluation

Public hospitals face multiple issues in performance evaluation, compromising their quality and effectiveness. Current practices predominantly rely on post-hoc assessments, lacking systematic approaches and unified metrics to manage tasks. Performance goals are not aligned with hospital-specific characteristics, and evaluation data often suffers from delays and inaccuracies. These shortcomings hinder effective implementation and diminish the role of performance evaluation in enhancing hospital management.

Additionally, the primary focus of evaluation remains on bonus distribution and management, neglecting daily operational assessments. This narrow scope undermines scientific rigor. Without properly structured evaluations, hospitals fail to leverage performance incentives, adversely impacting long-term development.

3.3. Integration level of full cost accounting and performance evaluation

The integration of full cost accounting and performance evaluation in public hospital financial management remains insufficient. Although some hospitals have initiated integration efforts, effective synergy between the two systems is lacking. This disconnect creates new challenges, such as inconsistencies between cost accounting and performance metrics, leading to unreliable decision-making criteria.

Currently, a widespread gap exists between full cost accounting and performance evaluation. Hospital administrators cannot accurately assess costs against performance indicators, preventing the formulation of financial strategies aligned with long-term goals ^[3]. Furthermore, poor integration weakens internal incentive mechanisms, resulting in inaccurate staff evaluations and negatively impacting operational efficiency and service quality. Thus, further exploration is needed to effectively integrate these systems in public hospital financial management.

4. Theoretical basis for integrating full cost accounting and performance evaluation

4.1. Information symmetry theory

The theory of information symmetry holds that when decision-makers make decisions, they often encounter the problem of information asymmetry, that is, there is an information difference between decision-makers and executors. This information asymmetry may lead decision-makers to make mistakes or deviations when formulating strategies or allocating resources. Integrating the data of full cost accounting and performance assessment can provide decision-makers with more accurate and comprehensive information.

Full cost accounting categorizes and analyzes various costs (e.g., direct, indirect, fixed, variable), revealing cost structures and distributions across departments and medical activities. Performance evaluation quantifies hospital performance through metrics, offering insights into operational outcomes. By integrating these datasets,

management gains holistic insights to better assess risks, refine strategies, and optimize hospital operations. Simultaneously, integrated data supports dynamic performance assessments, enabling timely adjustments to enhance competitiveness^[10].

4.2. Resource allocation optimization theory

The core premise of resource allocation optimization theory lies in integrating full cost accounting with performance evaluation to achieve optimal resource distribution in hospitals. Full cost accounting ensures comprehensive and accurate calculation and analysis of costs across departments and medical activities, thereby providing robust support for resource allocation decisions.

Through full cost accounting, hospitals gain clarity on cost structures for departments and activities, enabling rational resource distribution while minimizing waste and redundancy. Performance evaluation complements this by assessing departmental and activity performance, identifying misallocations, and guiding timely adjustments^[8].

Performance evaluation employs quantitative and qualitative methods to assess hospital departments and activities, pinpoint inefficiencies, and implement targeted optimization measures. By synergizing full cost accounting with performance evaluation, hospitals achieve scientifically grounded resource allocation, maximizing operational efficiency, and elevating overall performance and benefits^[9].

5. Integration model of full cost accounting and performance evaluation

5.1. Theoretical basis of the integration model

The integration model of full cost accounting and performance evaluation is grounded in the theoretical foundations of performance management and cost management. Performance management theory emphasizes goal-oriented approaches, using clearly defined objectives and metrics to assess and improve organizational performance. Cost management theory focuses on effectively managing and controlling costs to optimize resource allocation and reduce expenses. By integrating these two theories, the model combines cost control with performance improvement, thereby enhancing the overall efficacy of financial management in public hospitals^[10].

5.2. Key components and workflow of the integration model

Constructing the integration model requires addressing the following components and workflow. Firstly, define integration objectives. Clarify overarching financial management goals, such as improving performance, efficiency, and resource utilization.

Secondly, identify key indicators. Determine the key indicators for performance assessment, such as patient satisfaction, medical quality indicators, and medical service efficiency, etc. Determine the cost items for full cost accounting, such as direct costs (human resources, materials), indirect costs (equipment maintenance, administrative expenses), etc.

Thirdly, establish associations and weights. Analyze the correlations among the indicators and clarify their importance to the overall performance. Set appropriate weights for each indicator to reflect their importance in the performance assessment.

Fourthly, establish a data collection and integration mechanism. Establish an effective data collection mechanism, including the frequency, sources, and methods of data collection. Then, establish a data integration mechanism to integrate data from different departments and systems.

Fifthly, data analysis and performance evaluation. Analyze the collected data, compare the cost data and

performance indicators, and evaluate the relationship between medical performance and cost-effectiveness. By using statistical analysis and data visualization tools, potential correlation patterns and trends are discovered, and key performance and cost indicators are extracted.

Sixthly, formulate improvement measures and action plans. Based on the assessment results, formulate corresponding improvement measures and action plans. For the indicators of high cost and low performance, determine specific improvement goals and formulate corresponding specific measures to reduce costs and improve performance. Implement the improvement measures and action plans for each department and position, and clarify responsibilities and time nodes. Then, regularly monitor and evaluate the implementation effect of improvement measures, and make timely adjustments and optimizations.

This workflow outlines the fundamental steps for building the integration model. Starting with goal definition, it progresses through indicator selection, data integration, analysis, and action planning. The iterative nature of the process enables continuous optimization of public hospital financial management.

5.3. Application of the integration model in public hospital financial management

To improve the quality and efficiency of medical services, a public hospital implemented an integrated model of full cost accounting and performance evaluation. This model enabled the hospital to comprehensively analyze the cost distribution of medical services, correlate cost data with performance indicators, identify issues, and implement targeted corrective measures.

The hospital first defined its objectives and requirements, then established a cross-departmental team responsible for data collection and integration. The team collected cost data from all departments, developed a performance evaluation framework, conducted correlation analysis between cost data and performance metrics to identify inefficiencies, and then formulated improvement measures and action plans based on the analysis results. Additionally, the hospital regularly monitored and evaluated the outcomes of these measures, making adjustments and optimizations as needed. Through this process, the hospital achieved the integration of full cost accounting and performance evaluation, thereby supporting continuous improvement and optimization of its financial management ^[11].

6. Measures for integrating full cost accounting and performance evaluation in public hospital financial management

Public hospitals must prioritize the integration of full cost accounting and performance evaluation in financial management to ensure effective implementation and enhanced efficiency.

6.1. Improve full cost accounting mechanisms

Public hospitals should ensure the comprehensiveness of cost elements and processes, distinguishing between direct and indirect costs. During the cost accounting process, whether it is a direct department or an indirect one, a controllable cost or an uncontrollable cost, all need to be accounted for, and it is necessary to ensure that all accounting units, disease information, and project contents are involved. In specific work, all contents related to costs need to be accounted for, and accurate statistical analysis of financial data information should be carried out to establish a complete cost accounting working mechanism and system ^[12].

During this period, attention should be paid to the comprehensiveness of the process and content, and the relevant costs should be recorded. Integrate the performance assessment work into the full cost accounting

system, formulate measures to reduce costs, and utilize effective accounting methods to lay a solid foundation for improving the full cost accounting work system. Improve the relevant responsibility system and clarify the cost accounting responsibilities of each department and personnel. By means of performance assessment, the cost accounting performance within the responsibility scope of each department and personnel is evaluated and analyzed, and the expenses and costs of all personnel are calculated. Supported by the data and information of various performance assessment indicators, comprehensively analyze the cost content, effectively carry out the relevant cost accounting work, and promote the strategic development of public hospitals ^[13].

6.2. Standardize full cost accounting practices

In their financial management practices, public hospitals should proactively leverage performance evaluation methods to standardize comprehensive cost accounting criteria and identify optimal working approaches. Specifically, they should establish classification standards based on their operational conditions, organically integrate comprehensive cost accounting with performance evaluation mechanisms, and formulate unified working benchmarks. By utilizing data from various medical services, hospitals can enhance the accuracy of both performance evaluations and associated data. Concurrently, relevant departments should implement comprehensive cost accounting measures that clearly define cost calculation standards at both hospital and departmental levels, while unifying equipment cost accounting standards. These standards should be adapted to different operational characteristics through differentiated approaches. For instance, in hospital-level cost accounting, systematic organization of cost data for medical services should be required, with cost calculation and analysis conducted according to different functional divisions. This structured approach ensures scientific validity in accounting outcomes while effectively processing cost-related information ^[14].

In the cost accounting work of medical machinery and equipment, the data information of accounting data should be precisely controlled and regarded as the basic accounting part of the total cost accounting process. The calculation cannot be ignored, and the accuracy of all data and information must be ensured. During this period, performance assessment work should be carried out strategically to assist in the refined implementation of cost accounting work and ensure the integration of data and information for the entire cost accounting work. On the one hand, provide accurate information for performance assessment. On the other hand, ensure the integrated management of performance assessment and full cost accounting to meet specific work requirements.

6.3. Optimize cost accounting methods

In financial management, public hospitals should account for their public welfare and research-oriented characteristics. Performance evaluation is often influenced by internal/external conditions and policy factors, necessitating a robust evaluation system aligned with financial management requirements. This system should identify optimal full cost accounting methods and scientifically select measures tailored to evaluation needs.

First, during routine performance evaluations, comprehensive data on medical projects and costs should be collected to ensure evidence-based assessments. Relevant departments should adopt strategically guided, granular approaches to cost accounting. Utilize activity-based costing for project-level cost, and implement a single-track accounting system to ensure effective execution. Activity-based costing can also enable dynamic monitoring of cost consumption, clarifying activity-driven resource usage and allocating costs accordingly ^[13].

Meanwhile, the single-track system should integrate full cost accounting with performance management to streamline processes, unify data, and reduce time spent on cost. This integration ensures accurate data provision

for performance evaluation, achieving unified management of both systems ^[15].

Additionally, prioritize the application of computer technologies. Establish an integrated platform for full cost accounting and performance evaluation using network IT. This platform automates data input and generation, standardizes information, and enhances the efficiency and accuracy of current practices.

6.4. Establishing a dedicated integrated management platform

In recent years, with the rapid development of network information technology, the financial management work of public hospitals has begun to use modern management information systems. In the integration of full cost accounting and performance assessment, it is necessary to fully apply network information technology, give full play to its advantages and roles, build an integrated management platform, fully integrate and share various data information, and improve the timeliness and effectiveness of cost accounting and performance assessment ^[16]. In the process of using such management platforms, the management of public hospitals should be taken as the foundation, with full cost accounting as the core and performance assessment as the basic content. An integrated working platform should be constructed to reasonably collect and analyze data information, integrate various data contents, to guide the performance assessment work of the hospital's finance department, increase operational efficiency, and improve the level of management work.

To effectively create an integrated management platform, first of all, relevant preparatory work should be done well. The codes of each department should be uniformly set up, assets should be checked and verified, relevant contents should be approved, and the management of fixed positions and fixed staffing should be achieved ^[17]. Secondly, the platform should be reasonably designed. According to its situation, the cost information collection module, cost allocation module, cost accounting module, and the system for inputting cost accounting in the platform should be designed. The platform and HIS should be integrated to comprehensively obtain cost data information. Thirdly, screen out the best full cost accounting method to meet the current demand for obtaining cost data information and flexibly set the algorithm formula. Finally, design the functional modules of the relevant platform, set up the basic, interface, and data processing modules, ensure that the application of various modules meets the requirements, and comprehensively improve the integrated management level of full cost accounting and performance assessment in public hospitals.

6.5. Encourage the participation of all staff in communication and collaboration

The participation of all staff in communication and collaboration is an important means to achieve the integration of full cost accounting and performance assessment. During this process, it is necessary to optimize internal communication channels and promote communication and cooperation among various departments and positions.

First of all, public hospitals should regularly organize cross-departmental communication meetings to enable the heads and staff of various departments to exchange information on a regular basis. This can enhance cooperation among various departments and ensure that all staff participate in the integration of full cost accounting and performance assessment. Meanwhile, multiple communication methods are adopted to promote the participation of all staff in communication and collaboration. For example, online collaboration tools and social platforms can be utilized to share information and enhance communication among personnel within public hospitals. Finally, public hospitals should also establish performance assessment teams. The team members should consist of experts from multiple departments to guide them in formulating and implementing full cost accounting, and to effectively supervise them to ensure efficient cooperation and coordination among all links ^[18].

7. Conclusion

Through the application of the integrated model of full cost accounting and performance assessment, public hospitals can enhance their financial decision-making capabilities, optimize resource allocation and cost control, and strengthen the scientific nature of performance management. These achievements can enable public hospitals to better meet the needs of patients, improve overall performance, and achieve the goal of sustainable development.

When applying the integration model, public hospitals will face challenges in terms of technology, data, and culture. For technical limitations, public hospitals need to invest in updating information systems to ensure that data collection, integration, and analysis support the application of integrated models. To ensure the quality and reliability of the data, public hospitals need to ensure the effective operation of the integrated model. Public hospitals also need to adjust their internal culture and management practices to support the integration of performance assessment and cost control.

Although public hospitals will face these challenges when applying the integration model, the integration model still has broad application prospects. Public hospitals can optimize the design and methods, introduce precise and reliable tools, and utilize the analysis and prediction functions of data, etc., to enable the integrated model to better help hospitals improve performance levels, optimize resource allocation, and better meet the needs and expectations of patients. In addition, the integrated model can also be combined with areas such as quality management and risk management, thereby forming a more comprehensive management model.

Disclosure statement

The author declares no conflict of interest.

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Research on the Application of Brand Personality in Internet-Branding of Agriculture Products in China

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Abstract: China is a fast-developing nation, especially in traditional concepts of emphasis on agricultural production, with millions of highly educated college students as new generations of workers enter the workforce, while promoting the booming agriculture industry in China. Concerning these new generations of ambitious college students, it is a pretty attractive career to leverage their knowledge to spread their local special rural agricultural products (agri-products) to well-known places around the nation, even the world. Meanwhile, the Chinese government also supports rural products branding via internet marketing as well as the exploitation of online technologies. Su *et al.* pointed out that governments in China are expected to take more effective measures to enhance adoption rates of online purchases and sales technology, in particular for entrepreneurial farmers^[1]. Currently, the most existing phenomenon in China is that quantities of regional rural products with excellent quality but without national popularity. Thereby, it is significant to enhance the popularity of various brands in regional agricultural products using internet marketing, and also contribute to the nation's strategy of rural revitalization. To appeal to the nations' strategy, we are supposed to make use of brand personality (BP) traits, which probably contribute to robust internet branding of regional agricultural products. Our research will focus on the influences of differential dimensions of brand personality (BP) in terms of common rural products, additionally, we also attempt to design a BP model for internet branding of agricultural products in China. Furthermore, from the two perspectives of characteristics in rural areas (agricultural producers and agricultural consumers), measures to assist agricultural producers in building their brands through the application of internet tools and marketing should be recognized. On the other side, methods to enhance agricultural consumers' brand loyalty also need to be captured.

Keywords: Agricultural products; Internet marketing; Internet branding; Brand personality (BP); Consumers' brand loyalty

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1. Introduction

1.1. Research background

China is a conventional and enormous agricultural nation, with a wide variety of agricultural products scattered in diverse areas across the whole country. Likely, ResearchInChina reported that merely in the aquaculture industry

has shown steady growth in per-capita consumption ^[2]. In 2014, the gross output value of China's fishing industry amounted to RMB 2.0859 trillion, and the added value was up to RMB 971.8 billion. Nevertheless, it is curious that most traditional agricultural products with superb quality yet only well-known in local areas.

DCCI predicted that internet fundamental resources development and enrichment constantly accelerate, the rate of mobile internet access flow will accelerate, and to increase persistently ^[3]. At the end of December 2024, the total number of domain names will have reached 33.02 million. Apart from that, novel information and communication fundamental facilities development coordinately, the number of internet of things terminal consumers boomed to 2.6 billion households, which occupied 59.6% of the number of mobile network terminal connections. This revenue trend could increase over the years. This presents vast Internet marketing opportunities in China ^[4], comply with flourishing internet marketing opportunities in China, rural agricultural producers need to branding their local products via internet tools, over the years, the number of rural Internet users doubled between 2008 and 2012, it reveals steady trend of growth (11.6% to 23.7%) ^[4]. According to CNNIC ^[3], the number of rural internet users has reached approximately 300 million, which accounts for around 28.2% of the total number of internet users.

In addition to some supplementary industries such as financial industry also probably support the internet branding in agricultural industry, digital financial products and services such as WeChat, Alipay, and Bestpay might be related to transactions on e-commerce platforms, it is increasingly crucial of digital payment services as popularity online transaction and consumption tools among rural residents, Moreover, likewise Yu'e Bao, and apps about insurance, securities, and funds are effective digital wealth management tools that contribute to farmers handle their own capital reservation, liquidity management, and property appreciation ^[1].

1.2. Literature review

This study draws upon two perspectives of the literature. Some findings from several relevant research streams were reviewed by us, and subsequently, deficiencies were also recognized in our analysis. The first section focuses on the role of internet marketing related to agricultural products or marketing strategy for an agricultural product brand. Heang and Khan demonstrated that Chinese customers are very much attracted to online product information to compare and research which posted by companies ^[4]. Otherwise, Chinese consumers have become vital role of viewing online comments as important inputs to their purchasing decisions through the internet. They also found that Internet marketing is indeed helpful in agricultural businesses and worth investigating the development of Internet marketing in rural areas despite lower penetration rates. Su *et al.*, take perspective of digital financial market impact to rural China ^[1], emphasized Weibo and friend circle sales need to be adopted to maximize the sale of agricultural products, besides, several potential impacts embraced farmers' education level, skills training experience, engaging in new agricultural operation entities (e.g., family farms, professional cooperatives), and agricultural entrepreneurship navigate they adopt e-commerce. Jie *et al.*, implies that consumers in China are more likely trend to green ^[5], organic and healthful food such as include more whole grains and vegetables in their diets, Chinese Internet usage be treated as an effective and delightful way to have more abundant product related information and become the foremost source of information to gain food protection knowledge, due to focusing on expanded consultation and customization and content marketing to attract an audience, internet use has become the standard for almost everyone by assistant with image of the brand, subsequently, they supposed that visiting a website that has high-quality images, detailed information about organic ingredients and farming more likely attract consumers to make purchases.

The second section delves into how BP impacts consumer behavior, or classifies different types of BP

traits to separate brands. A strong brand personality may increase consumers' willingness to follow various brand activities as well as approve of them positively ^[6]. Bairrada *et al.* continued to reveal passion, sincerity, and excitement highly close to the relationship between BP and brand love ^[6]. Online brand communities were mentioned probably being available to integrate isolated customers, linked by a brand. Nevertheless, concentrating on attractiveness and passion should be considered by companies while creating a closer proximity between their brands and consumers. Batra *et al.*, confirmed that consumers not only prefer those brands that could satisfy their functional needs and wants ^[7], but also symbolize those personality aspects that they find most congruent with their own actual or desired ("aspired to") personality associations. They also make clear that brand category context can significantly impact the meaning of brand personality descriptors; moreover, engaging in potential modification of archetypical brand personality via advertising this quite critically important to improve the personality positioning for these brands. For the same respect, Donvito *et al.* claimed that if a perceived brand personality highly coherent with consumers' personalities ^[8], that brand more likely could be selected by them, Donvito *et al.* also highlight since it is difficult for customers to resolute competitive brands' physical attributes ^[8], BP has therefore become a key strategic component of a company's marketing program. Sensory, affective, and intellectual brand experiences have positive influences on responsible brand personality ^[9]. They also found that they prefer cultivating sensory and intellectual experiences rather than affective experiences, as well as building stronger brand personalities could be assisted by intellectual experiences. Luffarelli *et al.* from the perspective of the interaction between Logo design and BP on brand equity ^[10], found merely for the brand personality of excitement and the visual property of asymmetry, the interaction between Logo design and BP could be work, Luffarelli *et al.* subsequently propose that an exciting personality probably more congruent with brands due to asymmetrical logos tend to be perceived ^[10], they can positively influence consumers' evaluations of those brands.

However, previous studies research mainly focus on various internet marketing strategies involving current agricultural economic environment, to broaden the sales of agricultural products, whereas omitted the details in brand building which involved in agricultural marketing, apart from that, the rest of studies analyzed different various traits in BP, and even clarified the relationship between BP traits and consumers' behaviors as well as mentioned measures to handle with these personalities in band design via specific aspect such as Logo design or excavating symbolic meaning of brands related to consumers' personalities, even though, they took notion of some traits of BP in brand building, while they also have been limited research the ways, on which apply to agricultural products marketing, special for inter-marketing area. This paper concentrates on the agricultural environment in China and tries to provide a more detailed examination by analyzing and defining related BP traits for marketing of branded agri-products. First step is to recognize which agri-products are more suitable for internet branding, the second is to discover proper BP traits could be choose for internet branding of agri-products in China from the perspective of agricultural producers, the third is attempt to discriminate what kind of BP traits probably more congruent with agricultural consumers' brand loyalty improving, which contribute to internet branding of agricultural products. We propose a model to integrate certain BP traits, then link with agricultural producers' behaviors and agricultural consumers' loyalty for branded agri-products from two dimensions of agricultural producers and consumers.

2. Appropriate agri-products for internet branding

To promote agri-products through internet branding, we suppose that two basic skills need to be facilitated

with Chinese rural agricultural producers. The one is an expert in applying digital financial products. Su *et al.* pointed out that it is obvious that the transaction and capital flow of online sales counterpart online purchases ^[1], digital wealth management (e.g., Yu'e Bao, and apps) and digital payments (e.g. WeChat, Alipay) makes rural farmers highly rely on them when it comes to online sales. The other one is that education level or skills training experiences are necessary to match with rural agricultural producers. Operating farming activities is exactly like running a business entity. Su *et al.* explained that highly educated and richly trained experienced agricultural products operators can enhance their business management level and react to possible existing risks promptly ^[1]. In terms of this aspect, systematic training of farmers' financial knowledge should be strengthened by the external environment, like government departments, financial institutions, schools, and social education resources in China.

Following that, we detect that the majority of agri-products are probably linked with these four features, suitable for internet branding. First of all, non-discount agri-products, from the traditional view, it is are beneficial to spread commodities with low prices, to make discounts regularly by merchants. Under the reality circumstances, commodities discounting decisions might reduce their brand value, whereas alienate the correlation between the brand and consumers, particularly in agricultural product merchandising, Ataman *et al.* reveals product, distribution, and advertising enhance brand performance, while discounts do little in the way of brand building, that brings unreliable feelings from consumers to products likely expired products ^[11]. In the short run, discounting plays a tactical role by generating strong market sensation, but it has adverse effects on brand building compared with competitors in the long term.

Secondly, agri-products which easily to distribute match internet branding, distribution, and product decisions play a major role in the (short- plus long-term) performance of brands ^[11]. Distribution acts as an indispensable part of e-commerce; likewise, sorts of ponderous agri-products, not only is it difficult to reposition, but also hard to transport, for instance, cotton, wheat as well as rice. In case of it unable to ship to consumers timely, that incredibly disadvantageous effect in internet branding, Ataman *et al.* also believed that broader distribution signals manufacturer commitment to the brand and, potentially, its success in the marketplace as well as may increase the chance of within brand price comparison across stores ^[11]. So that constructing favorable image of internet brand, dexterous and convenient agri-products such as special local wine, special local snacks (e.g. melon seeds), or special native fruits (e.g. navel orange) much better properly for internet branding, meanwhile, these types of agri-products brands could be well differentiated, even maintain higher regular prices and profits than otherwise competitive agricultural merchandise.

The third effect element related to agri-products internet branding might be ecology, health. At present, organic food is increasingly getting more and more attention from the public in China. Wang and Jiang has reported in 2019 ^[12], at the 17th China International Agricultural Products Fair, the "Catalogue of Chinese Agricultural Brands" was officially released, the number of brands reached 300, 99% of the 300 brands are public brands at the county and city level, implies current Chinese residents accelerating to focus on organic and healthy food, which was significantly crucial connect with agri-products, particularly in food industry. Jie *et al.* also convinced consumers in China are becoming more health-conscious and conscientious about their eating habits ^[5], such as including more whole grains and vegetables in their diets. Given that increasing numbers of food safety incidents occur frequently nowadays, Chinese consumers are more likely to choose high-quality, branded, ecological agricultural products. However, a large number of Chinese citizens barely acknowledge purely organic healthy agricultural food, even though the characteristics of their production methods are that they do less damage to the environment and are beneficial to health. Jie *et al.* demonstrated that although China has the

fastest expanding organic sector ^[5], customer views about organic food items via social commerce are less well understood, resulting in agricultural producers being unable to leverage online platforms properly to comprehend the aspects that impact customers' desire to acquire agricultural goods. From this point of view. In virtue of network expansion, agricultural food brands could extend the source of information to gain food protection knowledge, correspondingly, encouraging agricultural consumers to join social media forums to meet their unique requirements, which was established by agricultural brand merchants. The network marketing market of agricultural products continues to expand, and the individual demand for green, safe, characteristic brand products continues to increase ^[13]. Jie *et al.* illustrated that through these personal networks ^[5], which belong to consumers or branders, the benefits of organic food may be shown increasingly, and the consumption of organic food can be increased, as well as consumer loyalty increased. Liang complements state the opportunity for marketing agricultural products was benefited by the emergence of the model of "Internet + agriculture" ^[13]. In summary, there is an apparent tendency of internet branding for ecological and healthy agricultural food.

Last but not least agri-product that could adapt to internet branding is the one with cultural connotations. A certain agri-products owns self-culture probably can be expanded easily, an agricultural brand with its own unique history story, or its cultural background, which is quite different from other competitors. Wang and Jiang hold the view that the growth environment ^[12], cultural background and packaging of agricultural products themselves also have different degrees of influence, agricultural producers need to constantly excavate own product cultural element, tell the emerging history of the brand or unforgotten story to consumers, make the image of own brand kept in customers' mind, except that, culture source can format the value of brand, that will helpful to promote market value of agricultural products, Liang maintained the use of the cultural value of the brand ^[13], such as food customs, taste of agricultural products, customs, human history resources, can enrich the marketing content of agricultural products brand. Brand communities based on social networks might be a style of internet branding that enables promoting the agri-product brand to spread, Sihvonen noted brand communities are important as social networks that reflect how brands are embedded in the day-to-day lives of consumers and how brands connect the consumer to brands ^[14], and consumer to consumer. Through daily communication with consumers online, a related brand can be connected with consumers closely, which reinforces internet branding. Another format to foster brand culture is gamification-based online engagement, Jie *et al.* pointed that the helpful tactics for merchants to increase consumer engagement and participation is gamification-based online engagement ^[5], which can help improve online education, online brand engagement, and information system engagement, gaming interaction refers as a interesting, relaxing and cheerful involvement probably coherent agri-products brand with correspondent consumers, at the atmosphere of online interacting game, it is unconsciously make the consumers recognized and adopted the culture of the related agri-product brand, naturally, they would accept concerted agri-product brand gradually.

3. Choose BP traits for internet branding of agri-products

Brand personality (BP) is defined as the set of human characteristics related to a brand, based on an approach that results from the anthropomorphizing of the brand ^[12]. Stimulating individual characteristics to mold a commodity's marketing traits, therefore, emerge unique brand image emerges, which sticks with the consumer's loyalty, and the construction of an emotional relationship between brand and consumers is conducive to extending the popularity of the brand. Typically, agri-products brands are usually associated with some well-known region's speciality with

high quality or unique flavor (e.g. food or snacks) by some certain groups of agricultural consumers, that mostly be presented as brand attachment like emotion of homeland, which spread the region agri-products cover the country by fellow-villagers (Lao Xiang). With the rapid internet economy, BP traits analysis plays a crucial role in internet branding of agri-products. Xu *et al.* expounded that brand personality scales are made up of 42 traits ^[15], and they can be grouped into five dimensions: Sincerity, Excitement, Competence, Sophistication, and Ruggedness. Appropriate BP traits need to be identified for internet branding of agri-products.

According to Bairrada *et al.* stated, sincerity acts as the score higher dimension as well as is closest to human traits in our relationships with others ^[6], which play an important role in brand marketing, agri-products are correlated to consumer's daily life closely, the high quality ecological, and environment agri-products was much emphasized by agricultural consumers. Regards to internet branding, what kind of BP traits in this dimension truly react? From the points of ^[15], three types of BP traits embraced family-oriented, wholesome, original which might be clarified for Chinese agri-products, for instance, family-oriented trait is demonstrated as some rural native rice wine or unique fruit juice, which are simply aroused memory of family reunion at some certain moment like conventional festivals, this kind of agri-products are effectively well-known by online consumers; wholesome trait obviously related to healthy and safety daily food such as organic vegetables, or daily snacks (e.g. melon seeds, peanuts), or even dessert (e.g. rice cake, candy), it exists a large amount of demands in online markets, due to the vast frontier of China, the residents of differential areas are really attracted by other's snacks; sort of handcraft products what originated from minority sections contains local particular national culture or custom probably be connected to original trait, it's more likely to promote these exquisite works via networks, those exquisite handcrafts what are made up with original materials inherit long and traditional nation's customs, origin emotions also are contained in those artworks like extraordinary ceramics as well. It is extremely convenient to make the citizens of various areas recognized via internet branding.

Bairrada *et al.* added that passion and excitement are also perceived as a dimension of BP ^[6]. We identified a unique trait that not only can make a certain brand distinguished from others via the internet, obviously, but also contributes to enhancing the consumer's loyalty. Liang claimed as well ^[13], to avoid competition and maintain consumers' loyalty to the brand, the "uniqueness" of agricultural products applied in the differentiation marketing strategy can narrow the selection range of consumers and reduce their price sensitivity.

Competence as another dimension was described by Bairrada *et al.* ^[6], concerning this dimension, reliable trait as guarantee of high quality agri-products, it is significant to enhancement of customer loyalty, no matter group of food products what daily suppliers, typically on the e-commerce platform, consumers fairly catering the whole and transparency agricultural production or manufacturing, what if take into consideration of the process of agricultural production combine with internet marketing, agricultural brands could be acknowledged across the internet.

Sustainability and environmental protection have been the mainstream topics when consumers choose their favored commodities, except for high-quality and original material merchandise; the goods, whether they possess sustainability or the function of environmental protection, are increasingly concentrated by the public. As Sander *et al.* mentioned ^[16], based on environment protection being a core dimension of sustainability and environmental sustainability advertising, it seems only logical that this dimension of brand personality should be impacted most, Sander *et al.* also believed ^[16], it probably proper to reflect increased relevance to consumers when it comes to add element of sustainability to brand personality. To shape the consumer's perception of a brand personality, online sustainability advertising generates trait inferences; it has a positive effect in the context of 'green propaganda', due to the large number of 'green' advertising messages, consumers are quite skeptical about their credibility.

Innovativeness in the field of agriculture is regarded as the last trait associated with internet branding. New agri-products are expected to activate brand switching, accelerate to shift of consumer demands, typically influenced by the internet. Wang *et al.* hold the view that brand innovativeness can influence consumer loyalty and switching behavior^[17]. Consumers who tend to innovative brands are used to regularly trying new offerings and are more likely to be faithful to them, furthermore, they are frequently exposed to new products. These brands also appeal especially to consumers who appreciate to surf on the internet, which can enrich their choices. The majority of brand innovativeness supporters undoubtedly as younger consumers, not only are they formed up domination percentage of online shopping, but also they fond of spreading their opinions on product evaluation though the communities what they approve, based on the view of Jie *et al.*^[5], when evaluating a product, a kind of social engagement created by younger consumers, they interact with others as members of a social group and solicit their opinions, which stimulated user interactions and user-generated information in several ways, such as product suggestions, customer reviews, and discussion forums. These actions enable online shoppers to make more accurate and precise agri-product brand choices, influencing their behavior toward a particular agri-product brand.

According to the results of the questionnaire survey, in the survey on the accuracy of distinguishing the different BP traits, it demonstrated that: 46.2% of consumers express general trust, 39.6% express trust, and 7.83% express complete trust, close to half of consumers trust the family-oriented trait benefit to internet branding of agri-products; similarity, 44.1% of consumers general trust wholesome trait indeed can improve customer's loyalty via internet branding, 33.1% express trust, and 5.56% express completely trust; based on **Table 1**, the rest of traits includes original, unique, reliable, sustainability and innovativeness are all revealed that the absolute strength on the proportion of consumer general trust, consumer trust and consumer completely trust respectively. Compared with the traits of family-oriented, wholesome, original, and sustainability associated with customers' loyalty improvement of online promotion about agri-products, the traits of reliability and innovativeness represent a higher occupation of consumers' trust in internet advertising on agri-products.

Table 1. Agri-product consumers' trust in BP traits towards internet branding

		Very distrustful	Distrust	General trust	Trust	Complete trust
Family-oriented	Number of people	7	10	124	106	21
	Proportion	2.61%	3.73%	46.2%	39.6%	7.83%
Wholesome	Number of people	3	8	98	97	16
	Proportion	1.35%	3.60%	44.1%	43.7%	7.21%
Original	Number of people	2	9	67	45	13
	Proportion	1.47%	6.62%	49.3%	33.1%	9.56%
Unique	Number of people	5	13	145	119	14
	Proportion	1.69%	4.39%	48.99%	40.20%	4.73%
Reliable	Number of people	4	12	167	129	13
	Proportion	1.23%	3.69%	51.38%	39.69%	4.00%
Sustainability	Number of people	2	8	129	98	25
	Proportion	0.76%	3.05%	49.24%	37.40%	9.54%
Innovativeness	Number of people	1	7	178	143	18
	Proportion	0.29%	2.02%	51.30%	41.21%	5.19%

4. A model for improving internet branding of agri-products

Based on the agricultural producers' inputs, the possible model (Figure 1) shows the above-described four agri-products that suit for internet marketing needs, matching the related BP traits respectively. Associated seven BP traits that are detect by us perhaps contribute to enhancing agricultural consumers' loyalty to certain brands, linking online shopping. Synthetically combine these two aspects, whereas achieving the final purpose, which could promote the process of internet branding of agri-products, ultimately, it attempts to make native agri-products famous across the whole nation.

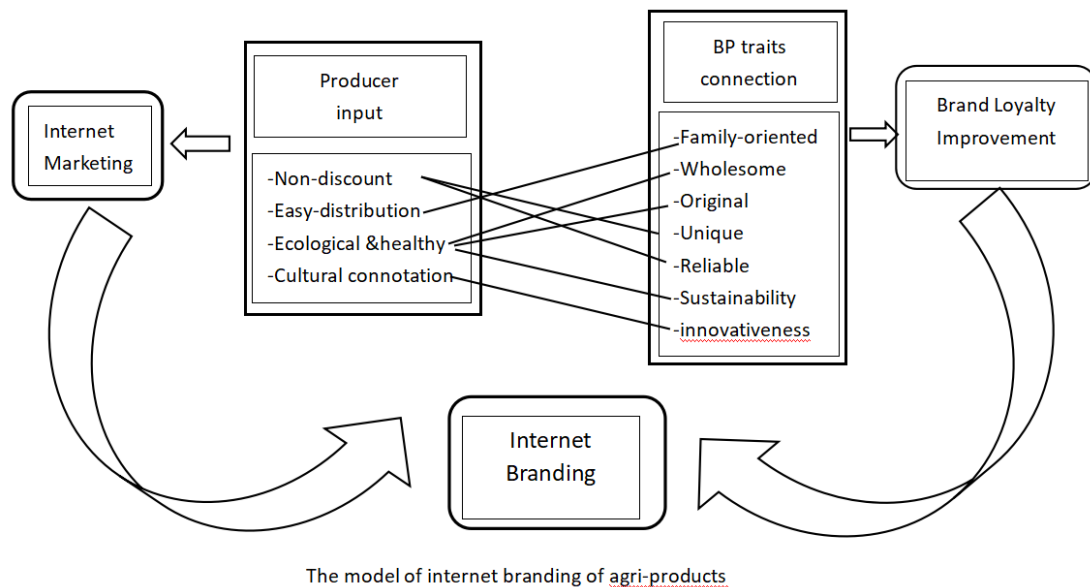


Figure 1. The model of internet branding of agri-products

Specifically, the products of Non-discounting might associated with the BP traits of uniqueness as well as reliable, non-discounting agri-products with specials of high quality or high standard, it is difficult to replace when it comes to other brands, reliability trait implies the high quality which trust by consumers, uniqueness symbolize commodities' special functions or connotation attach to consumers' trusts; Expect that, the agri-products that convenient to distribute much possible respect to the BP trait of family-oriented, at the important moment of family festivals, it is quite vital to goods shipping timely, providing celebrated goods; furthermore, well-known and general concerned agri-products by consumers of ecological and healthy merchandises, they are typically coherent with BP traits of wholesome, origin and sustainability as well, these typical BP traits demonstrate the symbolizes of healthy emphasizing, the guarantee of raw materials as well as environmental production respectively, which much simply can promote associated brand spreading; the last but not least, the BP trait innovativeness appropriate to enrich cultural connotation of agri-products, culture creativity involved in agri-products, more likely attracted young consumers' focus, additionally, the cultural connotation filled with innovativeness probably makes consumers convinced the related brand owned typical traditional history that can broader brand's effectiveness via internet.

5. Conclusion

The Chinese rural market has shown accelerated development in recent years, thanks to the general accessibility of

internet marketing, increasing numbers of agri-producers in rural areas have accepted the consciousness of internet promotion, as well as adopted various online tools. It has an extremely advantageous feature of building brand access to the internet. It is clear not that every brand of agri-products to promote via online properly, rely on our study, four kind of agricultural products have been found which suit for internet branding; in the meantime, sort of BP traits are available to enhance agricultural consumers' brand loyalty, from the two perspectives of internet marketing and consumers' brand loyalty improvement, nevertheless, It has been shown that, some concrete BP traits has close relationship to corresponding agri-products, therefore, we construct a model that congruent related agri-products with corresponding BP traits, it probably can reach the goal of internet promotion of brand for agri-products in China. However, some limitations indeed exist in our recent study, for instance, what's the degree of association between one BP trait and the corresponding agri-product? Can it achieve the expected outcome of internet branding? Whether it can show the predicted effects of the market or not, apart from that, whether this kind of model is appropriate all around the country, or merely limited to specific geographic areas. It needs further research to prove this kind of model, as well as adopting more reliable data to support further evidence.

Disclosure statement

The authors declare no conflict of interest.

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A Comparative Analysis of Green Finance Initiatives and Their Impact on Banking Performance: A Study of RHB Bank, ICBC, and Deutsche Bank

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Abstract: The banking industry is placing increasing emphasis on green finance to address climate change, support sustainable development, and align with environmental, social, and governance (ESG) goals, as well as sustainable investments to fund environmentally friendly projects. In an era of growing regulatory pressure and rising demand for sustainability from investors and stakeholders, green finance has become a vital tool for banks to enhance operational efficiency. It can reduce operational costs by financing energy-saving projects, improve asset quality by funding low-risk sustainable projects, and even attract capital from environmentally responsible capital markets. Additionally, green finance helps improve risk management frameworks by financing projects that align with long-term sustainable development objectives. This paper explores the relationship between green finance and the operational efficiency of three major banks—RHB Bank, Industrial and Commercial Bank of China (ICBC), and Deutsche Bank. The article focuses on analyzing how these banks integrate green finance into their strategies and the overall impact of these initiatives on operational performance, primarily cost reduction.

Keywords: Green finance; Operational efficiency; Risk management framework; Operational performance

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1. Introduction

The banking sector is increasingly focusing on green finance to fight climate change, support sustainable development, and align its Environmental, Social, and Governance (ESG) objectives ^[1]. Green finance includes products of green loans and bonds, as well as sustainable investments that finance environmentally beneficial projects ^[2]. It has become a vital tool for banks to improve their operational efficiencies in the era of heightened regulatory pressure and increased demand from investors and stakeholders around sustainability.

Although it is difficult to calculate the direct financial impact of green finance on operational efficiency by reasons of a lack of data, its benefits are widely acknowledged. They can help cut operational costs on energy-

efficient projects, improve asset quality through the financing of low-risk, sustainable projects, and even attract capital from environmentally responsible capital markets. Also, by financing projects compatible with long-term sustainability goals, green finance can improve risk management frameworks.

The essay explores the relationship between green finance and operational efficiency at three central banks: RHB Bank, ICBC, and Deutsche Bank. The essay focuses on qualitative insights into how these institutions embed green finance in their strategy and what the overall impacts are on operational performance, mainly cost reduction.

2. Methodology

The study analyses the effect of green finance initiatives on the operational efficiency of three major banks, RHB Bank (Malaysia), ICBC (China), and Deutsche Bank (Germany), from 2019 to 2023 ^[3-5]. Notably, the relationship between green finance activities, for example, green loans, green bonds, and green investments, and key financial performance indicators is analyzed, including total revenue, operational expenses, and operating profit.

2.1. Data sources

For the study, the data is taken from the annual and green finance-related reports from the official websites of the three banks, as they offer thorough and publicly accessible financial performance and green finance initiatives reports. These official documents are treated as reliable, and they present the bank's activity on financial management and sustainability.

The data used in the study runs from 2019 through 2023 to give a view of both the financial performance of the banks and their green finance performance for a five-year horizon. The purpose of the dataset is to understand how green finance initiatives are embedded within the operational models of the banks and to assess what impact they have on financial outcomes.

2.2. Analysis methods

The study employed a primarily descriptive and trend-based analysis method. First, key financial indicators such as total revenue, operating expenses, operating profit, and profit-to-income ratio are summarized for each bank, as well as their green finance activities, including green loans, green bonds, and investments. This gives an overview of the banks' green finance involvement and financial performance over the five years.

Green finance activities and the corresponding financial indicators are then analyzed with trend extrapolation. For the purpose, Excel and Python software are used in the calculation, analysis, and results visualization. The study identifies year-on-year changes in green finance investments and the corresponding variations in financial performance. It demonstrates whether improved operational efficiency correlates with increased green finance investments. The trend analysis also enables readers to understand if green finance initiatives are accompanied by higher revenue, operating profit, and net profit over time.

3. Analysis of green finance's impact on operational efficiency

3.1. Bank RHB (Malaysia)

3.1.1. Green finance initiatives at RHB Bank

As the green finance leader in Malaysia, RHB Bank has supported environmentally sustainable projects through different green financing products ^[3]. They comprise green loans and bonds to fund renewable energies, energy

efficiency, sustainable infrastructures, and climate resilience projects. RHB's green finance initiatives align with Malaysian national sustainability objectives and leverage government policy, including the Green Technology Financing Scheme (GTFS) and Sustainable Banking Guidelines.

RHB Bank was one of the first Malaysian banks to issue green bonds under the Climate Bond Initiative framework in 2017. The green bond issuance represents part of the bank's attempt to raise capital for projects helping to reduce carbon and improve energy efficiency. RHB's green finance portfolio covers renewable energy, sustainable agriculture, waste management, energy-efficiently buildings, etc. The bank also offers green loans to businesses and individuals, with terms targeted towards financing environmentally friendly projects that meet established sustainability criteria.

Sustainability principles are integrated into RHB Bank's corporate governance and risk management frameworks. By national and international green finance standards, including the Green Bond Principles and the UN Principles for Responsible Banking, the bank works closely with clients to check that the projects they finance are green. RHB's approach is a commitment to incorporate ESG factors into its operations.

3.1.2. Operational efficiency and green finance

Since RHB Bank's green finance initiatives have an indirect financial impact on its operations as they contribute to cost management, risk reduction, and market positioning, direct quantification of the financial impact they generate on operational efficiency is impossible.

One of the most obvious benefits of green finance is that it helps reduce costs. RHB Bank finances its customers' energy-efficient and renewable energy projects, which allows its customers to reduce their operational costs, consisting of energy use and environmental liabilities. Lower default rates on these projects stem from the positive regulatory incentives and government support, which make RHB's green loan portfolio more stable and less prone to default. Such stability lowers credit risk and may improve the bank's Non-Performing Loan (NPL) ratio, but direct correlations are difficult to identify. Green finance also means that RHB Bank can reach the growing market of ESG-minded investors. The surge in demand for green bonds on a global scale has seen RHB positioning itself as a sustainable leader. This improves the bank's capital market presence, liquidity, and access to the markets.

In addition, RHB Bank's green finance helps control climate risks. The bank's financing of renewable energy and energy-efficient infrastructure projects places it in sectors less susceptible to changes in regulations around carbon emissions. In addition to these areas, fewer risks associated with stranded assets, such as those connected to fossil fuels are present. By focusing on these low-carbon sectors, RHB lowers its exposure to the higher-risk industries and strengthens operational stability.

Besides, RHB's green finance focus also helps set it apart from other market participants. RHB's reputation as a green finance leader not only improves customer loyalty and brand value but also becomes increasingly important as sustainability becomes a key factor for consumers and investors. This can, over time, lead to more revenue and profitability. The following figure depicts the relevant trend for the bank:

As shown in the figure, RHB Bank's green finance, along with its revenue and operating profits, showed a similar uptrend from 2019 to 2023 (**Figure 1**). While the bank strongly supported sustainable finance by investing in green projects, revenue grew steadily, proving the positive influence of such green activity on the bank's business performance. At the same time, the bank sees green finance investment rebounding in line with the upturn in operating profit, indicating that these sustainable investments are helping it meet its green objectives and have a positive financial impact. This shows that the bank's economic growth strongly correlates with its green finance initiatives.

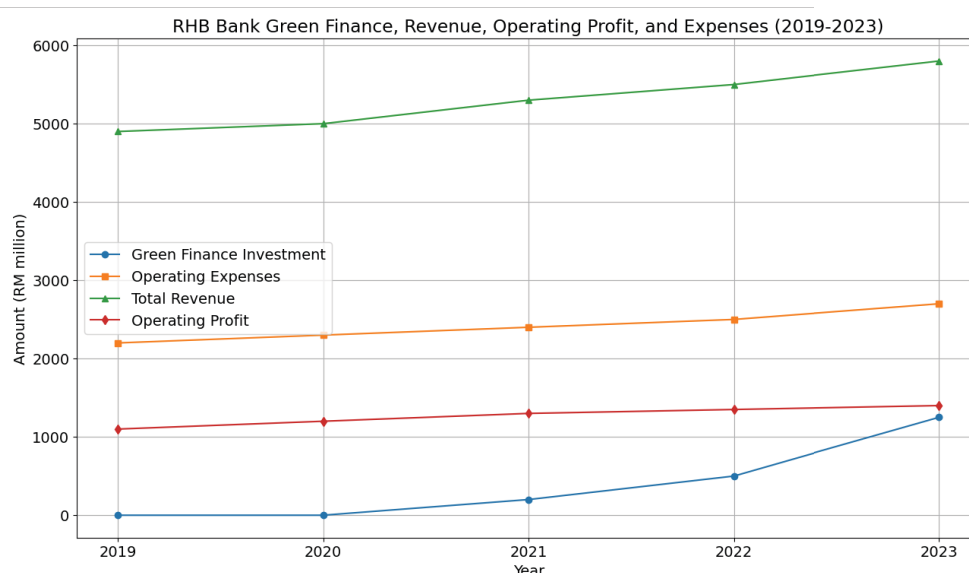


Figure 1. RHB Bank green finance, revenue, operating profit, and expenses (2019–2023)

3.2. ICBC (China)

3.2.1. Green finance initiatives at ICBC

ICBC, one of the largest commercial banks in China, has been a protagonist in developing China’s green finance sector ^[4]. The bank has invested heavily in green projects, including renewable energy, energy efficiency, and environmentally responsible infrastructure. Aligned with China’s ambitious environmental goals, to reduce carbon emissions and propel its sustainable development, ICBC’s green finance activities aim to comprehensively respond to the green initiatives.

Recently, ICBC has been actively developing its green finance portfolio. From issuing green bonds to funding large-scale projects in renewable energy, electric vehicles, and sustainable agriculture, the bank has initiated the green process. Project outcomes from these green bonds are certified to international standards, such as the Green Bond Principles, which means they are assessed with the most stringent environmental criteria. In addition, ICBC has offered green loans to both domestic and foreign customers, which support activities related to energy saving and lowering carbon emissions. ICBC incentivizes the move to more sustainable business methods and broader environmental and social responsibility goals by offering favorable financing terms for these projects.

3.2.2. Operational efficiency and green finance

Measuring the direct financial impact of ICBC’s green finance initiatives on operational efficiency is difficult, given that adequate data does not exist. Still, by qualitative analysis, we can uncover how such initiatives play a role in cost management.

Cost reduction is one of the main approaches that green finance helps to increase ICBC’s operational efficiency. ICBC finances green projects, including renewable energy installations and energy-efficient technologies, that help its clients save costs over the long term. The savings are usually realized through lower running costs, energy consumption, and carbon tax costs, as well as government incentives for environmental practices. Although the savings are not always revealed in ICBC’s financial statements, it can tighten loan performance and possibly lessen the default rate on green loans. Any project that can lead to cost savings is less likely to default and will help ICBC’s bottom line. The following table shows the operational performance of the bank:

Green finance also provides substantial risk mitigation advantages. Green projects are viewed as being relatively low risk, particularly in today's world, where the focus is increasingly on lowering carbon emissions and the transition to more sustainable energy sources. This allows ICBC to improve the credit risk of its portfolio of green finance compared to traditional loans. The more predictable cash flow of green projects (especially those supported by government incentives or focusing on energy-efficient infrastructure) will be less prone to default. This means the non performing loan (NPL) ratio in ICBC's green finance portfolio could be lower than traditional loans.

In addition, the rapid growth in green finance also assists ICBC in enhancing its market positioning. ICBC's growing strength in green finance underscores its leadership in sustainable finance as China seeks to make green finance a crucial means for meeting its climate goals. The strategic positioning also allows the bank to tap a new pool of investors interested in considering environmental, social, and governance (ESG) criteria. With the growing popularity of sustainable investments, ICBC's green finance activities place it at a competitive advantage in domestic and international capital markets. To differentiate from other banks in the market, ICBC has boosted its reputation and its long-term standing of operational stability.

Furthermore, green finance helps ICBC control long-term environmental risks. The bank mitigates its exposure to sectors suffering from regulatory control, i.e., fossil fuel industries, by financing projects in tune with global sustainability goals. In addition, the transition to low-carbon energy sources and sustainable infrastructure also enables ICBC to avoid investing in stranded assets that will become less valuable or even worthless in a future low-carbon economy. Through its green finance portfolio, ICBC manages potential risks that a project or investment could pose to the environment, consequently ensuring the sustainability of its operations in the long term. The following figure depicts the relevant trend of the bank:

As can be seen from the diagram, the bank's revenue and operating profit have a clear upward trend from 2019 to 2023 (**Figure 2**), and so does green finance investment. The diagram shows that green finance initiatives have a positive effect on the bank's financial performance, where the bank's investment in green finance initiatives results in high revenue and better profit. When the bank enlarges its green finance portfolio, it probably benefits from regulatory incentives and cost savings from energy-efficient projects, all of which serve long-term profitability. Lastly, the trend also reveals that the role of green finance is to aid sustainable growth and ensure the bank's financial success.

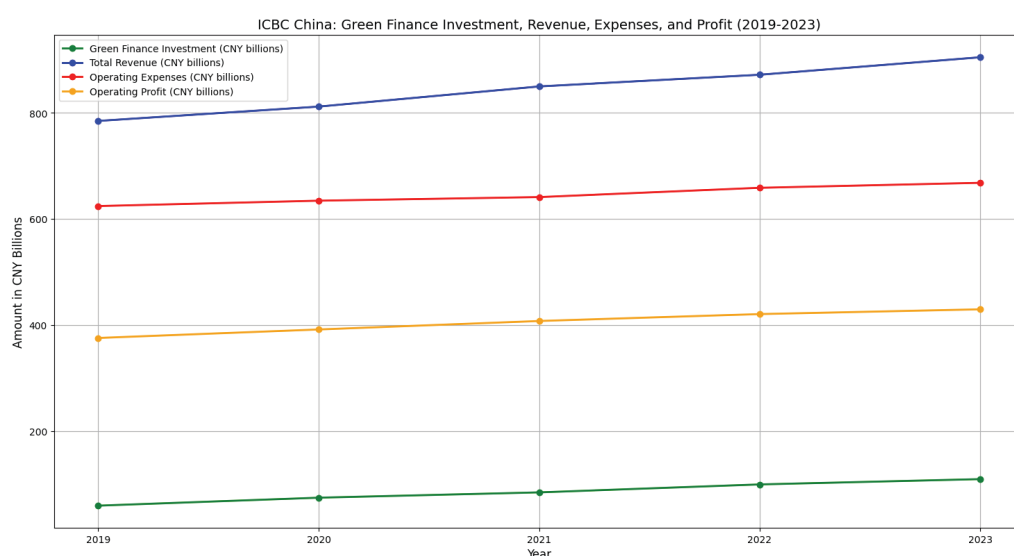


Figure 2. Trend of green finance investment, revenue, operating expenses, and operating profit of ICBC China (2019–2023)

3.3. Deutsche Bank (Germany)

3.3.1. Green finance initiatives at Deutsche Bank

As a leading provider of green finance and an active participant in sustainable development and the shift to a low-carbon economy, the German financial institution Deutsche Bank has significantly impacted Europe. The bank offers several green finance products, such as green bonds, sustainable investment funds, and green loans, to finance projects that promote environmental sustainability. The bank's objective is to contribute to global climate goals by reducing carbon emissions and boosting green technologies ^[5].

Green bonds are issued by Deutsche Bank for projects in renewable energy, energy efficiency, and sustainable infrastructure. These bonds are structured to international standards, such as the Green Bond Principles, which guarantee the funds go to projects with measurable environmental benefits. The bank has also created sustainable investment funds aimed at companies and projects that keep a close eye on environmental, social, and governance (ESG) benchmarks, attracting an increasing number of investors. Many investors consider ESG criteria the top investment priority to create a long-term sustainable impact.

Besides green bonds, Deutsche Bank provides green loans to companies and governments to implement energy efficiency, reduce emissions, and adopt renewable energy. The close client relationship enables financed projects to meet strict environmental standards. It helps the bank pursue its sustainability objectives and, thus, a sustainable economy.

3.3.2. Operational efficiency and green finance

The direct, quantifiable impact of Deutsche Bank's green finance initiatives on operational efficiency is hard to define. Still, their qualitative impact on long-term financial stability, cost management, and risk reduction is clear.

The key benefit of green finance is cost reduction. Deutsche Bank supports its clients in benefiting from reduced long-term operational costs relating to energy consumption, emissions, and access to government incentives. These savings reinforce positive loan performance, especially when projects beneficial to the environment have lower operating costs and are, therefore, less likely to default on loans. This, in turn, reduces credit risk and, thus, may lead to an improved bank's nonperforming loan (NPL) ratio.

Risk management also comes under the ambit of clean finance. Green finance funds are less vulnerable to regulatory changes on carbon emissions and another environmental standards. Deutsche Bank reduces its exposure to high-risk sectors, such as fossil fuels, which are facing increasing regulatory scrutiny that requires financing renewable energy and energy-efficient projects. Low risks are associated with green projects, especially in renewable energy, thereby significantly reducing the bank's overall risk exposure.

Moreover, Deutsche Bank improves its financial market's reputation through its green finance initiatives. The increased demand for sustainable investment products enables the bank to win a new segment of ESG-inclined investors. More generally, this enhances the bank's capital-raising powers, expands the investor base, and provides more liquidity. As an industry pioneer, Deutsche Bank has seen growing investor interest. It enhances its role as a sustainable bank, which fosters long-term business growth.

Deutsche Bank has a competitive edge thanks to its green finance offerings. The differentiation also helps attain customer loyalty and the momentum to increase revenue. It becomes operationally efficient to sustain the bank's long-term success in the market. The following figure depicts the relevant trend of the bank:

The diagram below illustrates the trend of green finance, revenue, expenses, and profit for Deutsche Bank, which is on a steady upward trajectory between 2019 and 2023 (**Figure 3**). The growth patterns of green finance

investments, revenues, and operating profit are similar, so there is a strong correlation between the bank's higher green finance activities and its improved operational performance. When Deutsche Bank's green finance portfolio expanded, the revenue and profit increased accordingly. This demonstrates how these environmentally friendly investments are positively affecting revenue and profit. By aligning green finance with environmental goals and the bank's business growth, we can see that green finance not only serves as a support to the bank's environmental goals but also becomes an engine for driving the bank's business development and further enhances the bank's competitive position in the market. A similar upward trend shows that green finance is strategically crucial for financial stability and market performance.

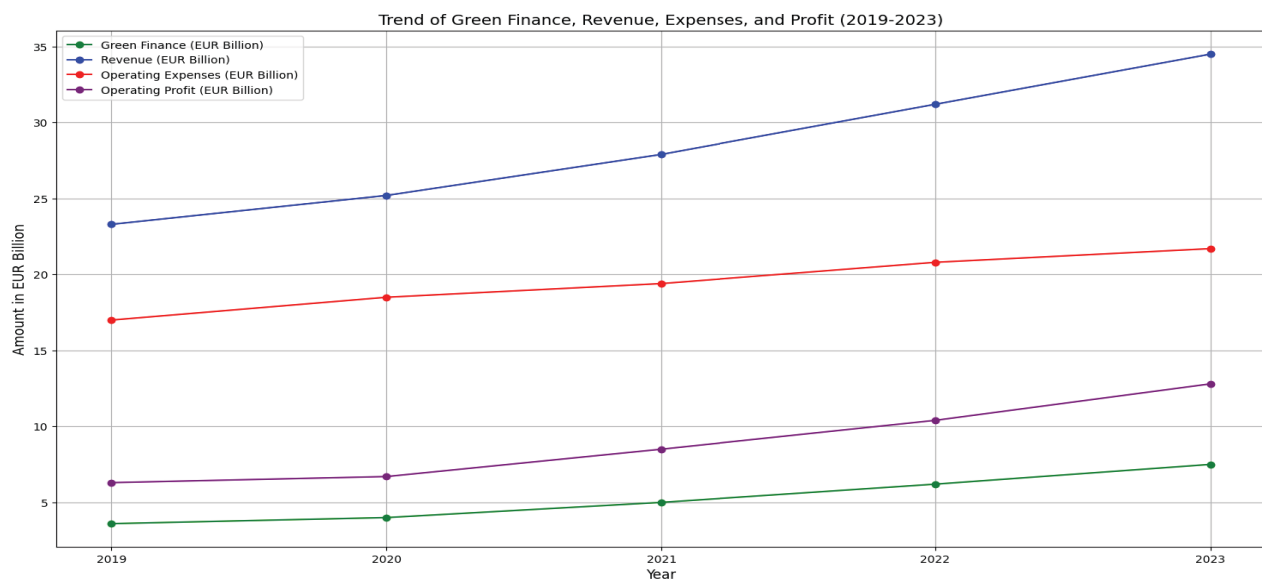


Figure 3. Trend of green finance, revenue, expenses, and profit for DB (2019–2023)

4. Policy recommendations

4.1. Policy recommendations for China

China's carbon-neutral objective by 2060 is consistent with ICBC's leadership in green finance ^[6]. However, green finance requires more definite and transparent regulations, especially in green loan definitions and bond issuance. However, promoting the process will require us to strengthen the Green Credit Guidelines and the Green Bond Endorsement Catalogue to ensure that the money is going to green projects. What's more, there is no ready access to green finance for most small and medium-sized enterprises in China, despite the critical role they will play in China's green transition. In such circumstances, policymakers may wish to adopt targeted incentives like tax breaks or risk-sharing mechanisms to encourage SME financing by banks for green projects (immaculate energy and green technology). Lastly, China can incentivize banks to realize their green finance targets with preferential risk weights on green loans, accelerating the transition to a green economy.

4.2. Policy recommendations for Malaysia

Although RHB Bank has been one of the biggest banks in the green finance sector in Malaysia, the green market as a whole is still underdeveloped ^[7]. Stronger infrastructure and regulation that is clearer regulations are required

to stimulate green finance. Certification schemes for green bonds could be introduced in Malaysia to provide market transparency and increase investment. And the country also needs to back green innovations, for example, by supporting cleantech startups with government incentives. In this way, the country can lower investor risks and boost private sector participation. Apart from that, Malaysia should use incentives like tax breaks or subsidies for renewable energy and energy-efficient projects to lower the risk taken by green investments. This will increase the attractiveness and contribute to sustainable economic development.

4.3. Policy recommendations for Germany

The successful implementation of sustainable finance at Deutsche Bank shows that policies favoring such finance help. Standards and mandatory reporting are needed to improve transparency and investor confidence and help Germany fully utilize the green bond market. More financing is needed for smaller-scale projects and projects led by SMEs. To make sure Germany's green economy is inclusive, there should be the introduction of low-cost financing to accommodate these ventures. In addition, Germany must concentrate on financing projects that support job creation and sustainable activities in a just transition. Last but not least, integrating environmental, social, and governance (ESG) criteria in all financial sectors will allow the whole financial industry in the country to become aligned with the EU's ambitions regarding climate neutrality by 2050 ^[8].

4.4. Comparisons of three countries

The performance of the above three typical commercial banks in green finance is presumed to represent the overall situation of the corresponding countries. In the consideration, the author provides a table to show the policy recommendations for the three countries as follows. The following table summarizes relevant policy recommendations for the three countries (**Table 1**).

Table 1. Policy recommendations for advancing green finance

Policy area	China	Malaysia	Germany
Green finance regulations	Clarify green loan definitions and bond issuance. Strengthen Green Credit Guidelines and Green Bond Endorsement Catalogue.	Establish green bond certification schemes to increase market transparency and attract investment.	Standardize green bond definitions and reporting requirements to boost transparency and investor confidence.
Support for SMEs	Provide targeted incentives (e.g., tax breaks or risk-sharing mechanisms) for banks to finance green projects for SMEs, especially in clean energy and green tech.	Support green innovation through government-backed incentives for clean tech startups.	Provide low-cost financing or incentives for smaller-scale green projects, particularly those led by SMEs.
Incentives for green finance	Offer preferential risk weights for green loans to encourage banks to exceed green finance targets.	Offer incentives like tax breaks or subsidies for renewable energy and energy-efficient projects.	Focus on financing projects that promote job creation in sustainable sectors to ensure a just transition.
Sustainability integration			Integrate environmental, social, and governance (ESG) criteria across all financial sectors.
Economic growth and transition	Support the transition to a green economy, aligning with China's carbon neutrality goal.	Encourage private sector participation and foster sustainable economic growth through green investment.	Align with EU goals for climate neutrality by 2050, promoting an inclusive green economy.

5. Conclusion

The essay presents a comparative study to assess the impact of green finance on the operational efficiency of ICBC (China), RHB Bank (Malaysia), and Deutsche Bank (Germany) (**Table 1**). The results show that green finance increases operational efficiency through the reduction of costs, risk management, and enhanced market positioning, enabling banks to support sustainability and gain a competitive edge.

Disclosure statement

The author declares no conflict of interest.

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Research on the Impact of Scenario-based Design of New Tea-drinking Spaces on Brand Value

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Abstract: In recent years, the new-style tea-drinking market has expanded rapidly. With the upgrading of consumer demands and the younger generation becoming the primary consumer group, the space experience centered around the “third space” has become a crucial strategy for brands to differentiate themselves. This research focuses on the impact mechanism of spatial scenario design on the brand value of tea-drinking brands, aiming to explore the internal relationships among the key elements of spatial design, brand perception, consumers’ emotional connection, and consumption willingness, providing theoretical support and practical references for scenario-based design in the industry. Through a combination of literature research and case-analysis methods, this study systematically reviews relevant domestic and international research on scenario-based design and brand value over the past five years. It selects representative brands as cases, deeply analyzes their spatial design strategies, user feedback, and market performance, and summarizes both successful experiences and existing problems. Scenario-based design is an important means to enhance the brand value of tea-drinking brands, but it needs to follow the four-in-one design principle of “brand consistency, functional diversity, experience coherence, and cost controllability.” In the future, brands should focus on the in-depth exploration and innovative expression of cultural elements, strengthen the multi-functional attributes of spaces, and achieve seamless integration of online and offline scenarios through digital means. In addition, it is recommended to adopt modular design to reduce scenario-updating costs and increase the return on investment. This research provides a theoretical basis and practical path for the optimization of the spatial design of tea-drinking brands, and has important reference value for promoting the high-quality development of the industry.

Keywords: New-style tea-drinking; Scenario-based design; Brand value; Third space; Cultural symbols

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1. Research background and significance

1.1. The competition dilemma in the new tea-drinking industry

In recent years, the new-style tea-drinking market has witnessed explosive growth and has gradually become

the core growth engine in the consumer field. Data from the China Chain Store & Franchise Association shows that the industry scale has exceeded 200 billion yuan, with an annual compound growth rate of around 18%^[1]. However, behind the apparent prosperity, there are hidden concerns. Leading brands such as HEYTEA and NAIXUE's TEA, although having an advantage in market share, have fallen into an "innovation bottleneck." The phenomenon of similar product formulas and marketing methods are becoming more and more common. It is worth noting that the Generation Z group, which accounts for the majority of consumers (over 60%), has shifted from simply pursuing the taste of beverages to "spatial emotional consumption," and the traditional product-centered competition strategy is clearly lagging behind the evolution of market demands.

1.2. The theoretical breakthrough of scenario-based design

Against this background, the localization practice of the "third space" has opened up a new track for new tea-drinking brands. The experience economy theory proposed by Pine and Gilmore reveals that the essence of modern consumption has shifted from material acquisition to value experience^[2]. Schmitt's research on sensory marketing further corroborates that multi-dimensional spatial stimuli can significantly enhance brand memory points^[3]. Take HEYTEA's "Inspiration Tea" themed store as an example. Its spatial design that combines tea culture with modern aesthetics not only increased the average customer price by 20% but also triggered spontaneous dissemination on social media, verifying that scenario-based design has gone beyond the scope of physical space and become a strategic carrier for brand-culture output^[4].

1.3. The practical value dimension of the research

This research focuses on three practical values: First, to construct a quantitative model of "design elements-emotional resonance-commercial value" to provide a scientific decision-making tool for the industry^[5]. Second, in view of the resource constraints of small and medium-sized brands, to develop modular scenario solutions (such as detachable cultural walls, multi-functional furniture systems) to reduce the renovation cost of single stores. Third, to explore the implementation paths of technologies such as AR virtual tasting and digital-twin stores, and promote the construction of a closed-loop of "online traffic-offline experience-data precipitation." These explorations are not only related to the profitability of single stores but also involve the reconstruction of the brand ecosystem in the new-consumption era^[6].

2. Investigation and research

2.1. Selection of research methodology

To comprehensively reveal the impact mechanism of scenario-based design on the brand value of new tea-drinking brands, this research adopts a mixed-research method, combining qualitative research with quantitative research. This approach aims to obtain research data from multiple dimensions and levels, and enhance the reliability and depth of research conclusions through the complementarity of the two methods^[7].

2.1.1. Deconstructing design strategies through case-analysis method

The qualitative research part mainly deconstructs the scenario-based design strategies of new tea-drinking brands through the case-analysis method. The specific steps are as follows:

Select 20 typical stores of 5 leading brands (HEYTEA, NAIXUE's TEA, CHAYANYUESE, LELECHA, and MI XUE BING CHENG) as the research objects, covering high-end, mid-end, and budget-friendly brands to

ensure the diversity and representativeness of the samples.

Collect data through multiple channels such as field research, consumer interviews, and social-media comments^[8], focusing on spatial design elements, such as cultural symbols, functional zoning, and digital facilities and their impact on the consumer experience.

The advantage of qualitative research is that it can deeply explore the complexity and diversity of scenario-based design and reveal the deep-seated motivations behind consumer behavior. However, its limitation is that the sample size is small, and the universality of the conclusions may be limited.

2.1.2. Verifying hypotheses through consumer questionnaire surveys

The quantitative research part mainly verifies the hypotheses proposed in the qualitative research through consumer questionnaire surveys and quantifies the impact of scenario-based design on brand value. The specific steps are as follows:

Based on the results of qualitative research, design a questionnaire that includes scenario-design elements, such as the density of cultural symbols, the rationality of functional zoning, consumers' emotional resonance, such as NPS value, satisfaction score, and brand-value indicators, such as willingness to pay, repurchase rate^[9].

The advantage of quantitative research is that it can verify hypotheses through large-sample data and provide more universal conclusions. However, its limitation is that it is difficult to deeply reveal the complex motivations behind consumer behavior.

2.2. Data collection and processing

To ensure the scientificity and reliability of the research, this study uses a multi-source data-collection and mixed-analysis method to obtain and verify data from different dimensions, striving to comprehensively reflect the actual effects of the scenario-based design of new tea-drinking brands and its impact on brand value.

2.3. Research model construction

To systematically analyze the impact of scenario-based design on the brand value of new tea-drinking brands, this research constructs a multi-dimensional research model, clarifying independent variables, dependent variables, and control variables, and excluding the interference of other variables on brand value through scientific methods to ensure the accuracy and reliability of research conclusions^[10].

3. Data analysis

3.1. Quantitative analysis of scenario-design elements

To construct a scientific evaluation system for scenario-design elements, this research conducts quantitative analysis on cultural symbols, functional zoning, and the degree of digitalization through multi-dimensional indicators and mixed methods to ensure the objectivity and operability of the data.

3.1.1. Cultural symbol density index

Field Measurement: The research team conducted on-site inspections of 20 sample stores, measured the store area using a laser rangefinder, and counted the number of national-trend elements, such as calligraphy decorations, traditional patterns, regional-cultural symbols item by item, calculating the density value per square meter^[11]. Invite 5 brand-design experts with at least 5 years of working experience to conduct blind evaluations with a

full score of 10 on the relevance between cultural symbols and brand culture, and take the average value after excluding scores with large subjective deviations.

3.1.2. Functional diversity score

Scenario Classification: Divide the store functions into four categories: “Quick-pick-up consumption,” “social interaction,” “office and study,” and “cultural check-in,” and count the number of functional scenarios supported by each store.

Layout Rationality Assessment: Three spatial-design experts conduct 5-level evaluations (1 = chaotic, 5 = excellent) based on indicators such as the smoothness of the moving line and the clarity of area separation, and take the average value as the final score. For example, NAIXUE Dream Factory supports all four types of functions and has a layout score of 4.7; while a community store only supports quick-pick-up and social functions and has a score of 3.1. The correlation coefficient between the functional-diversity score and the repurchase rate is 0.62 ($P < 0.05$), and the correlation coefficient with the average customer price is 0.57 ($P < 0.05$).

3.2. Verification of consumer behavior data

Through the multi-source verification of consumer behavior data, reveal the actual impact of scenario-based design on user decisions.

3.2.1. Cultural relevance and NPS value

Data Comparison: The average NPS of stores with high cultural relevance (score ≥ 8) is 72, which is significantly higher than that of ordinary stores (score ≤ 5 , NPS = 40). Take the “Listening to the Wind in the Bamboo Grove” themed store of CHAYANYUESE as an example ^[12], its NPS value reaches 78, and keywords such as “strong cultural atmosphere” and “suitable for taking pictures and checking in” account for 63% in consumer comments. The study found that Generation Z consumers (aged 18–25) are more sensitive to cultural symbols, and their NPS value in stores with high cultural relevance reaches 81, which is 12% higher than that of other age groups.

3.2.2. Functional diversity and repurchase rate

Stores that support more than 3 functional scenarios have an average repurchase rate of 45%, which is significantly higher than that of single-function stores. For example, the “Social Island” area in HEYTEA Lab stores increases the average stay time of consumers by 25 minutes, and the repurchase rate reaches 48%. Through the tracking of consumer moving lines, it is found that in multi-functional stores, 72% of consumers will trigger at least two types of scenario-based behaviors (such as staying and checking in after purchase), while this proportion is only 35% in single-function stores.

3.3. The impact path of brand value

Through the structural equation model (SEM) and mediating-effect tests, reveal the direct and indirect action mechanisms of scenario-design elements on brand value ^[13].

3.3.1. The emotional conduction path of cultural symbol density

Model Results: The standardized path coefficient of cultural-symbol density on emotional resonance is $\beta = 0.47$ ($P < 0.01$), and the path coefficient of emotional resonance on willingness to pay is $\beta = 0.63$ ($P < 0.01$). For example, through the design of cultural symbols such as murals and music in HEYTEA’s “Dunhuang Flying Apsaras”

themed store, the consumers' emotional-resonance score reaches 8.5 (full score 10), and the willingness to pay increases by 28% (the average customer price increases from 35 yuan to 45 yuan).

3.3.2. The premium ability of digital scenarios

The study found that taking NAIXUE as an example, the direct effect of the degree of digitalization on brand value is $\beta = 0.35$ ($P < 0.05$), and the "virtual clerk" increases the consumer-interaction time by 40% and the average customer price by 18%. The improvement of enjoyment ($\beta = 0.28$, $P < 0.05$) through digital design indirectly affects brand value. For example, LELECHA's AR menu increases the click-through rate of new products by 65%, indirectly driving a 12% increase in the repurchase rate.

4. Discussion and suggestions

4.1. Discussion

This research further improves the theoretical framework of "scenario experience-brand value" through empirical analysis and proposes the "four-in-one" design principle, providing a new perspective for the application of the experience-economy theory in the new tea-drinking industry^[14].

Deepening of Cultural Symbols: Emphasize the in-depth integration of cultural symbols and brand narratives rather than simple piling up. For example, the "Jiangfeng Yuhuo" themed store of CHAYANYUESE constructs a complete cultural narrative by combining poems, music, and spatial design, enabling the consumers' emotional-resonance score to reach 8.7 (full score 10).

Complexification of functional scenarios: Meet the diverse needs of consumers through multi-functional zoning, such as quick-pick-up areas, social islands, cultural exhibition areas, improving space utilization and user stickiness^[15].

Immersion of digital experiences: Use technologies such as AR menus and virtual IPs to enhance scenario interactivity.

Modularization of cost control: Reduce scenario-updating costs by more than 30% through detachable and reusable design elements (such as modular walls, prop systems), providing a feasible solution for small and medium-sized brands.

At the same time, the research verifies the key mediating role of emotional resonance in the path of "cultural-symbol density \rightarrow willingness to pay" (the mediating-effect proportion is 68.5%).

4.2. Practical suggestions

Based on the empirical research conclusions, this paper proposes a four-dimensional implementation framework for the scenario-based design of new tea-drinking brands, covering cultural-symbol reconstruction, functional-configuration optimization, technology-integration innovation, and cost-benefit control. The specific strategies are as follows:

4.2.1. Narrative reconstruction of cultural symbols

Break through the paradigm of superficial symbol piling-up and establish a three-dimensional integration model of "symbols-narratives-emotions." Achieve systematic expression of cultural symbols through the design of storylines in the scenario space (such as regional-cultural tracing, brand-development history). Take the "Jiangfeng Yuhuo" themed store of CHAYANYUESE as an example. It deconstructs the poetic flavor of "Mooring by the

Maple Bridge at Night” into visual symbols (ink-wash screens), auditory symbols (guqin background music), and interactive devices (poem projections), forming a complete cultural-narrative field.

4.2.2. Composite configuration of functional zones

According to the principles of spatial behavior, construct a trinity functional system of “efficiency-social-culture,” and design quick-pick-up areas, social islands, and cultural exhibition areas. The quick-pick-up area adopts a linear layout and an intelligent ordering system to ensure service efficiency (the average pick-up time ≤ 3 minutes); the social island is equipped with semi-open booths and shared desktops to promote social interaction (the user’s stay time is extended by 25 minutes), and the cultural exhibition area realizes the visualization of brand culture through dynamic display cabinets and interactive screens.

4.2.3. Scenario-based integration of digital technologies

Construct a “physical-digital” dual-scenario coupling system; develop AR menus based on LBS to achieve the situational presentation of product information; at the same time, increase the implantation of virtual IPs and create brand digital-human shopping guides to enhance service touchpoints.

4.3. Research limitations and prospects

Although this research has achieved certain results, there are still the following limitations.

The research samples are concentrated on leading brands and do not fully cover regional niche brands, so the universality of the conclusions may be limited.

Insufficient time span: The research data is mainly based on cross-sectional analysis and fails to reflect the long-term effects of scenario-based design.

On this basis, future research is expected to be carried out in more directions. Explore the scenario-based design strategies of regional brands and the sinking market, and propose a more universal theoretical framework; combine meta-universe technology to develop virtual brand spaces and explore new models of “combination of virtual and real” scenario-based design. Through longitudinal research, analyze the long-term impact mechanism of scenario-based design on brand value.

Disclosure statement

The authors declare no conflict of interest.

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Analysis of the Impact of US Tariffs on Chinese Enterprises and Corresponding Paths

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Abstract: The United States' tariff policy implemented under the framework of "reciprocal tariffs" has aroused widespread attention in the international community, and has had complex impacts on global trade. This policy not only has an impact on Chinese enterprises but also brings adjustments to global industrial chains, with varying perspectives from the international community. Based on an analysis of Sino-U.S. economic and trade relations, this paper structures the logic behind it and uses case studies for comparison to analyze the impact of U.S. tariff policies on Chinese companies. It explores how Chinese enterprises can respond to the negative effects of these tariffs. The study finds that in the face of U.S. tariff policies, Chinese enterprises will experience increased direct costs and forced supply chain adjustments. Therefore, the conclusion is drawn that companies need to address the impact of U.S. tariff policies through four aspects: Supply chain restructuring, market diversification, technological innovation, and compliance management.

Keywords: Tariff barriers; China-US trade; Economic development

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1. Introduction

In recent years, economic globalization has faced a backlash, with rising trade protectionism. The Sino-US trade friction is a prominent manifestation of this backlash, which has brought challenges to the multilateral trading system and international economic order, and bringing significant uncertainty to the world economic recovery. Since the establishment of diplomatic relations in 1979, Sino-US economic and trade cooperation has long been the "ballast" and "stabilizer" of bilateral relations. However, with China's rapid economic development and growing comprehensive national strength, the strategic positioning of the United States toward China has changed, shifting from a partner to a strategic competitor, and the economic and trade relationship has moved from complementarity to competition.

2. Evolution of China-US economic and trade relations

Since the establishment of diplomatic relations in 1979, the trade relationship between China and the United States has undergone a complex evolution marked by both deep cooperation and intense friction, reflecting the intricacies of competition and collaboration among major powers. This article, drawing on the narrative approaches of Li and Chen *et al.*, uses key events as milestones to trace the evolution of economic and trade relations between China and the United States ^[1,2].

2.1. Complementary cooperation and rapid growth

After the establishment of diplomatic relations between China and the United States, trade volume showed an expansion trend, with bilateral trade increasing from less than \$2.5 billion in 1979 to about \$583.7 billion in 2017, growing at an average annual rate of over 15%. The two countries have formed a deeply complementary pattern based on comparative advantages, with the U.S. exporting high-end manufacturing and technology products to China, while China exports consumer goods and intermediate goods to the U.S. In 2001, after China joined the WTO, the U.S. and China signed the “U.S.-China Trade Relations Agreement,” laying the institutional foundation for cooperation between the two countries, establishing rules such as market access and intellectual property protection, and promoting growth in bilateral investment.

2.2. The first phase of the trade war broke out and the first phase of the agreement

At the beginning of 2018, Trump took office as the 45th President of the United States. From the moment he assumed power, Trump regarded China as a major competitor, with the view that there were competitive dynamics between the two countries in areas such as trade and technology. He implemented a series of policy adjustments related to economic ties, which brought changes to China’s development environment. The Trump administration, adhering to the “America First” principle, adopted tough trade policies toward China with “national security” as one of the considerations. They introduced four rounds of maximum tariff lists for Chinese imports, imposing high tariffs on over \$500 billion worth of Chinese goods and restricting technology exports, leading to a temporary decline in Sino-U.S. trade. This reflected the development trend of U.S. actions in trade. To prevent a deterioration in Sino-U.S. trade relations, at the beginning of 2020, both sides reached the Phase One Economic and Trade Agreement through multiple rounds of negotiations. The agreement covered issues such as intellectual property protection, expanding market access, and currency stability. Both sides committed to increasing trade volumes in manufactured goods, agricultural products, energy products, and services. Additionally, they agreed on tariff issues, with the U.S. committing to phased reductions in tariffs on Chinese products, transitioning from increases to decreases in tariffs.

2.3. US “decoupling” and strategic confrontation

At the beginning of 2021, Biden took office as the 46th President of the United States. The Biden administration maintained a tough stance on trade with China, further strengthening technology-related export controls through policy tools such as the CHIPS and Science Act and the Inflation Reduction Act. Through the CHIPS and Science Act and the Inflation Reduction Act, they adjusted relevant export control policies, imposing restrictions on exports and investments in semiconductors, artificial intelligence, and other fields. The U.S. Department of Commerce also added hundreds of Chinese companies to the Entity List, which has had an impact on their operations within global value chains and introduced certain uncertainties to the stability of global supply chains. Additionally, the

U.S. imposed tariffs on Chinese goods with considerations such as “equivalent tariffs” and “port fees,” leading to a loss of orders for labor-intensive industries such as machinery and textiles.

This put pressure on profits for some companies, forcing them to reduce production or relocate capacity, directly impacting China’s export trade. In early 2025, Trump was set to become the 47th President of the United States, with reports indicating that he would nominate officials with distinct views on China to his cabinet and maintain a tough stance on tariff policies toward China.

3. Logical deconstruction of US policy towards China

The recent U.S. policy orientation toward China reflects a complex strategic consideration in the context of international system changes, involving multiple dimensions such as economic and strategic interests. Contemporary academic analyses predominantly deconstruct the logic underpinning American protectionist measures through tripartite analytical dimensions: Economic, political-strategic, and technological-institutional. Wang and Yang posit a four-dimensional framework to interpret U.S. trade protectionism, identifying its operative logic as rooted in: (1) strategic considerations for safeguarding national interests through trade policy adjustments; (2) institutional path dependencies inherent in domestic political architectures; (3) structural imperatives derived from cyclical economic patterns; and (4) systemic maintenance of trade regime dominance^[3]. Concurrently, Xu et al. supplement this analysis by introducing a perspective on technological competition, contending that U.S. tariff implementation is a response to the competitive dynamics in global technological development^[4].

This study adopts a multidimensional analytical framework to examine U.S. tariff policy formulation and implementation. From an economic perspective, these protectionist measures, through trade barriers and technological control strategies, have had an impact on China’s industrial upgrading process. The political factors involve the interaction between electoral cycles and the demands of domestic interest groups, which has led to the formation of relatively tough China policy stances. Strategically, these measures have played a role in the adjustment of global supply chains and the evolution of international governance regimes, and have had certain impacts on China’s participation in global rule-making.

3.1. Economic level

The Biden administration adjusted technology-related policies through the CHIPS and Science Act and the Inflation Reduction Act, adding hundreds of Chinese companies to the Entity List, which has affected technological cooperation in key areas. After Biden’s term, the Trump administration maintained and adjusted its tariff policies toward China, with a focus on high-end manufacturing sectors such as semiconductors and new energy vehicles in tariff application, and sought to influence the adjustment of global supply chains through trade measures. Additionally, the U.S. actively promoted the repatriation of manufacturing and adjustments to supply chains to reduce reliance on specific regions, guiding companies to shift production capacity to Mexico, Southeast Asia, and other regions through subsidy policies.

3.2. Political level

The U.S. two-party system centers around the Democratic and Republican parties, which take turns governing and dominate the American political landscape. Although there are differences in their core ideologies, both parties compete for voter support by adopting tough stances toward China. The Democratic Party, represented by Biden,

strengthens its competitive narrative with a “middle-class diplomacy” approach, while The Republican Party, led by Trump, advocates for trade policy adjustments under slogans like “bringing manufacturing back home” and “making America great again.” These policy choices are influenced by domestic political and economic factors, including considerations related to electoral cycles and responses to domestic economic issues. After Trump took office, he faced issues such as the expansion of domestic debt, the hollowing out of manufacturing leading to rising unemployment rates in the “Rust Belt” regions of the Midwest, which fueled growing public discontent with globalization. Therefore, Trump’s strategy involved the use of tariff policies, with the aim of addressing domestic public opinion concerns through discussions on trade issues.

3.3. Strategic level

The U.S. tariff policy toward China is influenced by multiple factors, including differences in social systems and values. Strategically, the United States has explicitly defined China as a primary “competitor” and even an “adversary” in authoritative documents such as the National Security Strategy Report and the Defense Strategy Report. The U.S. promotes its values, such as human rights and engages in institutional competition, which has led to differences in international influence between the two countries. The U.S. tariff policy toward China reflects the strategic competition between the two countries in multiple fields. Differences in some issues have also attracted attention in the international community.

4. The impact of US tariff policy on Chinese companies

Since the outbreak of the first phase of the Sino-US trade war, research on the impact of tariff shocks has significantly increased among scholars both domestically and internationally. At the micro level, previous studies have mainly focused on the effects of tariff policies on industry prices and trade volumes. Sun *et al.* found that mutual tariffs imposed by China and the US would reduce China’s imports of US agricultural products by more than 50% ^[5], while shifting these imports to countries like Brazil, Canada, and New Zealand. Zhou *et al.*, on the other hand, focused on the automotive parts industry, finding that the trade losses for the US automotive parts industry would be greater than those for China ^[6]. At the macro level, previous studies have primarily concentrated on the impacts of tariffs on welfare levels and overall price levels, but there is still debate over who suffers more from these negative effects. Ni *et al.* found that after the imposition of tariffs ^[7], the welfare loss for US residents was greater than that for China. Lu *et al.* argued that although China’s tax increase list had a greater impact on target industries in the US ^[8], China suffered a larger overall welfare loss. This paper will focus mainly on the micro level, analyzing the shocks and impacts faced by enterprises when confronted with tariff policies.

4.1. Direct costs increase, and corporate profits are compressed

The most direct impact of U.S. tariff policies on Chinese companies is the increase in export costs. As these costs rise, more American buyers turn to cheaper alternatives like Vietnam and Mexico. To prevent their market share from being entirely eroded by tariff barriers, many Chinese companies are forced to adopt price-cutting strategies to offset the tariff costs and secure orders. This leaves them in a dilemma: “Order or profit?” With profits squeezed, they can only cut prices upstream or reduce internal expenses, which may trigger a chain reaction leading to higher costs across the entire supply chain. Smaller firms, lacking bargaining power with both upstream and downstream suppliers, may face survival challenges due to rising costs. Compared to large multinational corporations, small

and medium-sized enterprises, lacking international legal and tax teams, are more vulnerable to becoming victims of the “tax burden trap.”

4.2. The supply chain is forced to adjust, and companies face a dilemma

In response to the U.S. imposing tariffs on Chinese goods, companies face two primary strategies. First, they can choose to relocate their factories overseas, which, despite the high costs, helps maintain existing market share. Second, companies may consider redirecting products originally destined for the U.S. market to domestic sales or the Southeast Asian market. However, this strategy is also challenging. On one hand, intense competition in the domestic market may require increased advertising and other sales expenses, potentially leading to reduced profits instead of growth. On the other hand, when exporting products to Southeast Asia, companies might encounter mismatches between user profiles and local consumers, as well as logistical and transportation issues, such as inadequate communication network coverage affecting information transmission. Additionally, political systems and stability fluctuations in some Southeast Asian countries could impose restrictions on tax policies and capital outflows, further complicating the export process.

4.3. Compliance risks and policy uncertainties increase, and the operating costs of enterprises reach a new peak

The United States continuously updates its tariff list, forcing companies to deal with more complex customs compliance, intellectual property reviews, and rules of origin. These changes may lead to higher prices for exported goods, affect the timeliness of contract fulfillment and the volume of cross-border logistics, thereby significantly increasing operational risks for businesses. First, U.S. Customs has become increasingly stringent in its declaration requirements for imported goods, including compliance reviews on product classification and proof of origin. Additionally, due to the recurring “pause-restart” policies, such as multiple adjustments to the duty-free policy for packages under \$800, companies are forced to frequently adjust their logistics strategies. Any discrepancy in information could result in cargo being detained or facing hefty fines. Second, the U.S. Customs and Border Protection has intensified its patent infringement reviews for Chinese goods, requiring companies lacking technical standard certifications to resubmit compliance proofs. This leads to extended delivery times and additional costs and expenses for these companies.

5. Conclusion and countermeasures

This study conducts a comprehensive and systematic analysis of the impact and pathways of U.S. tariffs on Chinese enterprises through in-depth exploration and analysis. Theoretically, it verifies the applicability of cost transmission, market substitution, and supply chain restructuring in asymmetric great power competition, contributing to relevant international trade theories. Practically, empirical research is conducted using literature review, comparative analysis, and case studies, concluding that companies need to address U.S. tariff policies by restructuring their supply chains, diversifying markets, innovating technologically, and managing compliance.

5.1. Supply chain restructuring and regional layout

In response to the challenges posed by U.S. tariff policies, companies should first leverage government support to participate in the national strategy of “focusing on domestic circulation while promoting dual circulation at home and abroad.” Secondly, China is actively advancing the construction of free trade zones and signing various

free trade agreements to expand its opening up. Companies should actively engage in the development of these zones to achieve resource sharing and complementary advantages, jointly creating a forefront for opening up and promoting coordinated development among neighboring enterprises. Finally, companies should rely on multilateral cooperation frameworks such as RCEP and BRICS, designing distributed supply chains and setting up distribution centers in multiple countries to flexibly manage cargo flows and reduce dependence on a single country. At the same time, they should shift production capacity for high-tariff products to regions like ASEAN and Central and Eastern Europe, forming deep cooperation through technology transfer and capacity sharing, and utilizing local free trade agreements to circumvent tariff barriers.

5.2. Market diversification and brand upgrading

Companies adopt market diversification strategies or brand upgrade strategies, ultimately to reduce their reliance on the U.S. market. On one hand, in line with the requirements of optimizing international market layout and promoting integration of domestic and foreign trade outlined in the “14th Five-Year Plan for High-Quality Development of Foreign Trade,” companies can diversify risks by exploring emerging markets. On the other hand, excessive dependence on the U.S. market can place companies at the lower end of the industrial chain, leading to low profits and weak risk resistance. According to the guidance on strengthening quality and brand building in “Made in China 2025,” companies can enhance value-added and expand customer bases through brand upgrades, thereby reducing their dependence on specific markets.

5.3. Innovation-driven and technology independence

Continuously escalating tariffs and trade restrictions may prompt Chinese companies to more firmly pursue independent innovation, enhancing the core competitiveness of their products, increasing product value-added, and boosting the irreplaceability of their offerings. In addition to innovating in key core technologies, companies can also innovate in production management. For example, they can introduce blockchain technology to achieve supply chain transparency, use IoT devices to monitor cargo status, and improve compliance. Furthermore, companies can establish dynamic monitoring models to assess in real-time the impact of tariffs and other trade restrictions on gross margins, laying the groundwork for future strategic planning.

5.4. Cost optimization and risk management

In the face of escalating tariff policies, companies should increase investment in automation and intelligence to reduce labor costs and enhance global competitiveness. Additionally, risk management must be prioritized. On one hand, companies can establish dynamic compliance mechanisms to track real-time changes in HTS codes and rules of origin from the U.S. Customs and Border Protection. On the other hand, they can hire lawyers to conduct “compliance stress tests,” simulating reviews for high-risk areas such as intellectual property and anti-exploitation laws to preemptively avoid unnecessary legal disputes. Finally, companies can use financial instruments to hedge against the compounded effects of exchange rate fluctuations and tariff costs.

Disclosure statement

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The Management Practice and Reflection of Centralized Drug Procurement in Hospitals

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Abstract: The centralized procurement of drugs in the medical system is a key link, which not only affects the economic effect of institutions, but also relates to the medical quality and patient safety. In the current era, centralized drug procurement in hospitals can meet the needs of most patients; however, the specific steps of the work still need to be optimized. Starting from the level of hospital drug centralized procurement work, this paper discusses the policy background, analyzes the practice of drug centralized procurement in tertiary hospitals, and provides specific work management suggestions, aiming to improve work efficiency and serve as a reference for optimizing subsequent hospital drug centralized procurement work.

Keywords: Hospital drugs; Centralized procurement work; Management practice; Suggestions

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1. Introduction

The medical system in our country is constantly changing, which is also due to adapting to the requirements of modern medical care. The complex operation of the medical system requires strong economic support, and the centralized drug procurement in hospitals involves a large amount of capital flow, thus drawing much attention. Hospitals are the main body of drug centralized procurement, and the management of drug centralized procurement work will have the most direct impact on the implementation of the centralized procurement policy. The drug market is constantly changing, and people's demand for medical care is also gradually increasing. The challenge of hospital drug centralized procurement work has intensified. How to ensure the safe supply and stability of drugs while effectively controlling the procurement cost of drugs is an urgent problem for hospital managers to solve. In addition, the development of digital technology and the increasing accumulation of medical data have forced managers to think deeply about the details of centralized procurement work and optimize as much as possible from different details to improve the efficiency of centralized procurement work management.

2. The development background of the centralized drug procurement policy

The policy of centralized drug procurement has a very profound background from its introduction to its formal use in the medical field. This article will analyze it from both macro and micro aspects: On the one hand, from the macro background, whether the national medical insurance system can operate sustainably is facing extremely severe challenges ^[1]. The degree of population aging in China is gradually deepening, the base of the elderly population is also expanding, and the prevalence rate of chronic diseases keeps rising, which prompts the people's demand for medical services to become increasingly vigorous, and thus, the expenditure of medical insurance funds is also increasing. In terms of the proportion of each expenditure, the cost of drug procurement accounts for a large proportion, which increases the burden on medical insurance funds. If timely control measures are not taken, the stability of the medical insurance system will also be greatly reduced. At the same time, the relevant state departments are constantly deepening the reform of the medical and health system, which is also an extremely crucial task ^[2]. For a long time, the policy of centralized drug procurement has been the starting point of medical reform, aiming to change the scattered situation of drug procurement in the past through the centralized procurement model. This large-scale procurement method, due to the large batch size, has a greater space for price reduction, and medical resources have been optimally allocated, promoting the medical industry to be more standardized and efficient ^[3]; On the other hand, from the perspective of the micro background, the problem that the people have difficulty in seeing a doctor and treating diseases has not been fundamentally solved, which has become an urgent livelihood issue to be addressed now. Because all links in the drug market are closely interrelated, and under the superposition of various factors, there has been a situation of successive markups, which results in an excessively high price for the final patients. This situation will not only increase the economic pressure on patient families but also cause irreparable regret, as some families are unable to afford it and cannot receive treatment on time. From the perspective of hospitals, if the cost of drug procurement cannot be effectively controlled, it will also affect their stable operation ^[4]. In the process of hospital drug procurement, it is usually necessary to negotiate with multiple suppliers, and the procurement process is extremely cumbersome, making it difficult to lower the cost. In addition, the instability of drug prices themselves may also increase the cost of hospitals. The fierce competition in the drug market has led some enterprises to ignore the regularity of marketing methods in pursuit of short-term interests, disrupting the market order. This kind of market chaos has blocked the promotion of high-quality drugs and also affected patients' choice of medicine. The centralized drug procurement policy can help patients control costs within a certain range, reducing the economic pressure on patients to a large extent.

3. The practice and management of the hospital in the centralized drug procurement work

The state holds a positive and encouraging attitude towards the centralized drug procurement policy. Tertiary hospitals are the main body of the medical system, and they are the pioneers in the work of centralized drug procurement ^[5]. In actual management practice, certain achievements have been made, but inevitable challenges also exist. The work of centralized drug procurement in tertiary hospitals currently presents diversified characteristics, as follows: In terms of drug use, the actual utilization rate of winning bid drugs in centralized procurement continues to rise ^[6]. Hospitals adjust and optimize the drug use directory to ensure that centralized procurement drugs meets clinical supply. Many commonly used drugs, such as drugs for the treatment of chronic diseases such as hypertension or diabetes, or some tumor treatment drugs, can be purchased through centralized

procurement, which can help patients reduce costs; In terms of procurement management, hospitals will create procurement channels for centralized procurement drugs, reduce intermediate links, and contact intermediate agencies and selected enterprises, which makes the originally cumbersome procurement links more concise and improves the procurement efficiency ^[7]. In addition, by using advanced information systems, hospitals can monitor the procurement and inventory of target drugs at any time to ensure the stability of drug supply. For example, hospitals can create an electronic order platform with suppliers, provide timely feedback on procurement information, and then shorten the procurement time to the shortest possible.

However, starting from the drug collection work of tertiary hospitals, some problems cannot be ignored. First, the stability of the drug supply is insufficient. The enterprises cooperating with the hospitals, affected by factors such as production capacity and raw material supply, find it difficult to supply drugs promptly, which is not conducive to the smooth conduct of clinical drug use in hospitals ^[8]. Even drug shortages occur, affecting the treatment of patients and easily causing doctor-patient conflicts. Second, the more prominent clinical adaptation problem. When the specifications and dosage forms of the collected drugs are different from those previously used in tertiary hospitals, it is easy for doctors and patients to have doubts about their efficacy and safety, which is not conducive to the promotion of drugs. For example, after the change of some drug dosage forms, patients have insufficient compliance in taking medicine, resulting in a relatively weak overall treatment effect. Third, there are prone to loopholes in information management ^[9]. Although the hospital has introduced an information system, there are differences in the integration and sharing of drug information, and there are data barriers among various departments within the hospital, which can easily cause information obstacles in links such as inventory management and procurement plan formulation, seriously affecting work collaboration and scientific decision-making.

Starting from the drug collection work in tertiary hospitals, certain achievements have been made in its working practice, but some problems are also faced. Only by optimizing the management process and strengthening communication and cooperation among all parties can problems such as clinical and information management be effectively solved, the smooth implementation of drug collection work be promoted, and convenience be provided for patients through policies to improve the quality of medical services.

4. Management suggestions for the centralized drug procurement work in hospitals

4.1. Strengthening the control of drug quality

The drug collection activities carried out by the hospital require attention to supervision after the drugs are launched on the market to effectively improve the drug quality. The hospital's drug supervision and other departments can understand the quality of the centralized collection of drugs, carry out all-around monitoring, grasp the content and concentration of each component of the drugs, and analyze the consistency of the products. The component content of drugs directly determines the therapeutic effect of the drugs. If the effective components are lacking, it is difficult to achieve the expected therapeutic effect ^[10]. Unstable component concentrations can easily lead to inaccurate drug dosages for patients, resulting in a lack of safety in treatment. For example, for a certain antibiotic drug collected by the hospital, there are different batches of the drug, and the content of the effective components fluctuates greatly. During the use process, it is prone to an insufficient therapeutic effect and even adverse reactions in patients, thereby affecting the improvement of the therapeutic effect.

In the process of drug quality control and management, clinical comparisons can be carried out. Through

these comparison activities, a scientific assessment of centralized procurement of drugs can be conducted, involving efficacy and adverse reactions. For example, for a certain type of drug with blood pressure-lowering effects, clinical research can be conducted with the original imported drugs, and the medication performance of different patients can be observed and recorded, including blood pressure control and adverse reactions ^[11]. After the conduct of the research, if it is found that the effect of the centralized procurement drug is comparable to that of the original drug and their adverse reactions are approximately the same, it can give doctors and patients confidence in the drug. However, if significant differences occur, the procurement strategy can be adjusted by promptly identifying the problems and using optimization measures.

Moreover, the implementation of clinical comparisons can promote the improvement of the quality of drugs collected through centralized purchasing. Judging from the research results, there are certain deficiencies in some aspects of the collected drugs. Enterprises can adjust the process in a targeted manner, optimize the quality control, and effectively enhance the drug quality. Meanwhile, based on the research results, it can provide convenience for the regulatory authorities to adjust the quality standards and regulatory methods, and guarantee the drug quality ^[12]. At the same time, a quality traceability system can also be established. Through the use of information technology, the entire process of drug production can be tracked and recorded. When quality problems occur, the root cause can be quickly traced, the reasons for the problems can be identified, and timely recall and rectification methods can be used to guarantee the safety of patients.

4.2. Simplify the procurement process

In the process of drug procurement in hospitals, the various links are rather cumbersome, which hinders the improvement of procurement efficiency. Under the traditional mode, the departments are responsible for submitting the applications for drug demands, which need to be approved by multiple departments before the procurement work can be finally realized. In the above activities, there is a lack of timeliness and smoothness in information transmission among various departments, which is prone to causing information islands, and the approval of drugs has a long cycle. For example, for the procurement application of drugs, it usually requires the participation of departments such as the Pharmacy Department, the Finance Department, and the Procurement Department. The implementation of each link is inseparable from signing and confirmation, which requires a lot of time and manpower.

In order to enhance the effectiveness of procurement, it is necessary to simplify the procurement process and strengthen the use of information technology. Through the construction of an integrated drug procurement platform, the integration of various links can be carried out to promote information sharing and the conduct of approval. Departments can submit procurement applications through the platform and utilize the automatic push function of the system for real-time display ^[13]. The implementation of the above activities helps to shorten the approval time and effectively improve the procurement efficiency.

4.3. Establishing a drug reserve system

Hospitals can improve the efficiency of centralized drug procurement through the improvement of the drug reserve system. As the supply of drugs is affected by many factors, such as natural disasters, raw materials, and drug manufacturing enterprises, the existence of these factors can easily lead to an insufficient supply of drugs. In order to effectively deal with the problem of drug supply shortages, hospitals need to carry out scientific reserve plans based on drug usage and demand. By flexibly using big data technology, conduct in-depth mining of drug usage

data, and grasp seasonal changes, disease trends, and hospital planning, etc., to effectively judge the demand for different drugs. For example, in the face of the high incidence season of influenza, the reserve of related drugs can be increased in advance^[14]. For common drugs for certain chronic diseases, the drug inventory can be replenished in a timely manner in combination with the number of hospital patients, medication cycles, and other information to meet the medication needs of patients. The reserve activities of drugs also need to consider the validity period and storage conditions of drugs, establish a good drug management mechanism, strictly follow the first-in, first-out principle, and regularly inspect the reserved drugs to avoid drug waste due to expiration^[15]. For drugs with special storage requirements, they can be refrigerated and protected from light, and it is necessary to determine whether the equipment can operate normally, thereby providing a practical guarantee for the quality of drugs.

Moreover, from the perspective of the hospital's drug reserve plan, a good response mechanism can be formulated. When facing the problem of drug supply shortage, the contingency plan can be promptly initiated to allocate the reserved drugs and provide them to the clinical department first. The in-depth cooperation between hospitals and enterprises can effectively deal with emergencies and make accurate and rapid responses to replenish the drug inventory. At the same time, hospitals can enhance communication and cooperation. In the face of special circumstances, they can conduct mutual drug adjustment and assistance, thereby addressing the challenges faced by the drug supply and making the hospital's drug supply more stable, and improving the effectiveness of medical services.

5. Conclusion

In conclusion, in the drug collection work of the hospital, it is necessary to attach importance to the construction of a scientific drug reserve system, effectively improve the stability and safety of drug supply, and solve the problem of drug shortage. Among them, in the management of hospital drug collection work, in order to further improve and implement it, the hospital management needs to pay more attention and make sufficient efforts. Specifically, the drug collection work of the hospital can effectively improve the effect of centralized collection through measures such as drug quality management, optimization of the procurement process, and improvement of the drug reserve system. At the same time, the continuous innovation of management concepts and technologies can point out the direction for the centralized drug collection work of the hospital, provide better services for patients, and effectively improve the medical quality.

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Analysis of the Modernization Reform Path of Enterprise Management in the Era of Digital Intelligence Economy

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Abstract: With the advent of the digital-intelligence economy era, intelligence and networking have profoundly changed people's lifestyles and working methods, and also posed new challenges and requirements for enterprise management. Against this background, modern management has become a new trend in the transformation of enterprise management. Based on this, this paper conducts research on the modernization transformation path of enterprise management in the digital-intelligence economy era, expounds the impact of the digital-intelligence economy on enterprise management in China, analyzes the connotation of modernization of enterprise management, and proposes the modernization transformation path of enterprise management, aiming to provide theoretical reference and practical guidance for enterprises to achieve modern management in the wave of the digital-intelligence economy.

Keywords: Digital-intelligence economy era; Enterprise management; Modernization; Transformation path

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1. Introduction

In the present era, the digital intelligence economy has become the core driving force promoting global economic development, profoundly changing the economic structure and operation mode of society^[1]. Chinese enterprises are in the midst of this wave, facing unprecedented opportunities and challenges. The rapid development of digital intelligence technology is reshaping the management concepts, organizational structures, and operation methods of enterprises in an all-around way. In-depth research on the impact of the digital intelligence economy on enterprise management and exploration of practical and feasible modernization transformation paths are of vital significance for enterprises to achieve sustainable development and enhance comprehensive competitiveness in the market competition.

2. An overview of modernization of enterprise management

Enterprise management modernization refers to a dynamic evolution process in which enterprises deeply integrate modern science and technology into the management system, promoting the elements and activities of the enterprise management system to be in line with and mutually promote the modern productivity level and its development trend marked by advanced material technology ^[2]. Modern management builds a complete management information system, uses emerging control technologies such as big data analysis and artificial intelligence algorithms, and constructs an efficient feedback mechanism to conduct all-around, real-time, and precise monitoring and correction of enterprise management activities, ensuring that the enterprise operation always moves forward along the established strategic direction. Enterprises can apply cutting-edge technologies such as cloud computing to promote the online and intelligent management of business flow, talent flow and capital flow, break information barriers, improve the efficiency of resource allocation and the accuracy of decision-making and the efficiency of execution, helping enterprises move steadily in the complex and changeable market environment and maintain a lasting competitive advantage ^[3].

3. The impact of the digital intelligence economy on the management of enterprises in our country

3.1. Actively promote the modern transformation of enterprises

With the rapid development of the digital economy, the economic and social framework of our country is undergoing a drastic transformation. Thanks to the rapid technological development and the upgrading of the industrial level, the flow of the labor force is gradually shifting from traditional fields to emerging industries, resulting in an unprecedented “reconstruction and differentiation” phenomenon in the economic and social structure. In the past, our country’s economy was based on agriculture, and then shifted to manufacturing and service industries. However, driven by the modernized economy, the development impetus is now tilting towards high-tech and service-oriented industries ^[4]. Emerging industries such as electronic information, biotechnology, new materials, new energy, and marine technology are emerging with vigorous vitality and huge growth potential. This transformation is not only reflected at the industrial level but also profoundly influences the production and lifestyle of workers and farmers, pushing them to transform towards the tertiary industry, especially the new service industry in the digital economy. The rise of emerging industries has become a new driving force for economic growth, and its core lies in the heavy reliance on innovation and technology, which further promotes the optimization and upgrading of the economic structure ^[5]. Therefore, the transformation and upgrading of social enterprises has become crucial. By integrating into the digital economy, enterprises can not only enhance their competitiveness but also inject strong impetus into economic transformation and development.

3.2. The digital divide is constantly expanding

Today, with the vigorous development of the digital economy, our country is encountering a new social rift digital gap. In the past, the differences between urban and rural areas, between workers and farmers, and between mental and manual labor constituted the foundation of social inequality. However, in the digital wave, although these traditional differences have weakened, they have not completely disappeared. Instead, they have given rise to a new inequality, the digital gap. This gap is mainly reflected in the acquisition and application of digital resources, making the gap between enterprises and between urban and rural areas more and more obvious. Especially in the enterprise field, although some enterprises have completed digital transformation and enhanced their own

competitiveness, a large number of enterprises still have an extremely slow pace in the digital process due to the lack of technical talents and digital operation skills. In rural areas, the problems faced by enterprises are more prominent. The weak technical infrastructure and insufficient investment make their integration speed in the digital economy slow, and the distance from urban enterprises is getting wider and wider.

3.3. The proportion of knowledge-based economy has increased

In the current “new economy” landscape, the influence of past economic drivers, such as individual work efficiency and working hours, on business achievements is no longer as significant as before. This phenomenon highlights the coexistence and synergy between knowledge and capital. Under such circumstances, high technology and innovation ability have become the core elements of enterprise competition ^[6]. Research indicates that innovation and creativity have become the new driving forces for modern economic growth, that is, through innovative solutions to address the problems faced by enterprises and thereby achieve value enhancement. Moreover, innovation is not limited to the technical level; it also encompasses in-depth insights and applications of different cultural and knowledge backgrounds, which further enrich the diversity of resource allocation. However, this has also led to an intensification of social division, especially in the ability to acquire and apply knowledge and technology, resulting in a significant gap. This gap exists not only at the individual level but also among different enterprises and even different countries, making the polarization of economic and social development more prominent.

4. The modernization transformation path of enterprise management in the era of digital intelligence economy

4.1. Updating the enterprise management model and constructing a new organizational form

Traditional factory system organizations, bureaucratic organizations, and network system organizations have been difficult to adapt to the complex and changeable market environment brought about by the rapid development of digital intelligence technology. In the era of digital intelligence economy, the wide application of digital technology promotes the update of enterprise management models and organizational forms, and prompts the emergence and development of platform system organizational forms. In terms of goal setting, platform system organizations have broken through the limitation of taking simple profit as the sole core goal in the traditional way, emphasizing the sustainable development of the business ecosystem and pursuing a win-win situation for multiple parties. In practical applications, relying on algorithm management and combined with relevant data analysis, they can gain real-time insights into market dynamics, customer demands, and internal operation conditions, providing accurate and efficient support for enterprise decision-making ^[7]. Its organizational members are not the mechanical execution of specific job tasks in the traditional sense. Instead, relying on the resources and capabilities provided by the platform, they give full play to their professional advantages and actively participate in the innovation and optimization process of the entire life cycle of products or services, becoming active participants in value creation. Its organizational technology mainly takes the digital technology cluster as the underlying support architecture, covering cutting-edge technologies such as big data analysis, artificial intelligence algorithms, cloud computing services, and Internet of Things connections, forming the synergy of multiple technologies, breaking information barriers among all parties, and promoting the efficient flow and sharing of data and resources ^[8]. Taking the e-commerce platform as an example, enterprises can accurately grasp consumers’ preferences and purchase trends through the in-depth mining and analysis of massive user transaction data, provide precise marketing

suggestions for settled merchants, and at the same time, use algorithms to optimize the logistics distribution path and improve the overall operational efficiency, thereby forming a new organizational form of a closed-loop ecosystem of products and services. Enterprises should focus on strengthening the construction of digital technology infrastructure and establishing governance mechanisms and incentive systems that adapt to platform-based operations to achieve efficient operation of the organization in the digital intelligence economy era ^[9].

4.2. Strengthening the management and application of algorithms and promoting the platformization of organizational forms

Against the background of the digital intelligence economy, the due role of algorithm management in enterprise management has been constantly prominent and has become an important driving force for the platform transformation of enterprise organizational forms. Platform-based organizations can utilize algorithm management technology to flexibly combine structures, resources, and capabilities, thereby enhancing the market response speed of enterprises. From the perspective of technical architecture, platform-based organizations can be divided into centralized platform-based organizations based on centralized technical architecture and distributed platform-based organizations based on distributed technical architecture ^[10]. Among them, centralized platform-based organizations rely on a unified central server and data center to efficiently integrate various resources within the platform and achieve centralized control of the operation process. For example, most current large-scale e-commerce platforms, by building a powerful central data processing system, conduct centralized storage and analysis of massive user data, merchant information and transaction data, and use algorithms to precisely match supply and demand sides, optimize product recommendations and search rankings, effectively improving the transaction efficiency and user experience of the platform. This model has relatively high data processing efficiency and accuracy, and can help the platform formulate unified strategic planning and operation strategies ^[11]. The distributed platform-based organization emphasizes the application of technologies such as blockchain and distributed ledgers to disperse data and business processing nodes to each participating entity, forming a decentralized organizational structure. This model has relatively flexible mechanisms such as task allocation and information provision, which can effectively mobilize the enthusiasm and creativity of all participants. Enterprises should rationally select the type of platform-based organization based on their actual situations and continuously optimize the governance mechanism and incentive system of the organization to promote efficient and sustainable development of the organization in the digital intelligence economy era ^[12].

4.3. Integrating the application of digital technology to promote the intelligentization of management functions

The integration of digital technology can promote the automation of repetitive management functions in enterprises and drive the intelligent development of enterprise management. First, it promotes the intelligentization of production and operation management. Digital technology can establish an intelligent self-organizing production mode, collect real-time equipment, logistics, and process data through the Internet of Things, and automatically optimize production scheduling based on information such as orders and inventories by relying on big data analysis and artificial intelligence algorithms. It precisely allocates resources, drives robots and automated equipment to collaborate according to algorithms, and independently completes material handling, processing, and quality inspection, effectively meeting the market's demand for product diversity. Second, it

realizes intelligent financial management with human-machine collaboration. The intelligent system uses OCR technology to recognize and input bills, applies blockchain to ensure data authenticity, and uses machine learning algorithms to analyze financial data, achieving intelligent budgeting, cost control, and risk warning^[13]. It can imitate the thinking mode of humans for financial management and assist financial personnel in systematically analyzing data, improving the accuracy of financial management. Third, it realizes the intelligentization of human resource management. In the personnel interview process, digital technology can use intelligent algorithms for talent analysis, screen resumes with the help of natural language processing, and assist in interview evaluation with artificial intelligence, helping enterprises incorporate outstanding talents. In terms of employee training, digital technologies such as VR and AR create immersive scenarios, and algorithms customize personalized plans to enhance the pertinence and effectiveness of training. In performance management, digital technology can collect various data of employees, formulate salary levels that match employee performance, provide an objective evaluation basis for management personnel, and promote scientific and humanized management. The fourth is to achieve intelligent marketing management. Relying on digital technology, enterprises can collect consumer and market data through multiple channels, use data mining and machine learning to build portraits, accurately understand demands and trends, formulate personalized strategies, and achieve precise marketing. At the same time, it can also automatically optimize advertising placement, improve the input-output ratio of resources, and drive marketing innovation and efficient development.

4.4. Exploring the potential value of data and the shift to digitalization of production services

Nowadays, data has become the core asset of enterprises. Exploring its potential value and promoting the digital transformation of production services can effectively enhance the competitiveness of enterprises. In terms of data collection, enterprises should resort to advanced data collection technologies to extensively collect internal and external data, covering multi-dimensional information such as production processes, customer behaviors, and market dynamics, to ensure the comprehensiveness and accuracy of the data. Through processing procedures such as data cleaning, integration, and storage, a high-quality enterprise data pool is constructed, laying a solid foundation for subsequent analysis. During the data processing, enterprises can apply advanced algorithms such as machine learning and deep learning to deeply mine the massive data and reveal the patterns and trends hidden behind the data^[14]. For example, by analyzing the purchase history and browsing behavior of customers, we can precisely understand the preferences of customer demands and provide a strong basis for product research and development and the formulation of marketing strategies. In terms of data analysis, data visualization technology can transform complex data into intuitive and understandable charts and graphs, enabling enterprise managers and employees to quickly understand key information and improve decision-making efficiency. For instance, using column charts to present the sales performance of different products and using line charts to show the changing trend of market share can assist enterprises in adjusting strategic directions promptly. In terms of digital applications, enterprises utilize data to provide value-added services to customers. For example, they combine data analysis to customize exclusive solutions for customers, carry out precise market analysis, industry trend prediction and other consulting services, achieve the transformation from traditional production services to digital and intelligent service models, promote the commercial utilization of data, maximize the release of data value, and gain an advantageous position in the fierce market competition^[15].

5. Conclusion

To sum up, the era of digital intelligence economy has brought profound influences in many aspects to enterprise management. It not only vigorously promotes the modern transformation of enterprises and increases the proportion of the knowledge-based economy, but also brings challenges such as the expansion of the digital divide. The modernization reform of enterprise management is imperative in the era of the digital intelligence economy. By analyzing the application of digital intelligence economy to enterprise management and proposing modern management measures, such as building a new organizational form, strengthening algorithm management, and integrating digital technology and mining data value, it can provide effective guidance for enterprises to grasp the opportunities and challenges of the times. In the future development process, enterprises should continuously pay attention to the development trends of digital intelligence technology and actively explore innovative management models to achieve long-term development of enterprises and the continuous progress of the social economy.

Disclosure statement

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The Foundation and Path for Haikou to Build Itself into the “Capital of Chinese Tourism Performance”

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Abstract: Focusing on Haikou’s strategic development to become the “Capital of Chinese Tourism Performances,” this paper delves into its foundational conditions and implementation paths. By analyzing Haikou’s rich cultural resources, favorable geographical environment, thriving tourism industry, and continuously improving policy support, it explores how to further integrate resources, innovate development, enhance the quality and influence of tourism performances, and achieve the goal of becoming the “Capital of Chinese Tourism Performances.” This provides theoretical support and practical guidance for the high-quality development of Haikou’s cultural and tourism industry.

Keywords: Haikou; Tourism performance capital; Basic conditions; Development path

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1. Introduction

As people’s living standards improve, travel is no longer limited to traditional sightseeing tours. As a form of in-depth experiential tourism, travel performances are increasingly favored by tourists. They integrate cultural arts with the tourism industry, not only enriching the essence of travel but also injecting new momentum into the dissemination of urban culture and economic development. Leveraging its unique natural and cultural advantages, Haikou has set the strategic goal of becoming “China’s Capital of Travel Performances,” aiming to promote deep integration and high-quality development of the cultural and tourism sectors, enhancing the city’s cultural soft power and international influence.

2. Haikou city’s foundation to build “China’s tourism performance capital”

2.1. Rich and diverse cultural resources

Haikou City boasts a long history and unique cultural heritage, providing an inexhaustible source of inspiration for tourism performances. As a national historic and cultural city, Haikou has a history of over 2,000 years since its founding, with the ruins of Qiongzhou Ancient City bearing witness to the vicissitudes of time^[1,2]. Stories of

historical figures like Hai Rui and Qiu Jun have been passed down through generations on this land, their spirit and deeds serving as precious material for cultural creation ^[3]. For example, one could use the upright life of Hai Rui as a model to create historical stage plays, vividly portraying ancient anti-corruption culture through lively performances, allowing visitors to appreciate the depth of history while enjoying the shows ^[4].

Haikou's folk culture is rich and diverse, with traditional festivals such as the Xian Lady Cultural Festival and the Flower Exchange Festival, which carry the beliefs and emotions of the local people ^[5]. Elements like sacrificial rituals, folk dances, and music from these folk activities can be integrated into tourism performances ^[6]. Taking the Xian Lady Cultural Festival as an example, the dance movements and musical melodies from its sacrificial rituals can be artistically processed to create dance performances. These performances showcase Xian Lady's heroic deeds and patriotic spirit to visitors while also introducing them to Hainan's unique folk beliefs ^[7].

Haikou is located on the coast of the South China Sea, where maritime culture is a significant cultural feature. The customs of fishermen and the history of the Maritime Silk Road are all highly attractive cultural elements ^[8]. A live performance themed around the ocean can be created, using lighting, sound effects, and actors to depict the hardships of fishermen going out to sea for fishing and the prosperity of the Maritime Silk Road. This allows visitors to appreciate the charm of maritime culture ^[9].

2.2. Superior geographical environment and climate conditions

Haikou's natural environment provides a unique stage for tourism performance. The tropical coastal scenery of Haikou boasts a continuous coastline, pristine beaches, and crystal-clear waters. The beauty of Haikou's tropical seaside is breathtaking ^[10]. Hosting outdoor tourism performances in such an environment can offer audiences a unique audio-visual experience ^[11]. For example, beach music festivals held on holiday beaches feature stages set up on the sand, allowing spectators to enjoy musical performances while feeling the sea breeze and the pounding waves, creating a relaxed and joyful atmosphere ^[12].

The pleasant climate, with a warm and humid sea breeze, makes Haikou a spring-like place all year round, suitable for hosting various tourism performances. Compared to many cities in China where winters are cold and not conducive to outdoor performances, Haikou's climate has significant advantages ^[13]. This makes domestic and international performance groups more willing to choose Haikou for their shows, attracting more tourists to come and watch. Whether in the scorching summer or the mild winter, visitors can comfortably enjoy tourism performances in Haikou ^[14].

2.3. Thriving tourism industry

In recent years, Haikou City's tourism industry has developed rapidly, providing a broad market space for the growth of the tourism performance industry. With the advancement of Hainan International Tourism Island construction, Haikou, as the provincial capital, has seen a steady increase in the number of tourists received annually. In 2023, Hainan Province welcomed 90.062 million domestic and international tourists, generating a total tourism revenue of 181.309 billion yuan, representing year-on-year increases of 49.9% and 71.9%, respectively, compared to 2019, which saw growths of 8.3% and 71.4%, respectively. The large number of tourists provides ample demand for tourism performances. For example, the Jay Chou Carnival World Tour Haikou leg attracted 154,600 fans, who not only attended the concert but also participated in other tourism activities, boosting local tourism consumption ^[15-17].

Tourism infrastructure is well-developed, with Haikou continuously increasing its investment in tourism

facilities. Transportation, accommodation, and dining options are becoming increasingly complete. The completion of large venues such as the Wuyuan River Stadium and the Haikou Bay Performing Arts Center has provided excellent hardware conditions for hosting various tourism performances. Meanwhile, the emergence of numerous high-end hotels and distinctive bed-and-breakfasts offers comfortable accommodation choices for tourists. Additionally, Haikou's transportation network is becoming more advanced, with the continuous expansion of routes at Meilan International Airport, connecting it closely with major cities both domestically and internationally, making travel more convenient for visitors.

2.4. Policy support and industrial development

The government's policy support has provided strong guarantees for the development of Haikou's tourism industry. Policy incentives, along with the construction of the Hainan Free Trade Port, have brought numerous policy benefits to Haikou's tourism industry. For example, visa-free entry for personnel from 59 countries and a 15-day visa-free entry for foreign tour groups on cruise ships have lowered the barriers for overseas performance teams and audiences to enter, enhancing Haikou's appeal as a platform for cultural exchange. At the same time, Haikou has introduced a series of policies to support the development of the cultural performance industry, such as financial subsidies and tax incentives, encouraging enterprises and individuals to invest in tourism performance projects.

Industrial agglomeration: Haikou actively promotes the agglomeration development of the tourism performance industry, forming a certain scale and industrial chain. The Fung Xiaogang Film Commune at Mission Hills regularly stages an immersive outdoor large-scale live performance called "Prelude to Nanyang," which boosts urban vitality through regular, on-site immersive experiences. Meanwhile, around the tourism performance industry, related sectors such as performance planning, stage design, and ticket sales have also developed, forming a complete industrial chain. For example, in the vicinity of the Haikou Bay Performance Center, several performance planning companies and stage design studios have gathered, providing comprehensive services for hosting performance events.

3. Current situation of tourism performance development in Haikou

3.1. Rich and diverse performance types

Currently, the types of tourism performances in Haikou City cover various fields such as concerts, live shows, plays, musicals, children's theater, and live-action performances. In recent years, Haikou has attracted many famous singers like Jay Chou, Zhang Shaohan, and Xue Zhiqian to hold their concerts. These concerts not only draw large numbers of fans but also enhance the city's reputation and influence. For example, Jay Chou's concert at Wuyuanhe Stadium attracted tens of thousands of fans, creating a vibrant atmosphere that became a major event in the city's cultural life.

Cultural and artistic performances are frequently held at venues such as the Haikou Bay Performing Arts Center, including comedy plays by Happy Mahua, classic operas, and ballets. These performances enrich the cultural lives of residents and tourists, enhancing the city's cultural appeal. For example, Happy Mahua's plays, known for their humorous style and profound themes, have won the hearts of audiences, attracting many citizens and visitors to buy tickets to watch.

Live performances, represented by the prelude version of "Nanyang Stories" at the Fung Shu Kwan Film

Commune in Mission Hills, immerse audiences in historical and cultural charm through authentic settings and vivid performances. Set against the backdrop of Nanyang during the Republic of China era, these performances showcase the social landscape and character stories of that time, transporting viewers back to that era as if they were traveling through time.

3.2. The construction of performance venues has been continuously improved

Haikou City has increased its efforts in constructing performance venues, with a number of modern venues being built and put into use. The Wuyuan River Stadium, which can accommodate 50,000 people, is an important venue for hosting large concerts and sports events. Its advanced facilities and excellent conditions have attracted many renowned artists from home and abroad to perform there. For example, singers like Jacky Cheung and Karen Mok have held concerts at the Wuyuan River Stadium, delivering spectacular audio-visual experiences to audiences. The Haikou Bay Performing Arts Center, positioned as “international, avant-garde, and youthful,” boasts nearly 1,400 seats and can meet various performance needs such as dance, drama, opera, musicals, and children’s shows. Since its completion, the center has hosted over 700 performances, becoming one of the most active cultural performance venues in the province. For instance, the classic opera “The Barber of Seville” performed at the center received high praise from the audience for its superb performance and beautiful music.

Oriental globe grand theater: With more than 1,800 seats and world-class stage facilities and sound equipment, it can host large-scale cultural performances, international conferences, and other activities. The completion of the theater has further enhanced Haikou’s performance carrying capacity and provided a guarantee for hosting high-quality tourism performances.

3.3. The scale of tourism performance market is gradually expanding

As the tourism performance products continue to diversify and the market is further cultivated, the scale of Haikou’s tourism performance market is gradually expanding. Box office revenue has been growing; in recent years, the box office income from Haikou’s tourism performances has shown a yearly increasing trend. In 2023, the box office revenue from Haikou’s tourism performances reached 1.78 billion yuan. For example, the Kanye West World Tour Haikou leg saw tickets sell out quickly upon release, generating 730 million yuan in consumption, creating a significant box office income.

Increase in audience, an increasing number of tourists and residents are beginning to pay attention to and participate in tourism performances, leading to a growing audience. In 2023, the number of visitors to Haikou’s tourism performances reached 80,000, with out-of-town tourists accounting for 95%. For example, during the 2023 (24th) Hainan International Tourism Island Joy Festival, various performances at the Haikou Bay Performance Center attracted a large number of citizens and tourists, adding a rich cultural atmosphere to the festival.

3.4. Existing problems and challenges

Despite the development of tourism performances in Haikou City, some issues and challenges remain during the process. The lack of originality is evident; many tourism performance works lack innovation and depth, with severe homogenization, and there is a shortage of original works that reflect Haikou’s unique characteristics and cultural essence. Some performances merely mimic successful cases from other regions without fully tapping into Haikou’s cultural resources, making it difficult to leave a lasting impression on the audience. There is also a shortage of professional talent; the development of the tourism performance industry requires a large number of

professionals, including playwrights, directors, actors, and scenic designers. Currently, the tourism performance sector in Haikou City faces a relative scarcity of specialized talent, and the talent cultivation system is not well-established, which hinders the industry's growth. For example, some performances suffer from suboptimal stage effects due to a lack of professional scenic design expertise, affecting the overall quality of the show.

The industrial chain lacks coordination, and the collaboration between various links of the tourism performance industry chain is not tight enough, resulting in a disconnection between upstream and downstream industries. For example, there is a lack of effective communication between performance planning and tourism marketing, leading to a mismatch between the promotion of performances and the needs of the tourism market, which affects the market effect of performances.

4. The path of Haikou to build itself into the “Capital of Chinese Tourism Performance”

4.1. Strengthening the excavation and innovative integration of cultural resources

Delve into the cultural essence, organize professional teams to conduct in-depth research and exploration of Haikou's historical culture, folk culture, and maritime culture. Extract representative cultural elements and integrate them into tourism performance works. For example, create a musical reflecting the modern commercial development of Haikou based on its Qilou culture, showcasing the unique charm of Qilou culture through various artistic forms such as music, dance, and drama.

Innovate performance formats and content, utilizing modern technological means such as virtual reality (VR), augmented reality (AR), and holographic projection to innovate the presentation of tourism performances, enhancing audience participation and experience. For example, in live performances, AR technology can be used to allow audience members to interact with the performance scenes through their mobile screens, increasing the entertainment value and appeal of the show. At the same time, continuously update the performance content based on market demand and audience feedback, promptly adjusting the program arrangements to maintain the freshness and appeal of the performances.

Promoting the deep integration of culture and tourism by combining tourism performances with Haikou's tourist attractions and routes, creating a fusion product of “performance + tourism.” For example, host performances themed around volcanic culture at Volcano Park. Visitors can watch these performances while touring the park, gaining a deeper understanding of volcanic culture. At the same time, offer travel packages related to tourism performances, such as a one-stop service of “performance + accommodation + dining,” to meet the diverse needs of tourists.

4.2. Increasing policy support and industrial support

Improving the policy system to further refine the policy framework for the development of Haikou's tourism performance industry, increasing support for venue construction, original production creation, and talent cultivation. For example, establish a special fund for the development of tourism performances to provide financial subsidies for outstanding projects; introduce tax incentives to reduce the burden on tourism performance enterprises.

Strengthen industry guidance by formulating development plans for the tourism performance industry, clarifying development goals and key directions, and guiding social capital investment into this sector. Encourage companies to increase their investment in tourism performance projects and support cross-regional and cross-

industry collaborations, fostering several competitive tourism performance enterprises. For example, guide large tourism companies to collaborate with performance companies to jointly develop tourism performance products, achieving resource sharing and complementary strengths.

4.3. Improving the quality of tourism performance and brand influence

To create high-quality performance projects and increase support for premium tourism performances, we encourage enterprises to produce artistic works with Haikou characteristics and high standards. By organizing tourism performance competitions and art exchange activities, we aim to enhance the quality and level of performance works. For example, regularly holding the Haikou Tourism Performance Competition to select outstanding performance works and teams, providing rewards and support, to promote the creation and development of premium performance projects.

Strengthen brand building and promotion to establish a positive image for Haikou's tourism performances. Utilize various channels for publicity and promotion. Leverage social media, online platforms, and tourism fairs to widely promote Haikou's tourism performance products, enhancing brand awareness and reputation. For example, create high-quality promotional videos and post them on major social media platforms to showcase the highlights of Haikou's tourism performances; participate in domestic and international tourism exhibitions, and set up dedicated booths to promote the Haikou tourism performance brand.

Carrying out international cooperation and exchange, leveraging the policy advantages of the Hainan Free Trade Port to strengthen collaboration with internationally renowned performing arts institutions and artists. Introduce world-class performing arts projects and talents to enhance the internationalization level of Haikou's tourism performances. At the same time, promoting Haikou's tourism performance to the international market, showcasing the charm of Chinese culture. For example, invite internationally renowned musical theater groups to perform in Haikou, learning from advanced international performance concepts and techniques; organize outstanding Haikou performance teams to participate in international performances, expanding the international market.

4.4. Cultivate and introduce professional talents

Strengthen the construction of talent cultivation systems, encouraging local universities and vocational colleges to offer majors related to tourism performance. Enhance cooperation with tourism performance enterprises, establish internship and training bases, and cultivate professional talents that meet market demands. For example, Hainan University can offer majors such as tourism performance directing and stage art design, collaborating with companies like Haikou Bay Performance Center to provide students with internship opportunities and improve their practical skills. Introduce high-end talent, formulate preferential policies, and attract outstanding tourism performance talents from home and abroad to develop in Haikou. Through talent introduction programs, provide high-end talents with housing, children's education, medical care, and other guarantees to address their concerns. For instance, renowned screenwriters and directors can receive housing subsidies, talent apartments, and other preferential policies to attract them to work in Haikou.

Strengthening talent training and exchange, regularly organize tourism performance professionals to participate in training and exchange activities, learn advanced concepts and technologies, and improve their professional skills. For example, invite renowned performance experts from home and abroad to hold lectures and training sessions in Haikou, organize local practitioners to attend industry seminars and academic exchange

activities, and broaden their horizons and thinking.

4.5. Improving the tourism performance industry chain

Strengthen collaboration across the upstream and downstream of the industrial chain to promote synergy among all segments of the tourism performance industry, forming a complete industrial chain. Companies involved in performance planning, production, marketing, and ticketing should enhance communication and cooperation to achieve resource sharing and complementary strengths. For example, performance planning companies can collaborate with tourism marketing firms to jointly develop promotional strategies for performances, thereby increasing their market recognition and influence.

Expand the extension areas of the industrial chain, focusing on the tourism performance industry and developing related extended fields such as performance derivative product development and cultural tourism town construction. Develop Haikou-characteristic performance derivatives, like performance peripheral products and cultural souvenirs, to increase the added value of the industry. At the same time, integrate tourism performance projects with the construction of cultural tourism towns, creating comprehensive tourism destinations that combine performances, travel, leisure, and shopping. For example, build a cultural tourism town themed around the Republic of China culture around the Fung Xiaogang Film Commune in Mission Hills, complemented by hotels, restaurants, and commercial streets to provide all-around tourism services for visitors. Enhance the integration with other industries, promoting the fusion of tourism performances with catering, accommodation, and shopping, forming a synergistic effect. For instance, offer dining packages and accommodation discounts related to tourism performances to attract tourists to engage in additional consumption while watching shows. Additionally, construct shopping centers and specialty commercial streets around performance venues to meet tourists' shopping needs.

5. Conclusion

Haikou City has unique and advantageous conditions for building itself into the “Capital of Chinese Tourism Performance.” Rich cultural resources, superior geographical environment, thriving tourism industry, and policy support provide ample room for the development of the tourism performance industry. Although there are still some issues and challenges at present, by enhancing the exploration and innovative integration of cultural resources, increasing policy support and industrial assistance, improving the quality and brand influence of tourism performances, cultivating and attracting professional talent, and perfecting the tourism performance industry chain, Haikou City is expected to achieve its goal of becoming the “Capital of Chinese Tourism Performance,” promoting high-quality development in the cultural and tourism sectors, and enhancing the city's cultural soft power and international competitiveness. In the future, as various measures are gradually implemented and the industry continues to develop, Haikou's tourism performance industry will surely usher in an even more glorious future, becoming a significant destination for tourism performance not only in China but also worldwide.

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Evolutionary Game Analysis of Digital and Intelligent Transformation of Livestock Enterprises

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Abstract: The livestock farming is an important pillar of the rural economy in China. To explore the impact of government technical subsidies and pollution penalties on the digital and intelligent transformation of livestock enterprises, an evolutionary game theoretical model between the government and livestock enterprises is constructed. The interaction mechanism of the game between the government and breeding enterprises is explored, and simulation is conducted. The research results show that the combined strategy of pollution penalties and technical subsidies is the optimal strategy for the government; the system is jointly driven by government subsidies, technical costs of transformation input, public willingness, and enterprise willingness.

Keywords: Government; Livestock enterprises; Evolutionary game; Willingness constraint

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1. Introduction

Digital and intelligent construction is an inevitable trend for achieving the modernization of agriculture and an intrinsic need for the comprehensive realization of rural revitalization in China. The livestock industry is becoming a hot spot in the development of rural economy in China with the aid of digital and intelligent technologies. As of 2023, the income from the livestock breeding industry has accounted for more than 40% of farmers' income, and the output value of the livestock breeding industry has accounted for 34% of the total output value of China's agriculture^[1, 2]. However, large-scale breeding generates a huge volume of waste. When the efficiency of waste treatment cannot keep up with the output efficiency, it will cause environmental pollution. With the development of digital and intelligent technologies, some livestock enterprises have attempted to implement digital and intelligent transformation to realize real-time automatic treatment of waste and improve the efficiency of waste treatment^[3-5].

Due to the particularity of the livestock industry, on the one hand, the livestock residues have certain pollution to the environment, and on the other hand, they can also be used as fertilizers. Livestock enterprises utilize digital

and intelligent technologies to reduce the pollution of pollutants to the environment and can also protect the nutrients of manure and sewage to a greater extent. Generally, the government will encourage livestock enterprises to implement digital and intelligent transformation to improve the pollutant treatment capacity, and will subsidize the livestock enterprises that implement digital and intelligent transformation, while punishing enterprises whose pollutant discharge does not meet the standards. In addition, the concept of enterprises and the government undertaking social responsibilities has been valued by all levels of society^[6, 7]. For example, when an enterprise implements digital and intelligent transformation but the government does not provide support, the government's reputation will be damaged. When an enterprise does not carry out digital and intelligent transformation and causes excessive pollutant discharge, its reputation will also be damaged^[8, 9]. To sum up, the digital and intelligent transformation issue of the government and livestock enterprises under the pollutant treatment mechanism is complex and unpredictable. How both sides will choose in terms of strategies, what kind of interaction will occur between the strategies and how they will evolve are currently unclear, and it is necessary to conduct in-depth research.

At present, there are few studies on the digital and intelligent transformation of livestock enterprises. Cheng *et al.*, from the perspective of collaborative governance, discussed the impact of tax and fee reduction policies on the digital transformation of traditional resource-based enterprises^[10]. Wang *et al.* deeply analyzed the key roles of two mechanisms, namely sewage discharge fines and government rewards, on the emission reduction behaviors of enterprises^[11]. Song *et al.* based on the evolutionary game theory, verified the positive impact of government subsidies on the effect of environmental emission reduction^[12]. Zhuo found that digital transformation can significantly improve the innovation quality of enterprises^[13]. Xu *et al.* further explored the promoting effect of digital transformation on ecological innovation and sustainable performance^[14]. However, there are few studies on the digital and intelligent transformation of livestock enterprises in the existing research. Based on the evolutionary game theory, this paper deeply explores the impact of government subsidies and punishment measures on the strategic choice of digital and intelligent transformation of livestock enterprises, which has important theoretical significance and practical value.

The main contributions of this paper include:

- (1) Constructing an evolutionary game model between the government and livestock enterprises under the digital and intelligent transformation mechanism, revealing the equilibrium mechanism among all stakeholders.
- (2) Based on the evolutionary path and direction of the game between the government and enterprises, proposing targeted strategic suggestions.

2. Model construction

- (1) In the digital and intelligent transformation of the government, the strategy set is $A = \{\text{Support, Not Support}\}$, and the probability of support is $x(0 \leq x \leq 1)$; the strategy set of breeding enterprises is $B = \{\text{Active Transformation, Passive Transformation}\}$, and the probability of active digital and intelligent transformation is $y(0 \leq y \leq 1)$, as shown in **Table 1**.
- (2) When the livestock enterprises actively transform, they enhance the ability to handle pollutants and reduce environmental pollution. At this time, the pollutant treatment income of the enterprises is I and the comprehensive income is R_1 , and the government's income is respectively G_1 . The cost of implementing

digital and intelligent transformation for enterprises is C_2 , and the government's income is respectively G_2 . When the livestock enterprises passively transform, they do not invest any cost. The cost required for handling pollutants is recorded as W , and the comprehensive income of the enterprises is R_2 . Environmental pollution is caused, and the loss to the government's reputation is V .

- (3) The government offers tax deductions (denoted as S) to enterprises undergoing digital and intelligent transformation, as well as cost subsidies for digital and intelligent transformation (denoted as C_1). The negative constraint is the penalty (denoted as F) imposed on enterprises for passive transformation and causing pollution.
- (4) When breeding enterprises actively carry out digital and intelligent transformation but receive no support from the government, it will cause certain reputation losses D_1 . When breeding enterprises are not active in digital and intelligent transformation, the enterprises will suffer image losses D_2 . When the government does not support enterprises in digital and intelligent transformation, the government will suffer reputation losses D_3 ^[15].

Table 1. Evolutionary game payoff matrix

Both sides of the game		Livestock enterprise	
		Positive transformation (y)	Negative transformation ($1-y$)
Government	Support(x)	G_1-C_1-S $R_1+S+C_1-C_2-C_3+I$	G_1-C_1-S $R_2+S+C_1-C_3-D_2-W$
	Not supported ($1-x$)	G_2-D_1 $R_1-C_2-C_3+I$	G_2-V-D_3 $R_2-C_3-D_2$

3. Sensitivity analysis

In order to present more intuitively the role of government technology and tax subsidies, as well as the technical costs that enterprises need to invest for active transformation in the digital and intelligent transformation process of livestock enterprises. In this paper, the MATLAB 2016a software is used to conduct numerical simulation of various parameters. The ode45 instruction is used to solve the replicator dynamic equations. Combined with the setting rules of numerical simulation in the existing literature, the initial assignment of each parameter is set as follows.

Table 2. Initial assignment of each parameter

Argument	R_1	R_2	C_1	C_2	D_1	D_2	D_3	S	I	W	V
Assign	120	100	30	60	80	30	10	30	10	20	40

3.1. The influence of technical subsidy costs C_1

Under the condition that other factors remain unchanged, let the values C_1 be set at 15, 30, 45, 50, and 60, respectively, and examine the impact of technical subsidy costs C_1 on the digital and intelligent transformation strategies of the government and breeding enterprises. As shown in **Figure 1(a)**, when the value C_1 is less than 50, the strategy evolution of the government tends to 1. As the value C_1 increases, when it is greater than 50, the strategy evolution of the government gradually tends to 0. Thus, within a certain range, the impact of government

technical subsidies C_1 on the government's strategy is positive. However, as the government subsidy increases and the government cost exceeds a certain threshold, the government is no longer inclined to support breeding enterprises in their digital and intelligent transformation.

In **Figure 1(b)**, as the value C_1 increases, the slope of the curve becomes smaller and smaller, that is, the probability that breeding enterprises actively carry out digital and intelligent transformation will gradually decrease. Thus, it can be known that although the impact of government technical subsidies on the strategic choice of digital and intelligent transformation of breeding enterprises is positive, as the technical subsidies for breeding enterprises increase, the probability of government support for the transformation of breeding enterprises becomes smaller, resulting in less expected benefits for the transformation of breeding enterprises, and ultimately weakening the willingness of breeding enterprises to actively transform.

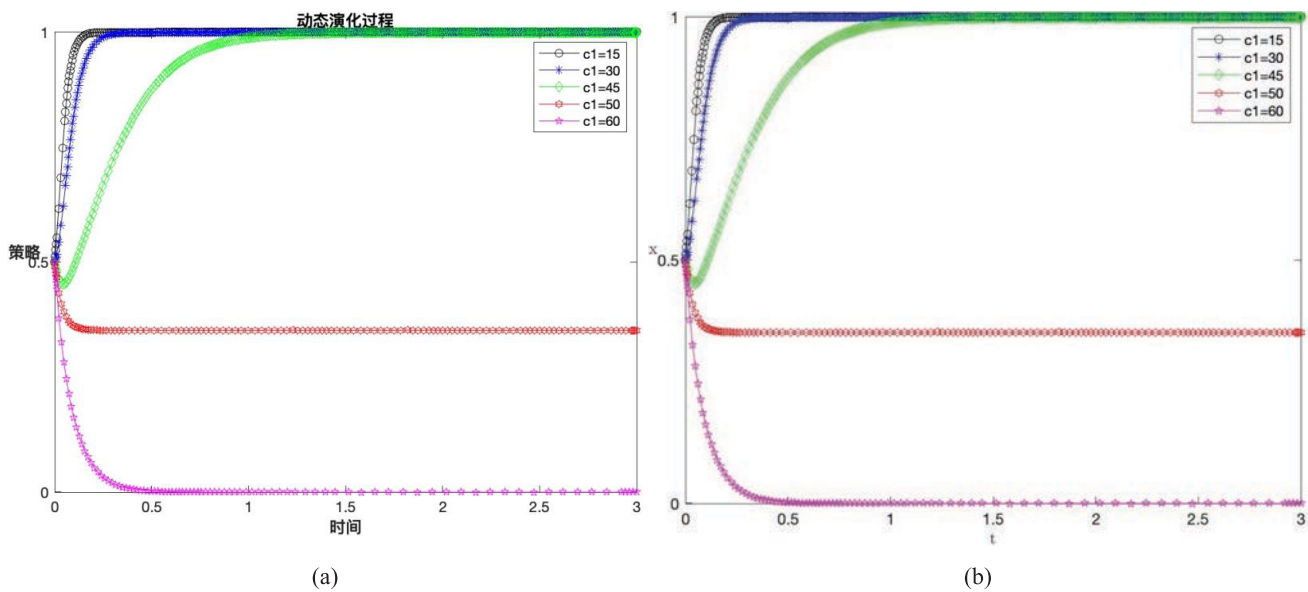


Figure 1. The influence of technical subsidy costs C_1

3.2. The influence of investment cost C_2 in digital and intelligent transformation technology

Under the condition that other factors remain unchanged, let the values C_2 be set as 20, 70, 130, 186, and 187, respectively. The impact of the simulation enterprise's transformation technology investment cost on the digital and intelligent transformation strategies of the government and enterprises was investigated. The simulation results are shown in **Figures 2(a)** and **(b)**. When the value C_2 is relatively small (less than 186), the strategy evolution of both the government and the breeding enterprises tends to 1. As the value C_2 increases, the slopes of the curves of both decrease, that is, the probability that both support the digital and intelligent transformation of enterprises gradually decreases. It should be noted that when the value is close to 186, due to the high upfront investment cost and the lag in the benefits brought by waste treatment, the intention of enterprise digital and intelligent transformation shows a downward trend at the beginning. As the benefits brought by waste treatment become increasingly significant, enterprises gradually tend to adopt an active transformation strategy. When the value C_2 is large (greater than 186), because the investment cost required for digital and intelligent transformation is too high and has exceeded the benefits brought to the enterprise by the transformation, the attitude of enterprises towards transformation becomes negative. Therefore, as time goes by, the cost for the government to promote enterprises'

digital and intelligent transformation becomes higher and higher, eventually leading the government to tend not to support enterprise transformation.

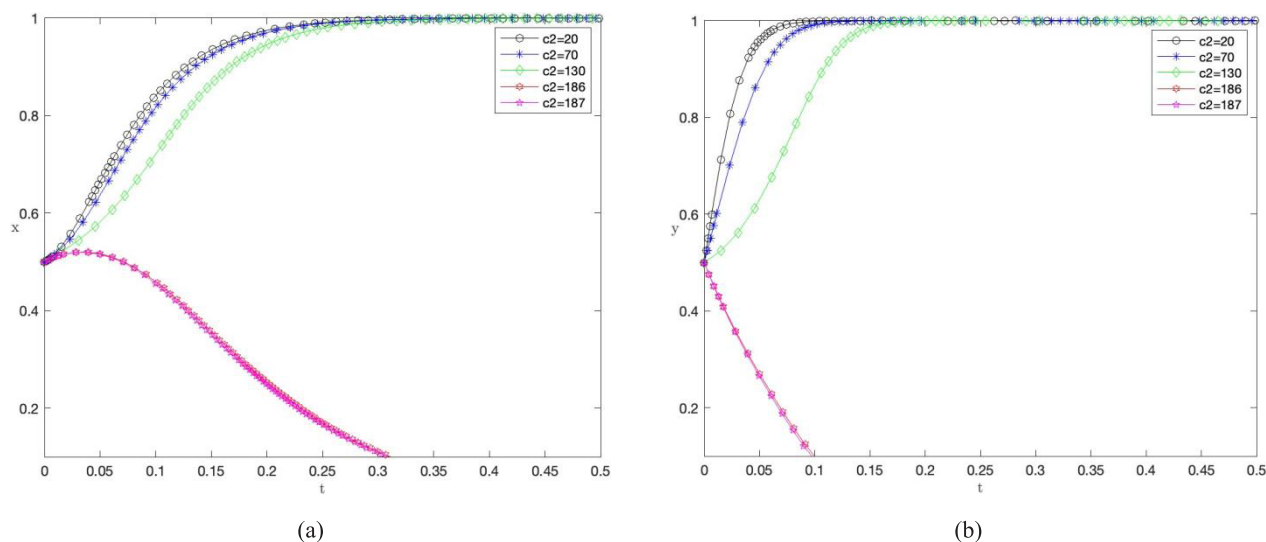


Figure 2. The influence of investment cost C_2 in digital and intelligent transformation technology

4. Conclusion

This paper starts from the background of the digital and intelligent transformation of livestock enterprises, constructs an evolutionary game model between the government and livestock enterprises, and conducts research and analysis on the evolutionary process and influencing factors of both sides. The research results show that:

- (1) The increase in government subsidies is an important factor promoting the digital and intelligent transformation of enterprises. The higher the direct technical subsidy, the more inclined the livestock enterprises are to undergo digital and intelligent transformation. However, as the subsidy cost increases, when it exceeds the benefits brought to the government by the transformation of enterprises, the benefits obtained by the government are not enough to cover the costs paid, and the government will choose not to support the digital and intelligent transformation of enterprises.
- (2) With the increase in the technical cost required for the digital and intelligent transformation of enterprises, the willingness of enterprises and the government to support digital and intelligent transformation will weaken. When it exceeds a certain threshold, the government and enterprises will tend to choose the {unsupported, passive transformation} strategy.
- (3) It is worth noting that in the entire digital and intelligent transformation process, the environmental impact has a relatively obvious lagging characteristic, so that the improvement effect of pollutant pollution in the early stage of digital and intelligent transformation cannot be fully reflected, resulting in the government choosing the non-support strategy in the early stage. However, as the effect of pollutant treatment gradually emerges, the government begins to choose to support the digital and intelligent transformation of enterprises.

To sum up, in order to further promote the implementation of the digital and intelligent transformation plan of livestock enterprises and promote the comprehensive and high-quality development of China's livestock industry,

the following countermeasures and suggestions are put forward:

- (1) For enterprises, by increasing investment in digital and intelligent systems, improving the overall economic benefits and environmental protection benefits of the industry, and focusing on the research and development of enterprise waste treatment and value-added products, efforts should be concentrated on solving the bottleneck problems of process technology and procedures that restrict the waste treatment capacity.
- (2) For the government, it is necessary to build a digital and intelligent platform to provide information and digital and intelligent services for the livestock industry, such as establishing a data center for the livestock industry and an intelligent livestock demonstration base. Furthermore, it is necessary to optimize the business environment, improve the efficiency of policy implementation and administrative efficiency, encourage livestock enterprises to actively carry out digital and intelligent transformation, and at the same time, strengthen the government's supervision of the livestock industry to promote the green, healthy and sustainable development of the livestock industry.

Disclosure statement

The authors declare no conflict of interest.

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The Creation Path of Regional Brand of Tourism Performance in Hainan

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Abstract: Hainan boasts unique natural and cultural resources, offering tremendous potential for development in the tourism performance sector. This paper delves into the significance and value of creating a regional brand for Hainan's tourism performances. Based on an analysis of the current state of Hainan's tourism performance, it explores the challenges faced and proposes a multi-faceted approach to building a regional brand, including resource integration, product innovation, brand communication, and talent cultivation. The aim is to promote high-quality development in Hainan's tourism performance industry, enhance the cultural appeal and market competitiveness of Hainan's tourism, and support the construction of Hainan as an international center for tourism consumption.

Keywords: Hainan tourism performance; Regional brand; Creation path; Cultural tourism integration

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1. Introduction

In the context of deep integration in the cultural and tourism industry, tourism performances, as a unique cultural tourism product, are increasingly becoming an important means for various regions to enhance their tourist appeal and enrich the travel experience. Hainan, with its enchanting tropical scenery, diverse ethnic cultures, and the unique advantages of its free trade port policy, is vigorously developing its tourism performance industry. Creating a regional brand for Hainan's tourism performances not only helps to integrate Hainan's rich tourism performance resources and boost the overall competitiveness of the industry, but also further enriches the connotations of Hainan as an international tourism consumption center. This promotes the transformation and upgrading of Hainan's tourism industry and has far-reaching significance for Hainan's economic development and cultural dissemination^[1-3].

2. Development status of tourism performance in Hainan

2.1. Rich tourism performance activities

In recent years, tourism performance activities in Hainan have flourished, with increasingly diverse forms. Besides

traditional “red artists” performances, there are also impression series live shows, large-scale song and dance performances, and red culture-themed shows ^[4]. For example, Sanyas Everlasting Love vividly presents historical themes such as the “Legend of Deer Head, Jianzhen’s Journey to Japan, and the Prefect of Yazhou” through captivating song and dance performances; the “Red Detachment of Women” staged at the Qionghua Theater in Boao spreads red culture, allowing visitors to gain a deeper understanding of local history and culture while enjoying the performances ^[5]. Since 2023, large-scale commercial performance events across the province have attracted approximately 940,000 audience members, with about 49% coming from outside the island, generating tourism revenue of around 3.407 billion yuan, demonstrating the strong driving effect of tourism performances on Hainan’s tourism economy ^[6, 7].

2.2. Rational theater distribution

Hainan’s tourism performance venues are mainly located in developed tourist areas such as Haikou, Sanya, Wanning, Xinglong, Qionghai, and Baoting. These regions boast abundant tourism resources, convenient transportation, and well-equipped facilities, attracting a large number of tourists and providing a broad market for tourism performances ^[8]. For example, the Sanya Everlasting Show Performance Venue adopts a “theme park + performance” business model. Visitors can explore various cultural attractions within the scenic area before and after watching the show, significantly enhancing their experience and drawing many domestic and international audiences ^[9].

2.3. Continuously improve the quality of performances

As the tourism performance market develops, Hainan’s various performance theaters are increasing their investment, improving hardware facilities, and enhancing performance quality. Many theaters have evolved from small venues with just a few hundred seats to large air-conditioned theaters with over a thousand seats, featuring more advanced stage designs and significantly improved sound, light, and electrical technology applications, offering audiences a better audio-visual experience ^[10]. For example, the Sanya Everlasting Show Theater, which cost 200 million yuan to build, has 4,000 seats and advanced stage design, capable of delivering stunning visual effects to the audience ^[11].

3. The challenges faced by the creation of regional brand of tourism performance in Hainan

3.1. Weak brand awareness and lack of overall planning

Currently, most tourism performance companies in Hainan operate independently, lacking an overall plan for regional branding and a sense of coordinated development ^[12]. Each performance project lacks unified strategic guidance in brand positioning, image building, and market promotion, making it difficult to form a strong brand synergy ^[13]. Some companies focus too much on short-term economic benefits, neglecting long-term investment in brand building, which results in low brand recognition and reputation ^[14].

Brand value recognition is insufficient, with most performance projects still at the basic stage of “performance as product,” lacking a deep understanding of brand premium capabilities ^[15]. For example, some Li and Miao cultural theme performances in Hainan only use traditional songs and dances as program content, failing to deeply integrate them with regional cultural IPs, leading to low brand recognition and weak market competitiveness. There is a lack of brand operation entities. Performance projects are mostly operated by scenic spots or tourism

enterprises, lacking a coordinating body at the provincial level. For instance, projects like Sanya Everlasting Love and Betel Nut Valley have gained some local fame but fail to form a brand alliance, making it difficult to achieve cross-regional resource integration^[16, 17]. The lack of brand protection mechanisms results in frequent issues such as trademark infringement and content plagiarism. Some traditional performance projects, due to untimely registration of intellectual property rights, have led to the misuse of cultural symbols. For example, Li ethnic groups brocade patterns are casually used by some merchants for product packaging, damaging the cultural value of the brand.

The deep-seated contradiction of the overall planning deficiency lies in the fragmented spatial layout, with most performance projects concentrated in core cities like Sanya and Haikou, while high-quality resources in Central and Western counties and cities remain underutilized^[18]. For instance, Wuzhishan Li ethnic culture is rich in resources, but there is a lack of matching performance projects, leading to imbalanced regional development. The synergy within the industry chain is insufficient, with loose connections between performances and tourism, accommodation, transportation, and other sectors, resulting in a prominent “see-and-go” phenomenon among tourists^[19]. Data shows that the average stay duration for Hainan’s tourism performance projects is less than 1.5 hours, far below that of mature international destinations (such as Las Vegas, where performance projects attract visitors to stay for over three days). Policy support is fragmented, with existing policies often focusing on subsidies for individual projects and lacking systematic support for brand cultivation and market promotion. For example, some performance projects have been forced to halt due to broken capital chains, yet local authorities have not established a risk-sharing mechanism^[20].

3.2. Insufficient exploration of cultural connotation and serious product homogenization

Hainan boasts rich cultural resources, including Li ethnic culture, maritime culture, and red culture. However, in the development of tourism performance products, these cultural resources often remain superficial, lacking in-depth exploration and interpretation. For instance, some performance projects showcase Hainan’s ethnic customs but fail to delve into their historical roots and cultural significance, making it difficult for tourists to resonate. In certain performances, the use of cultural elements appears forced and disconnected, failing to integrate organically with the content. For example, some projects rely excessively on high-tech means to achieve visual effects while neglecting the intrinsic value of cultural elements, resulting in a lack of cultural depth in the performances. In the Hainan tourism performance market, some projects exhibit imitation and plagiarism, lacking originality and uniqueness. This leads to severe homogenization of performance products, making it hard to establish brands with market competitiveness.

Product homogenization is severe, with a single form of expression. Hainan’s tourism performance products are relatively monotonous, mostly featuring song and dance performances, lacking innovation and diversity. This singular form of expression fails to meet the increasingly diverse needs of tourists and can easily lead to aesthetic fatigue. Some performance projects exhibit similar content settings, lacking specificity and differentiation. For example, multiple projects focus on Hainan’s ethnic customs, but their specific presentations are largely the same, failing to leave a lasting impression on visitors. The presentation of regional characteristics in Hainan’s tourism performance products is not prominent enough, failing to fully showcase Hainan’s unique natural landscapes and cultural ambiance. This results in a lack of recognizability for performance products, making it difficult for them to stand out in fierce market competition.

Although Hainan boasts abundant cultural resources, the exploration and presentation of local cultural

connotations in tourism performance products are not yet deep enough. Some performance projects simply imitate successful cases from other regions, lacking innovation and failing to fully showcase Hainan's unique history, culture, folk customs, and natural scenery. The products suffer from severe homogenization, unable to meet the increasingly diverse needs of tourists, which reduces the market competitiveness of Hainan's tourism performance.

3.3. The brand communication channel is single and the marketing effect is not good

Hainan's tourism performances mainly rely on traditional promotional channels for brand communication, such as travel agency recommendations and scenic area brochures, with insufficient use of new media and internet platforms. The content and format lack creativity, making it difficult to attract the attention of younger tourists. Additionally, there is a lack of systematic marketing planning, leading to a lack of coherence and focus in marketing activities, which hinders the effective expansion of the brands influence.

3.4. Shortage of professional talents restricts the development of brands

The development of the tourism performance industry requires professionals in screenwriting, directing, acting, stage design, marketing, and more. However, Hainan currently faces a shortage of specialized talent in tourism performances. The talent cultivation system is inadequate, with insufficient related programs offered by local universities and poor alignment between the supply and demand of talent in enterprises. This shortage leads to a lack of innovation in performance products, low brand operation and management levels, severely hindering the development of Hainan's regional tourism performance brands.

4. Creation path of regional brand of Hainan tourism performance

4.1. Strengthen resource integration and clarify brand positioning

Integrate cultural resources and delve into Hainan's historical culture, folk culture, maritime culture, and other distinctive cultural resources to establish a cultural resource database. Break down geographical and corporate boundaries, enhance cooperation and exchange among various tourism performance projects, integrate advantageous resources, and create a tourism performance product system with Hainan characteristics. For example, combine the Li and Miao cultures of Hainan with its maritime culture to produce large-scale live performances that showcase Hainan's unique ethnic charm and maritime allure.

Clarify the brand positioning based on Hainan's cultural characteristics and tourism market demands. Highlight Hainan's unique advantages as a tropical island tourist destination, aiming to create the image of a "Capital of Tropical Island Cultural Performances." Attract domestic and international tourists with its distinctive cultural appeal. Emphasize the core values of the brand, such as romance, warmth, and multicultural integration, to form a clear brand recognition for Hainan's tourism performances among visitors.

4.2. Create innovative performance products and improve brand quality

Content innovation encourages performance enterprises to increase investment in original works, using historical stories, folk legends, and local customs of Hainan as material to create performances with Hainan characteristics. Emphasis is placed on combining storytelling with entertainment value, integrating modern technological elements to enhance the appeal and impact of performances. For example, virtual reality (VR) and augmented reality (AR) technologies are employed to create immersive performance experiences, allowing visitors to feel the charm of Hainan culture as if they were there in person.

Innovative forms break free from the constraints of traditional performance formats, exploring diverse performance styles. Besides stage and live performances, street performances and interactive shows can also be developed to increase visitor participation and experience. For example, setting up performance areas for street artists in tourist attractions and hosting interactive folk cultural performances allows visitors to interact closely with performers, enhancing their understanding and appreciation of Hainan culture. Quality improvement involves strengthening quality supervision of tourism performance products and establishing a robust quality evaluation system. From scriptwriting, directing, and acting to stage design, costumes, and props, strict quality standards are enforced to ensure high-quality performances. Regularly inviting professionals to assess and guide performance products continuously improves and enhances performance quality, elevating brand value through superior products.

4.3. Strengthen brand communication and expand brand influence

Diversify communication channels, fully utilizing the internet, social media, and other emerging platforms to conduct comprehensive and multi-level brand promotion. Establish an official website and social media accounts for Hainan tourism performances, promptly releasing performance information, stunning photos, behind-the-scenes snippets, and more to attract fan attention. Leverage TikTok, Weibo, WeChat, and other platforms to create creative short videos and live stream performance clips, expanding the reach of the brand. Collaborate with online travel platforms to include tourism performance products in travel route recommendations, increasing product exposure.

Holding brand events, regularly organizing tourism performance festivals and cultural arts festivals with international influence, inviting renowned domestic and international performing arts groups to participate, aims to create a brand event for Hainan's tourism performances. By hosting these events, media attention and tourist participation can be attracted, enhancing brand recognition and reputation. For example, the Hainan International Tourism Performance Festival includes opening ceremony performances, excellent showings, and forums on the performance industry, showcasing the development achievements of Hainan's tourism performances and promoting cultural exchange and cooperation in the performing arts between China and other countries.

Conduct cooperative marketing and strengthen cooperation with other tourist destinations, tourism enterprises, cultural institutions, etc., to carry out joint marketing activities. Through resource sharing and complementary advantages, jointly promote the regional brand of Hainan's tourism performances. For example, collaborate with scenic areas in neighboring cities to launch joint products combining "tourism performances + scenic area tours"; work with airlines and hotels to bundle tickets for flights, accommodations, and performance tickets, thereby increasing the market share of the brand.

4.4. Cultivate professional talents and consolidate the foundation of brand development

Improve the talent cultivation system, strengthen cooperation between local universities and vocational colleges with tourism performance enterprises, and offer majors related to tourism performances, such as performance, directing, stage art design, and cultural industry management. Develop talent cultivation plans based on market demand, emphasize practical teaching, establish internship and training bases, provide students with practical opportunities, and cultivate professionals who can meet the needs of the tourism performance industry's development.

Attract high-end talent and formulate preferential policies to draw outstanding tourism performance talents

from home and abroad to develop in Hainan. Provide guarantees in housing, children's education, medical care, and other aspects to address the concerns of these talents. Through talent introduction, advanced concepts, technologies, and experiences will be brought in, enhancing the creative level and management capabilities of Hainan's tourism performances. For example, offer substantial subsidies and rewards to renowned screenwriters, directors, and actors introduced, attracting them to join the Hainan tourism performance industry.

Strengthen talent training and exchange by regularly organizing training and exchange activities for tourism performance professionals, inviting domestic and international experts and scholars to give lectures and provide guidance. Encourage professionals to participate in domestic and international performance competitions, seminars, and other events to broaden their horizons and enhance professional competence. Establish an industry talent exchange platform to promote communication and cooperation among talents, fostering a favorable environment for talent development.

4.5. Strengthen policy support and optimize the brand development environment

The government has introduced a series of policies to support the development of the tourism performance industry, including financial subsidies, tax incentives, and land support. A special fund for the development of the tourism performance industry has been established to provide financial assistance to outstanding performance projects, original works, and talents; tax reduction policies have been implemented for tourism performance enterprises to reduce their burden; priority is given to meeting the land needs of tourism performance projects, providing solid policy support for industrial development.

Optimize the approval process, simplify the approval procedures for tourism performance projects, and improve approval efficiency. Establish a one-stop approval service platform to achieve informatization and convenience in the approval of performance projects. Reduce unnecessary approval steps, shorten approval time, provide efficient and high-quality services for enterprises, and stimulate market vitality.

Strengthen market regulation, enhance supervision of the tourism performance market, and standardize market order. Establish and improve mechanisms for market entry and exit, crack down on unfair competition, and protect consumers' legitimate rights and interests. Intensify the review of performance content to ensure it is positive and healthy, aligning with socialist core values, and create a favorable environment for market development.

5. Conclusion

Creating a regional brand for Hainan's tourism performance industry is a key measure to promote high-quality development in this sector. It holds significant importance for enhancing the cultural depth and market competitiveness of Hainan's tourism. Despite numerous challenges currently faced in building a regional brand for Hainan's tourism performance industry, effective approaches such as strengthening resource integration, innovating performance products, enhancing brand communication, cultivating professional talent, and increasing policy support can help Hainan develop a tourism performance brand with international influence. This will not only enrich Hainan's tourism offerings and meet the increasingly diverse needs of tourists but also further integrate Hainan's cultural and tourism industries, contributing to the construction of an international tourism consumption center and injecting new vitality into Hainan's socio-economic development. In the future, Hainan's tourism performance industry should continuously innovate and innovate, steadily enhancing brand value to secure a

prominent position in both domestic and international tourism performance markets, becoming a shining card showcasing Hainan's cultural charm.

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Disclosure statement

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Research on Conflict of Interest and Integration Mechanism in Cross-Departmental Collaborative Governance

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Abstract: With the increasing complexity of social public affairs, cross-departmental collaborative governance has become an important model of modern administrative management. However, conflicts of interest frequently occur during the collaboration process, which are mainly reflected in resource allocation, goal differences, and power games. These conflicts are caused by factors such as cultural differences within departments, inconsistent performance evaluation systems, and personal interests of department members. To address these issues, it is necessary to design multi-level integration mechanisms, including establishing stable communication channels and unified goals and evaluation systems. Successful integration cases in various fields, such as food safety supervision, environmental protection, and urban transportation governance, show that effective integration mechanisms need to establish institutionalized communication carriers, form a consensus target system, and design guarantee measures with both incentives and constraints. Although current research has achieved certain results, there are still limitations, such as insufficient attention to underdeveloped regions, a lack of consideration of cultural factors, and a narrow focus on internal government collaboration. Future research can explore differentiated integration models, introduce third-party assessment institutions, and strengthen research on the participation mechanism of enterprises and social organizations.

Keywords: Departmental collaborative governance; Conflict of interest; Integration mechanism; Influencing factors; Case study

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1. Introduction

As the complexity of social public affairs continues to increase, cross-departmental collaborative governance has gradually become an important model of modern administrative management. During the “deregulation, regulation, and service” reform implemented by China in 2018, multiple provincial governments established cross-departmental joint approval mechanisms. Shanghai Pudong New District has integrated 12 departmental functions,

such as market supervision and taxation, and the time for enterprise establishment is shortened to 3 working days^[1]. This practice shows that inter-departmental coordination can effectively improve administrative efficiency. Conflicts of interest frequently occurred during the collaboration. For example, in the joint food safety rectification campaign in a certain place in 2020, the agricultural department focused on the supervision of production links, and the market supervision department focused on the circulation field. The two sides had differences on testing standards and law enforcement authority, resulting in the postponement of the special operation for two months^[2]. This conflict stems from differences in departmental functional positioning, but also involves unequal performance appraisal indicators. For example, the ecological and environmental protection department attaches importance to the effectiveness of pollution control, while the economic department pays more attention to the speed of industrial development^[3]. Existing research focuses on theoretical framework construction. For example, literature visual analysis shows that domestic and foreign scholars have achieved rich results in collaborative governance of subject relations and institutional design, but the research on interest games in dynamic operation is relatively weak^[4]. Especially in the Chinese situation, there are both vertical hierarchical constraints and horizontal competition relationships between departments. This dual characteristic makes conflict manifestations more complex. For example, during the construction of the Guangdong-Hong Kong-Macao Greater Bay Area, the environmental protection departments of different cities must not only implement superior emission reduction indicators, but also balance local economic development needs, which has led to the hindering of the implementation of the coordinated pollution control agreement^[5].

2. Analysis of conflicts of interest in cross-departmental collaborative governance

In cross-departmental collaborative governance, conflicts of interest are manifested in diverse and complex forms, mainly reflected in three levels: resource allocation, goal differences, and power game. Taking resource conflicts as an example, the competition for limited resources by different departments often leads to reduced cooperation efficiency. For example, in food safety supervision, the agricultural department is responsible for the inspection of the production link, and the market supervision department is responsible for the inspection of the circulation link. The two parties have repeatedly experienced repeated inspections or equipment idle due to competition in equipment procurement budgets^[2]. Data shows that in 2021, about 37% of the special funds for food safety in a certain province are used to repeatedly purchase rapid testing equipment with the same functions. This waste of resources directly weakens the actual effect of cross-departmental cooperation. The goal-oriented conflict is more concealed but significantly destructive. When the environmental protection department emphasizes ecological protection indicators while the economic development department focuses on the growth of industrial output value, the differences in performance evaluation standards between the two parties will form resistance to policy implementation. This contradiction is particularly prominent in the construction of a development zone in a city in the Yangtze River Delta.

The Environmental Protection Bureau's policy of requiring enterprises to install pollution treatment equipment is hedged with the tax incentives promised by the China Merchants Bureau, resulting in the 12 contracted enterprises eventually withdrawing their investment^[3]. The power conflict is concentratedly reflected in the competition for decision-making dominance. In the early stages of smart city construction in a district in Shanghai, the big data center and various business departments had a fierce debate on the right to formulate data interface standards, resulting in an 8-month delay in the start of the project^[1].

3. Factors influencing conflicts of interest

The causes of conflicts of interest in cross-departmental cooperative governance involve many factors. From the perspective of internal departments, cultural differences between different departments often cause conflicts. For example, some departments focus on efficiency first, while others emphasize procedural norms, which makes it difficult to coordinate the decision-making rhythm. The traffic management department of a certain city had friction with the detailed review requirements of the project and the environmental protection department, which eventually delayed the construction period for three months ^[2]. Inconsistent performance evaluation system is also an important obstacle. For example, in food safety supervision, agricultural departments pay attention to output indicators while market supervision departments focus on passing rates, resulting in differences between the two parties in setting the frequency of sampling inspections. The personal interests of department members cannot be ignored. A survey has shown that more than 40% of grassroots civil servants are more concerned about the acquisition of resources in their departments rather than the overall project benefits ^[5]. These internal factors are intertwined, causing information blockade, responsibility shirking, and other phenomena often occur during the cooperation process. When a province promoted the construction of smart cities, three of the six participating departments refused to share core data, which directly led to the failure of system integration.

4. Integration mechanisms for resolving conflicts of interest

In cross-departmental collaborative governance, effective resolution of conflicts of interest requires the design of multi-level integration mechanisms. First, establishing a stable communication channel is the key to reducing misunderstandings. For example, when Shanghai was promoting the construction of smart cities, the project was postponed due to inconsistent data standards between the environmental protection department and the transportation department. By establishing a weekly cross-departmental joint meeting, the technicians of both sides jointly build an information sharing platform, ultimately real-time connection between air quality monitoring data and traffic flow analysis. Such mechanisms not only promote information transparency but also relieve tensions between departments through regular dialogue. Secondly, unified goals and evaluation systems can balance the demands of multiple parties. Taking food safety supervision in a certain province as an example, the agricultural department focuses on pesticide residue testing in the production link, and the market supervision department focuses on label compliance in the circulation link. The two local governments have formulated the “Cross-Departmental Collaborative Performance Evaluation Measures” and used the “full-chain pass rate” as a joint assessment indicator to prompt department staff to shift from a single responsibility to a coordinated goal. Data shows that after the implementation of this method, the regulatory duplication rate decreased by 37%, and the traceability efficiency of problematic products increased by 52%. This institutional innovation proves that breaking departmental barriers requires linking collaborative outcomes to individual performance, thereby changing the inherent way of profit calculations.

5. Case studies of successful integration

Successful cases of integrated mechanisms in cross-departmental collaborative governance can be found in multiple practical areas. For example, in terms of food safety supervision, multiple government departments have caused regulatory loopholes due to unclear division of responsibilities. The “Food Safety Joint Command Center” established by a certain province has enabled the agricultural department to form a normalized collaboration

between the market supervision department by formulating a departmental responsibility list, a shared testing data platform, and a joint law enforcement process. The platform integrates agricultural product traceability system and market sampling data, and realizes information interoperability through cross-system permission settings. Data shows that the province's pork product pass rate increased by 19.3% after the collaboration mechanism was operated for two years, and the number of consumer complaints fell by 42%. This effect comes from the three-level coordinated meeting system held regularly, namely a three-dimensional communication system composed of provincial quarterly meetings, municipal monthly meetings, and county biweekly meetings. Another typical case comes from the field of environmental protection.

A certain river basin ecological governance project faces a conflict of targets between the water conservancy department and the environmental protection department in the early stage. The water conservancy department focuses on flood control and drainage functions, while the environmental protection department emphasizes water quality improvement indicators. This difference has led to repeated modifications to the project plan. After the introduction of the third-party expert evaluation team, the two sides reached a consensus on the ecological flow control standards and finally formed a combined ecological weir design that takes into account both flood control and water purification. This technical intermediary mechanism cooperates with the reform of the target assessment system and incorporates the basin water quality improvement indicators into the performance appraisal of the water conservancy department. Monitoring data after the project is completed shows that while the ammonia nitrogen concentration in the basin has dropped by 65%, the flood control standards have been increased from once in twenty years to once in fifty years.

Cross-departmental collaboration in comprehensive urban transportation governance is also worthy of attention. To solve the problem of "road zipper", a megacity established a comprehensive underground pipeline management information system, requiring municipal, power, communication, and other departments to submit pipeline data and participate in the Federation's review before construction. By setting up a dynamic evaluation system for "road excavation index", double constraints on credit deductions and economic penalties are imposed on repeated excavation behaviors. During the three years of operation of the system, the rate of repeated excavation of roads has decreased by 82%, and the rate of pipeline accidents has decreased by 57%. These cases reveal three key elements of an effective integration mechanism: first, establishing institutionalized communication carriers, such as regular meetings, data platforms, etc. physical connections; second, forming a consensus target system, eliminating target differences through adjustment of assessment indicators or unified technical standards; designing guarantee measures that emphasize both incentives and constraints, and transforming the results of collaboration into the actual interests of the department. It is worth noting that there are differences in successful experiences in different fields.

Ecological and environmental governance relies more on the integration of technical standards, food safety supervision focuses on process reengineering, while urban management emphasizes data sharing mechanisms. But the common point is that they both break through the rigid constraints of traditional departmental boundaries and build a dynamic allocation network of resources and information through institutional innovation. This networked collaboration model shows strong adaptability in practice. For example, in the process of investment promotion, a certain economic development zone handles the land approval and environmental protection pre-examination process in parallel, and shortens the approval cycle for 45 days through the "joint pre-examination meeting" mechanism. This mechanism innovation is essentially an improvement in efficiency through operational process optimization without changing the statutory responsibilities of the department. Judging from the implementation

effect, successful integration mechanisms can often produce multiplier effects. The “One-stop Enterprise Service” system implemented by a certain city integrates 327 approval matters from 28 departments. On the surface, it is a technical platform construction, but in essence it forces departments to reconstruct the approval process through data sharing.

After the system is running, the average number of corporate affairs operations has dropped from 7.8 to 0.3 times, but the more far-reaching impact is that it promotes the accumulation of trust among departments and lays the foundation for subsequent deepening of collaboration. The formation of this trust capital is often more sustainable than specific technical means. Existing practices also show that leadership has special value in the integration process. When a certain place promoted the renovation of old communities, there were differences between the housing and construction departments and the civil affairs departments on the priority of fund use. The intervention of the deputy mayor in charge did not adopt administrative orders, but instead organized staff from both departments to visit 20 communities to collect residents’ opinions, and finally determined the implementation principle of “priority of basic transformation and synchronous age-friendly transformation”. This flexible coordination method not only maintains departmental autonomy but also ensures the realization of overall goals. Data shows that the city’s renovation project residents’ satisfaction rate reached 93.7%, far exceeding other regions that adopted the traditional working method during the same period. These practical experiences provide a new perspective for theoretical development, that is, cross-departmental collaboration not only requires mechanism design, but also pay attention to dynamic adaptation capabilities during implementation.

6. Conclusion

In the process of cross-departmental collaborative governance, the existence of conflicts of interest often hinders the realization of policy goals. Research has found that conflicts caused by uneven resource allocation among departments are the most common, such as the conflict between the environmental protection departments and industrial development departments in a certain province, which revolves around the supervision of polluting enterprises. The former focuses on environmental indicators, while the latter pays more attention to economic growth data ^[5]. This difference in targets has led some enterprises to be free from supervision for a long time, which not only damages the ecological environment but also affects market fairness. Field research shows that departments in underdeveloped areas are more likely to have conflicts due to tight financial resources. Three departments at a county-level city once had a dispute over sharing an official vehicle for half a year. Future research can explore differentiated integration models, for example, referring to the ecological compensation mechanism of the Guanzhong Plain urban agglomeration, and designing a cross-departmental resource replacement model. The existing theoretical framework does not consider cultural factors enough, and the “face concept” in Chinese traditional culture will affect the willingness of department leaders to cooperate, which was confirmed in a cross-provincial river basin governance consultation meeting-the two directors delayed the project for three months due to differences in public opinions ^[6].

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Digital Intelligence Empowerment and New Quality Productivity of Listed Enterprises in Fujian Province

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Abstract: This paper examines the impact of digital intelligence transformation on new quality productivity in enterprises in Fujian Province. It highlights the challenges these enterprises face, such as limited talent and infrastructure, in adopting technologies like cloud computing, big data, and artificial intelligence. The research finds that digital intelligence can enhance innovation, efficiency, and market adaptability, driving significant improvements in productivity. The study emphasizes the need for organizational changes and government support to overcome barriers and accelerate transformation, offering valuable insights for both academia and industry.

Keywords: Digital intelligence; New quality productivity

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1. Introduction

The private economy is a significant force in achieving the goal of building a socialist modern strong country and realizing the second centenary goal. As a major province for private enterprises, Fujian's private economy contributed nearly 70% of the provincial GDP and 94% of the number of enterprises in 2023. However, challenges remain, including the large proportion of traditional industries and the excessive number of small and medium-sized enterprises. To promote the transformation from a major private economy province to a strong private economy province, the Fujian Provincial Government issued the "Opinions on Implementing the New Era Private Economy Strong Province Strategy to Promote High-Quality Development" in August 2023. This document clearly states the support for the specialized, refined, distinctive, and innovative development of small and medium-sized enterprises, as well as the expansion of private enterprises. Developing new quality productivity is an intrinsic requirement and important focus for the high-quality development of specialized and innovative enterprises. Therefore, improving the new quality productivity of these enterprises is a key guarantee for Fujian's deeper implementation of the new era strategy for a strong private economy province.

2. Current research status and review

2.1. Research progress of new quality productivity

In the context of rapid changes in the global economic landscape and continuous technological innovations, the study of new quality productivity has become a focal point for both academia and industry. In recent years, many scholars have conducted in-depth discussions on the connotation, characteristics, formation mechanisms, and enabling effects of new quality productivity.

In terms of connotation, existing literature suggests that new quality productivity emphasizes the core role of technological innovation in driving productivity development^[1]. It is not merely the digitization or informatization of traditional productivity, but rather the reorganization and optimization of production factors based on the application of new technologies and the development of new business models, achieving a qualitative leap in productivity.

On the formation mechanism, existing research suggests that the cultivation and development of new quality productivity require multi-faceted support and conditions^[2]. Technological innovation is the cornerstone of new quality productivity development, while a sound institutional environment, policy support, talent training, a well-developed education system, and the collaborative innovation drive between enterprises and society all contribute to the comprehensive formation and continuous progress of new quality productivity.

Regarding its enabling effects, existing literature suggests that high-quality development ultimately comes down to the development of productivity^[3]. The intrinsic logic of new quality productivity enabling high-quality development is that new technologies accelerate the transformation of production methods, new driving forces enhance economic growth rates, and new qualities improve the quality of economic development.

Regrettably, current research on new quality productivity mostly remains at the theoretical level, lacking sufficient empirical support. However, recent studies have begun to address this gap.

2.2. Research progress of digital intelligence

The term “digital intelligence” is a new concept emerging in the field of digital economy research. As the digital economy rapidly develops, it has progressed from the informatization phase driven by IT methods to the digital phase based on big data and cloud computing technologies, and finally to the digital intelligence phase, where data serves as a factor of production, supported by artificial intelligence technologies. Currently, research on digital intelligence is still relatively limited, with the literature mainly focusing on two areas: the driving forces of digital intelligence transformation and the economic effects of digital intelligence.

In the research on the driving forces of digital intelligence transformation, scholars believe that the realization of digital intelligence transformation requires both external and internal driving factors. On one hand, the key external driving force lies in the application of new technologies, such as cloud computing, blockchain, and artificial intelligence technologies^[4-6]. On the other hand, internal driving factors within enterprises are linked to organizational and management changes. Some studies argue that organizational and management changes within enterprises, by optimizing processes, encouraging innovation, and improving efficiency, provide the impetus for digital intelligence transformation^[7]. Therefore, these changes are an important step and key guarantee for achieving digital intelligence transformation^[8].

In terms of the economic effects of digital intelligence, previous literature has mainly explored the macroeconomic and microeconomic effects from two perspectives. For example, from a macro-consumption perspective, they found that the degree of regional digital intelligence can promote the integration of upstream

and downstream value chain products and factor markets, reducing transaction costs and improving total factor productivity, thus facilitating the smooth operation of both domestic and international dual circulation.

At the micro level, scholars have conducted rich discussions based on the enabling effects of digital intelligence in different application scenarios, such as enterprise supply chains, business credit, corporate social responsibility, and multinational trade ^[3, 9]. For example, a study found that digital intelligence transformation can improve information asymmetry, promote innovation performance, enhance financial stability, and further empower corporate performance ^[3].

2.3. Research review

In summary, the enabling effects of digital intelligence have been widely discussed in academia. Meanwhile, research on new quality productivity has also gradually become a hot topic. However, there are at least two areas that require further expansion.

From the perspective of enterprise new quality productivity, there is a need for further empirical exploration of its formation mechanism. Although a considerable amount of literature has delved into the connotation, characteristics, formation mechanisms, and enabling effects of new quality productivity, these studies are mainly theoretical and lack empirical evidence ^[1–3]. Therefore, this project will empirically explore the formation mechanism of enterprise new quality productivity from the perspective of digital intelligence transformation to fill the gap in empirical research.

From the perspective of research progress on digital intelligence, there is a need to further expand the application scenarios of its enabling effects. Current literature mainly focuses on discussions of digital intelligence in enterprise supply chains, business credit, corporate social responsibility, and multinational trade ^[9, 10]. However, the impact of digital intelligence on enterprise new quality productivity, a crucial force for enterprise survival and development, has been rarely explored. Therefore, it is necessary to further expand the application scenarios of digital intelligence enabling from the perspective of enterprise new quality productivity.

3. Conclusions and policy implications

3.1. Conclusions

This study explores the impact of digital intelligence transformation on enterprise new quality productivity. It is found that the digital intelligence transformation may enhance a company's innovation capability, production efficiency, and market adaptability, thereby improving the level of new quality productivity. By driving technological innovation and facilitating personalized customization, enterprises, after introducing digital technologies such as cloud computing, big data, and artificial intelligence, are able to more efficiently integrate and utilize resources, achieving a qualitative leap in productivity. This process allows enterprises to make significant progress in technological innovation and market competitiveness.

However, the success of digital intelligence transformation relies not only on external technological drivers but also on internal organizational changes within enterprises. To achieve improvements in new quality productivity, companies must focus on fostering an innovation culture, gaining support from management, and effectively integrating digital tools. Only by creating a positive innovation atmosphere internally can enterprises fully unleash their productivity potential and maintain a competitive edge during the transformation process.

At the same time, private enterprises in Fujian Province, especially small and medium-sized enterprises, face

numerous challenges in digital intelligence transformation. For example, a shortage of technical talent, insufficient funding, and weak digital infrastructure have hindered the speed and effectiveness of transformation. These issues have affected the smooth progress of enterprises in digital intelligence transformation and limited the improvement of new quality productivity. Therefore, government policy support is crucial in this process. By providing tax incentives, innovation rewards, and digital technology training, the government can effectively help enterprises overcome these obstacles and accelerate their transformation pace.

3.2. Policy implications

To accelerate the digital intelligence transformation and enhance the new quality productivity of private small and medium-sized enterprises in Fujian Province, several key policy initiatives should be considered. First, the government should invest in educational and technical training programs to address the talent gap. These programs should focus on emerging technologies such as artificial intelligence, big data, cloud computing, and digital management. By improving the digital skills of the workforce, small and medium-sized enterprises will be better equipped to adopt these technologies and integrate them into their operations, ultimately boosting their innovation capacity and productivity.

In addition to talent development, improving digital infrastructure is a crucial step for facilitating digital transformation. Firms in Fujian often face challenges due to insufficient technological resources, which limits their ability to adopt and utilize digital tools effectively. The government should provide subsidies, tax incentives, and low-interest loans to help these enterprises invest in digital technologies, equipment, and platforms. This financial support will enable enterprises to upgrade their systems, improve operational efficiency, and remain competitive in a technology-driven economy.

Moreover, fostering collaboration between small and medium-sized enterprises, universities, research institutions, and technology providers is essential to accelerating the adoption of digital innovations. The government should create platforms for public-private partnerships to facilitate knowledge exchange, enabling enterprises to gain access to advanced technologies and new business models. Industry-specific collaboration initiatives will also help small and medium-sized enterprises tailor their digital transformation strategies to meet the specific needs of their sectors, leading to more efficient and targeted technological adoption.

The government should also focus on creating a supportive policy and regulatory framework to promote digital transformation. Simplifying the regulatory processes related to technology adoption and ensuring robust data security measures will reduce barriers for enterprises in embracing digital solutions. Additionally, providing clear guidelines and offering incentives for adopting digital intelligence technologies will encourage businesses to take the necessary steps toward modernization. A flexible, innovation-friendly regulatory environment will allow small and medium-sized enterprises to integrate advanced technologies while remaining competitive.

Finally, the government should implement policies that encourage innovation and foster sustainable growth. This can include providing financial rewards for innovation, supporting research and development activities within enterprises, and establishing digital innovation hubs. By encouraging enterprises to adopt personalized customization and technological innovations, they will be able to better adapt to market demands, increase efficiency, and differentiate themselves in the market. These policies will not only support enterprises in Fujian Province but also lay a strong foundation for the province's overall economic growth through enhanced new quality productivity.

In summary, a comprehensive approach involving talent development, infrastructure improvement, financial

support, collaboration, regulatory facilitation, and innovation-driven policies is essential to promoting the digital transformation of small and medium-sized enterprises in Fujian Province. By implementing these strategies, the government can help businesses overcome the challenges associated with digital transformation, increase their productivity, and strengthen their competitiveness in the global market.

Disclosure statement

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Digital Inclusive Finance and Financing Constraints of Small and Medium-sized Enterprises

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Abstract: Digital financial inclusion provides financial services through digital platforms, aiming to improve the ability of MSMEs and low-income groups to access financial resources, thereby easing their financing constraints and promoting economic growth and inclusive development. As an innovative financial model, digital financial inclusion utilizes modern technological means to significantly improve the accessibility and convenience of financial services, especially in areas where traditional banking services are under-covered. Digital finance has promoted the popularization of financial services such as micro-credit, micro-savings, and micro-insurance, and helped improve the financing environment of low-income groups and small and micro enterprises. At the same time, digital financial inclusion promotes financial literacy education and digital inclusion construction, and enhances the acceptance and use of digital financial instruments by the general public, which is the key to achieving sustainable development of digital financial inclusion. Therefore, digital financial inclusion can better ease the financing constraints of small and medium-sized enterprises and promote economic development.

Keywords: Digital inclusive finance; Small and medium-sized enterprises; Financing constraints

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1. Introduction

One of the core mechanisms of digital financial inclusion is to reduce the information asymmetry faced by MSMEs in accessing credit by easing financing constraints. With the help of advanced technology, digital platforms have improved transparency, streamlined lending processes, and provided alternative data sources for credit assessment, significantly enhancing SMEs' financing capabilities. Digital financial inclusion not only promotes corporate innovation and growth but also stimulates consumer demand, which in turn creates a positive feedback loop that benefits the overall economy. Despite the huge potential of digital financial inclusion, there are still many challenges in its implementation. For example, high investment costs, inadequate digital infrastructure, and cultural resistance may limit the widespread adoption of digital financial instruments by SMEs. Policymakers therefore need to address these issues and promote financial literacy and digital inclusion initiatives to ensure that digital financial inclusion can more effectively support MSMEs and thus enable economic growth ^[1-2].

In conclusion, digital financial inclusion is not only an important tool to ease financing constraints for MSMEs, but also a key factor to drive innovation and economic development. By overcoming existing challenges and maximizing the potential of digital finance, it will bring long-term positive impacts to businesses and society.

2. Overview of digital financial inclusion

Digital financial inclusion marks a fundamental shift in the way financial services are delivered, expanding the reach of financial services through technological innovation and significantly reducing the cost of services^[3]. This shift has profound implications for groups that have traditionally struggled to access banking services, especially small and medium-sized enterprises. The rapid development of digital financial services over the past decade, with the spread of mobile technology and the Internet, has driven the construction of a more inclusive financial services system and created new financial opportunities for more people and businesses.

3. Mechanisms for digital financial inclusion

Digital financial inclusion works effectively through several key mechanisms, the core elements of which are as follows:

3.1. Technology integration

By integrating advanced technologies such as mobile payments, blockchain, and artificial intelligence, digital platforms are able to efficiently assess credit risk and automate financial transactions. Such technological integration not only improves service efficiency, but also significantly reduces operating costs, making it more economically viable to provide services for small accounts.

3.2. Make data-driven decisions

Financial institutions are able to leverage alternative data sources (such as payment history, social media activity, and e-commerce transactions, among others) to assess the creditworthiness of borrowers. This approach is particularly useful for groups that lack a traditional credit history, especially small and medium-sized enterprises. With this data-driven approach to credit assessment, financial institutions can gain a more comprehensive understanding of borrowers' credit risks and provide more personalized financial services.

3.3. Reduce transaction costs

Digitization has significantly reduced the cost of providing financial services. By reducing reliance on traditional physical infrastructure, financial institutions are able to extend services to areas that were previously inaccessible due to high costs. This cost advantage has made financial services more accessible, especially to small and medium-sized enterprises and low-income groups, driving greater financial inclusion.

4. The current situation of financing for SMEs

At the beginning of 2020, the global spread of the novel pneumonia epidemic has severely impacted China's real economy, especially small and medium-sized enterprises. The resumption of business operations, disruption of cash flow and supply chains, and a sharp drop in foreign orders have caused concern. Small and medium-sized

enterprises are the main force driving China's economic development. By the end of 2018, small and medium-sized enterprises accounted for 97.6 percent of all industrial enterprises above designated size, and their main business income and profit accounted for 56.7 percent and 51.6 percent, respectively, according to the Statistical Yearbook of China Small and Medium-sized Enterprises.

However, in terms of obtaining financial support, it is difficult to match their contribution to social and economic development. The financing constraint of small and medium-sized enterprises is not only a chronic disease that hinders their own development, but also one of the important bottlenecks restricting China's economic transformation and upgrading. At present, the Chinese economy is in a critical period of changing the growth model, improving the structure, and changing the driving force. The gear shift of economic growth is obvious. At the same time, the unpredictable external economic environment has posed a major test to China's economic development. Therefore, it is particularly important to study how to alleviate the financing difficulties of small and medium-sized enterprises.

SMEs play a vital role in the global economy as they are the main drivers of job creation and economic growth. However, access to adequate financing remains one of the most significant challenges for these enterprises. Studies have shown that about 70 percent of SMEs globally face financing gaps of varying degrees, severely constraining their growth potential ^[4].

4.1. Sources of financing

The main sources of financing for SMEs include:

- (1) Traditional bank loans: Still the most important external financing channel, but the application process is often complicated, and the approval rate is low.
- (2) Equity financing: Includes venture capital and angel investment, but these options are usually only available for certain types of businesses with high growth potential ^[5].
- (3) Supply chain finance: Obtaining financing support through business relationships with large enterprises.
- (4) Alternative financing platforms: Including emerging financing channels such as crowdfunding and P2P lending.

4.2. Difficult and expensive financing

SMEs face multiple obstacles in accessing financing, starting with asymmetric information. As lower-middle enterprises lack complete financial records and credit history, it is difficult to fully demonstrate their business potential to financial institutions, so assessment costs are relatively high. Secondly, SMEs lack the necessary evaluation mechanism due to their low collateral value content and fewer tangible assets. At the same time, the operation scale of SMEs is limited, so the transaction cost of SMEs is relatively high, the scale economy effect is insufficient, and the risk diversification ability is limited. These reasons all lead to the financing of SMEs is very difficult.

5. The role of digital financial inclusion in easing financing constraints

Digital inclusive finance plays an important role in alleviating financial constraints by leveraging digital technologies to improve the availability and affordability of financial services, particularly in areas not covered by the traditional financial system. The goal of digital inclusive finance is to increase the accessibility of financial

services through scientific and technological innovation, so that more people, especially low-income groups, small and medium-sized enterprises, and residents in remote areas, can access convenient and low-cost financial services. The following are the main roles of digital financial inclusion in easing financing constraints ^[6]:

5.1. Reducing financing costs

Digital financial inclusion has lowered the operating costs of traditional banks and financial institutions through mobile payments, online lending platforms, and other means. Applying artificial intelligence (AI), machine learning, and big data technologies, digital financial inclusion is able to automate loan application, risk assessment, and approval processes. This not only improves the efficiency of loan approval, but also reduces labor costs, thereby reducing the overall cost of obtaining financing for borrowers ^[7].

5.2. Broaden financing channels

Small and medium-sized enterprises (SMEs) are one of the groups facing the most severe financing constraints. Traditional banks tend to be more cautious in approving loans to SMEs due to a lack of guarantee and insufficient credit history. However, with the help of big data analysis, blockchain technology, and credit scoring models, digital inclusive finance can comprehensively assess the credit status of enterprises, reduce risks, and provide loan services ^[8]. This enables more SMEs to access financing support, especially with no collateral or low collateral. In the traditional financial system, many low-income people, farmers, young people, and those without fixed assets have difficulty getting loans from financial institutions. Digital financial inclusion provides loans to these groups through non-traditional means such as credit scoring and consumer behavior analysis.

5.3. Improving access to finance

Traditional financial institutions tend to be concentrated in urban and economically developed areas, while residents in remote and rural areas often lack access to basic financial services. Digital financial inclusion has broken through geographical restrictions through means such as the Internet and mobile payment, enabling residents in remote areas to also enjoy financial services such as bank loans, insurance, and payments ^[9]. No matter farmers, low-income families, or small businesses in remote areas can access digital financial platforms through mobile phones or computers to apply for loans and buy insurance. With the popularity of smartphones and the Internet, more people can access digital financial services via mobile devices. Functions such as digital payment, online lending, and balance management allow those without bank accounts to carry out basic financial activities, thus gaining wider financial support and reducing financing barriers ^[10].

5.4. Optimizing financial products and services

Digital financial inclusion platforms can provide more personalized financial products to different user groups through big data analysis, behavior prediction, and AI technology. For example, based on a user's consumption record, credit data, repayment history, etc., the financial platform can customize the appropriate loan amount, interest rate, and repayment term for the borrower. Compared with the "one-size-fits-all" policy of traditional banks, such customized services can better meet the needs of different customers. Digital inclusive financial platforms usually provide more flexible repayment options, such as regular installments, early repayment, and late repayment, which helps to ease the financial pressure of borrowers and increase the feasibility of repayment, thereby improving the repayment rate of loans and further reducing financing risks.

5.5. Improving credit assessment and risk control

While traditional bank credit relies on a fixed credit history and collateral, many low-income groups and small and medium-sized enterprises do not have a well-established credit history. By integrating multi-dimensional data sources, such as social network data, mobile payment records, and e-commerce transaction data, digital inclusive finance provides a dynamic and comprehensive credit assessment of users. This assessment is not limited to financial status, but can also be combined with consumers' payment behaviors, living habits, social relationships, etc., to provide more information for credit decisions. By monitoring users' financial activities in real time, digital financial platforms can quickly discover potential risks or signs of default, and conduct timely warning and risk control. For example, by analyzing the transaction data and consumption habits of borrowers, the platform can detect abnormal behaviors and take measures to reduce default risks in advance ^[11].

5.6. Enhancing financial transparency and trust

Blockchain technology provides a more transparent and secure record of transactions and credit management for digital financial inclusion. Through blockchain, financial transactions can be recorded on the ledger in real time and are immutable, increasing the transparency of transactions, reducing the problem of information asymmetry, helping credit institutions to better assess the credit of borrowers, and reducing the occurrence of fraud. By establishing an information sharing mechanism, many digital inclusive financial platforms allow different financial institutions and credit platforms to share borrowers' credit information, transaction history, etc., thus helping borrowers establish a sound credit history, reducing obstacles to financing, and enhancing the overall transparency and efficiency of the financial market.

5.7. Promoting financial education and knowledge

Digital financial inclusion is not just about providing financing services, it is often accompanied by universal access to financial education. For example, many digital platforms will provide users with knowledge related to financial management, credit, and insurance through channels such as apps and WeChat to improve their financial literacy. Through these educational activities, users can better understand financing products, loan processes, repayment arrangements, and other content, to make more informed financial decisions and reduce financing difficulties caused by information asymmetry ^[12].

5.8. Dealing with sudden financial crisis

When emergencies such as epidemics and natural disasters occur, traditional banks are often unable to provide emergency financing support to the majority of the population in a timely manner due to network limitations and inadequate services. Digital inclusive finance, by means of mobile platforms and online lending, can respond quickly to market demand and provide short-term loans, consumer loans, and other products to enterprises and individuals in need of emergency funds to help them tide over difficulties ^[13].

By introducing digital technologies and innovative financial models, digital financial inclusion has eased financing constraints at multiple levels. It not only broadens financing channels and reduces financing costs, but also enhances the availability and personalization of financial services through more precise risk assessment and flexible product design ^[14]. In addition, digital financial inclusion has enhanced the efficiency and fairness of the financing market through innovations in information transparency, credit assessment, and risk management. With the continuous progress of digital financial technology, inclusive finance will further boost economic development, promote the fair distribution of

social wealth, and provide financing support to more small and medium-sized enterprises and individuals^[15].

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Strategic Choices in Growth and Distribution: Shared Development

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Abstract: Economic growth and fair distribution are two major goals pursued in economic development. Through a comparative analysis of economies such as those in Europe and the United States, it is found that: Economic growth does not have to be conditional on the expansion of income gap; growth will not automatically lead to fair distribution; efficiency and fairness can occur simultaneously; the transformation of the economic development mode can be achieved through income distribution. A shared development model that takes into account both growth and fairness is the choice to achieve sustained and stable economic growth. It is necessary to deepen the reform of the income distribution system, improve social security and other measures to promote the development achievements to benefit the majority of workers more, and achieve both efficiency and fairness at the same time.

Keywords: Economic growth; Income distribution; Shared development; Development model

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1. Introduction

Growth and distribution have always been two core issues in economic research. From classical economists, Marxist political economy, and neoclassical economics all studying the distribution and growth of wealth, to the New Cambridge School represented by Kaldor, which greatly promoted the research on the relationship between income distribution and economic growth^[1]. The choices of growth and distribution made by the majority of developing countries or latecomer countries have also formed different viewpoints, such as growth first and distribution later, emphasizing distribution over growth, and distributing while growing. According to a 2006 World Bank report, among more than 200 developing economies worldwide between 1950 and 2008, only the Taiwan region of China and South Korea transitioned from low-income to high-income status, 13 economies moved from lower-middle income to high-income status, and most middle-income economies fell into long-term economic stagnation, with per capita national income struggling to exceed \$10,000. Those countries that fell into the “middle-income trap” share some commonalities, with a slowdown in economic growth and an expansion of

income disparity being among the more prominent features. For developing countries or latecomer countries, it is of great significance to handle the relationship between distribution and growth properly in the process of pursuing economic growth. China has long experienced rapid economic growth oriented towards GDP, but it has also been accompanied by the deterioration of the income distribution situation. For China, handling the relationship between distribution and growth properly in the process of transitioning from the middle-income stage to the high-income stage is of great significance for successfully crossing the “middle-income trap” stage and achieving the sharing of economic development achievements by all.

2. Typical facts of income distribution and strategic choices for economic growth

2.1. The practice of developed countries such as Europe, America, etc.

In the process of industrialization in European and American countries, for a long time, they focused on growth but neglected distribution. In the early stage of development, it was a typical model of emphasizing growth over distribution. With the coexistence of high growth rates, deteriorating employment situations and poverty in the later stage of industrialization, and social polarization between the rich and the poor, they began to realize the importance of income distribution in the 1970s. Facing the deterioration of the income distribution situation, they have all carried out income distribution reforms to narrow the income gap. The United States implemented joint stock ownership, allowing more resources and wealth to be jointly held by the people, encouraging employees to hold property rights. The income gap gradually narrowed, the share of labor income tended to rise, and the Gini coefficient tended to decline. After World War II, Japan developed its production rapidly, but the low income level of the people led to various contradictions. In 1960, the Japanese government formulated the “Income Doubling Plan”, and through the strong and continuous promotion of the government, people’s income grew rapidly.

The United Kingdom was the first country to complete industrialization. In order to narrow the income distribution gap and realize the sharing of labor achievements, the British government adopted active employment and perfect social security policies ^[2]. According to the estimation of the World Bank, the Gini coefficient of developed countries such as the United States, the United Kingdom, Japan, and Germany was higher than 0.4 during the process of industrialization due to emphasizing growth over distribution. In the later stage of industrialization, when distribution and growth were equally emphasized, the Gini coefficient was basically maintained below 0.4. The current high-welfare countries represented by Europe and the United States were typically “emphasizing growth over distribution” in the early stage, resulting in the polarization of the gap between the rich and the poor. Later, they gradually realized the importance of distribution, gave consideration to both distribution and growth, and the income distribution gap was effectively alleviated, and the economy continued to grow steadily.

2.2. The successful strategies of East Asian countries or regions

As the “Four Asian Tigers”, South Korea, Singapore, Taiwan, China and Hong Kong, China, took the opportunity of industrial transfer from Western developed countries in the 1970s and 1980s, absorbed a large amount of foreign capital and technology, rapidly promoted industrialization, and achieved rapid economic development of their own countries. These emerging economies distributed while growing. During the economic development process, South Korea focused on fair distribution and promoted the growth of people’s employment and income through a series of policies, including human capital investment and giving priority to the development of labor-intensive

industries. Taiwan regarded “common prosperity” as the primary goal of economic and social development during the development process and is a typical economy that achieves fair distribution and economic growth. Through measures such as early land reform, education investment, the prosperous development of small and medium-sized enterprises, and a sound social security system, it ensured fair income distribution during the process of rapid economic growth.

During the economic development process, Singapore established a collective bargaining mechanism led by the government for a stable increase in labor wage income, ensuring the distribution of labor income during the development process. For these late-developing countries (regions) in East Asia, such as South Korea and Taiwan of China, their economies continued to grow at a high speed, while the income gap remained basically stable or even decreased. Their development is a typical “distribute while growing” model of the interaction between rapid growth and fair distribution, which also enabled them to smoothly transform from traditional agricultural societies to modern industrial societies and become typical examples of successfully entering high-income countries ^[3-5].

2.3. The negative lessons of Latin American countries

Latin American countries are typically the regions with the most severe polarization, the typical cases of “growth without development”, represented by Brazil, Mexico, and other Latin American countries as well as some small Southeast Asian countries. Due to the concentration of political power and monopolistic control in Brazil, the exclusion of the social security system for low-income groups, educational injustice, giving priority to economic growth, emphasizing the decisive role of capital accumulation, and ensuring the continuous increase of profit volume and amount by controlling the income level of workers, the economy experienced a stage of rapid growth. However, the income distribution gap was very large. They hoped to achieve equalization of income distribution after economic success, but the income gap continued to expand. Later, some improvements were made in the development process, but the overall income distribution has not been effectively improved.

In the development process of Mexico, excessive liberalism was advocated and wealth distribution was concentrated in the hands of a few. For example, some Southeast Asian countries, such as Malaysia, entered the lower-middle income level in the 1960s and 1970s, and some even reached the upper-middle income level. However, in the subsequent development, the economy has been unable to grow continuously and stably, and has long lingered in the low-middle income stage. There are many reasons for the inability of these economies to grow continuously and stably, but the large income distribution gap is their common and obvious feature. Whether it is Latin America or some countries in Southeast Asia that have fallen into the “middle-income trap”, economic growth is disconnected from the all-round development of society, ignoring the relationship between economic growth and structural changes, and between economic development and the development of people and society ^[6].

3. Insights and policy recommendations

The enlightenment we get from the development experience of countries or regions such as Europe, America, and others is: First, economic growth does not have to be based on the expansion of income gap. The development strategy of growth first and distribution later is not only unfavorable to the fairness of income distribution for late-developing countries, but also not conducive to the sustained and stable economic growth. The “East Asian Miracle” shows the organic combination of economic growth and income distribution, and the realization of economic development and people’s sharing of economic benefits. In the process of economic development,

people's sharing of growth benefits. For late-developing countries, they do not have to follow the model of "growth first and distribution later" of developed countries, avoiding the painful and long development process of achieving economic growth at the expense of people's interests. On the contrary, the lesson from Latin America shows that blindly focusing only on growth and ignoring distribution will lead to serious polarization and hinder the sustained and stable economic growth. The development strategy oriented by "efficiency first" in China for a long time has also led to the widening of the gap between the rich and the poor in our society.

Second, growth will not automatically lead to fair distribution. If policy adjustment is not emphasized, the income distribution gap will instead become increasingly wider. Economic growth automatically spreads the benefits of economic growth through the "trickle-down" effect and the "diffusion" effect, improving income distribution. However, the prerequisite for this effect is a perfect market mechanism. Judging from the development experience of countries like those in Latin America, under the model of "emphasizing growth while neglecting distribution", economic growth has not produced the "trickle-down" effect and the "diffusion" effect on income distribution. The main reasons are the imperfect markets in these countries, incorrect government intervention, and the disruption of the market by trade unions and political power, etc. In addition, it is possible to achieve relatively fairer income distribution and the continuous progress of economic growth simultaneously, with efficiency and fairness occurring concurrently. The development model of East Asian countries tells us that through government-led economic development and attaching importance to fair distribution during economic growth, the simultaneous realization of growth efficiency and fairness can be achieved ^[7]. The contradiction between efficiency and fairness can be resolved through the sharing of economic growth benefits.

Furthermore, during the transitional period in our country, income distribution, through its influence on investment, consumption, etc., can achieve the transformation of the economic development mode from investment-driven to domestic demand-driven, and from the extensive growth type relying on the quantity of factor input to the endogenous growth type driven by the quality of factor input, realizing high-quality economic development.

For late-developing countries with imperfect market mechanisms, the guiding function of government policies should be emphasized in the strategic choice between growth and distribution. First, in the primary distribution, attention should be paid to the problem of the low share of labor income to prevent the national income from tilting towards capital and the government. Attention should also be paid to the improvement of the income of low-income groups, and the income of high-income groups should be further regulated through personal income tax, inheritance tax, property tax, etc. Second, the employment opportunities of low-income groups should be improved. The human capital level of low-income groups, such as those in rural areas should be enhanced through the inclination of expenditures on education, medical care, vocational skills training, etc. During the process of "targeted poverty alleviation and poverty reduction", infrastructure investment should be appropriately inclined towards rural areas to give full play to the resource endowment advantages of rural areas, thereby promoting the increase of farmers' income.

Additionally, the wage gap among industries should be narrowed. The wage gap among industries is significantly differentiated. Studies have found that the financial industry has always been an industry with relatively high average income, while the average income of those engaged in agriculture has always been the lowest. In the process of transformation and upgrading, particular attention should be paid to the wage gap among industries, especially the high wages in monopolistic industries, which leads to the expansion of social income distribution. Finally, deepen the reform of factor income distribution. The irrationality of income distribution

is not only due to the inequality of human capital but also the inequality based on physical capital. Physical capital is mainly based on production factors such as land and capital. The decisive role of the market in resource allocation should be given full play. Through various measures, promote the increase of income for low-income groups, narrow the overall social income gap, and achieve the sharing of economic development achievements by everyone^[8].

4. Conclusion

Growth does not automatically lead to fair distribution; policy regulation is the key. The early practices of developed economies such as Europe and the United States have shown that neglecting distribution, especially primary distribution, can lead to serious social problems and hinder the healthy development of the economy. The development facts of some Latin American countries, such as Brazil and Mexico tell us that for latecomer countries, adopting the early growth-first-and-then-distribution or growth-oriented and distribution-neglecting concepts of developed countries to guide economic development will result in prominent social problems, continuous deterioration of income disparity and economic growth, and even economic regression. The development experiences of emerging economies such as South Korea, Taiwan of China and Japan indicate that during the development process, the government can formulate various policies, such as increasing the income of low-income earners, raising workers' wages, and extending workers' education years, to achieve fairness in distribution and sustainability in economic growth.

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Analysis of the Deep Cooperation Model between Higher Vocational Colleges and Enterprises Under the “Belt and Road” Initiative

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Abstract: With the proposal and implementation of the “Belt and Road” initiative, economic development requires the drive of a large number of talents and real industries. Local governments along the route also encourage universities and enterprises to carry out high-level school-enterprise cooperation to promote the effective sharing of education and economy, thus ensuring the development of the regional economy. In order to better adapt to relevant national policies, promote regional economic development, and supply high-quality and skilled talents to society, higher vocational colleges should strengthen education reform, introduce the school-enterprise cooperation mechanism, achieve the deep integration between schools and enterprises, and promote regional economic development. Based on this, this paper analyzes and studies the deep cooperation model between higher vocational colleges and enterprises under the “Belt and Road” initiative for reference.

Keywords: “Belt and Road”; Higher vocational colleges; Deep school-enterprise cooperation; Cooperation mechanism; Deep integration

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1. Introduction

The “Belt and Road” is an important initiative for the country to further enhance its level of opening-up and achieve common development with countries along the route. Higher vocational education is an important part of higher education, which can cultivate more highly-skilled talents for society and enterprises and provide technical and resource support and guarantee. In this context, higher vocational education should conform to the trend of the times and carry out educational work based on national development strategies, establish close connections with countries along the “Belt and Road”, promote education reform, and advance the development of education internationalization. In this context, deepening school-enterprise cooperation is an inevitable choice for achieving long-term development. Schools and enterprises should seize the development opportunities, innovate the cooperation and development model, and promote the long-term development of both sides.

2. Significance of deep school-enterprise cooperation in higher vocational colleges under the “Belt and Road” initiative

The “Belt and Road” initiative aims to promote economic cooperation and development among countries and regions along the route. Under the deep school-enterprise cooperation model in higher vocational colleges, higher vocational colleges can provide intellectual support and talent reserves for enterprises. The specific significance is as follows:

2.1. Responding to policy calls

The “National Vocational Education Reform Implementation Plan” clearly points out the important value of school-enterprise cooperation. The country’s emphasis on it has also been continuously increasing, affirming the specific significance of school-enterprise collaboration, proposing an important talent-training mechanism, and constructing an integrated multi-party docking mechanism. The introduction of the policy also indicates the direction for educational work, which is helpful for schools and enterprises to build a close cooperative relationship and cultivate innovative talents with strong quality and ability. Higher vocational colleges’ strengthening of school-enterprise cooperation construction can respond to national policy calls, improve the quality of education, and further promote the overall development of the region^[1].

2.2. Cultivating international talents

At present, many higher vocational colleges have begun to strengthen talent-training work and focus on the cultivation of international students, continuously increasing the enrollment of international students and further expanding the number of international students coming to China. Moreover, higher vocational colleges should also actively participate in international education organization cooperation activities to cultivate talents with an international perspective in the new era. Therefore, higher vocational colleges should strengthen communication with enterprises, establish corresponding cooperation mechanisms, improve the quality and effectiveness of education, and highlight the value of education^[2].

2.3. Improving international competitiveness

The “Belt and Road” initiative helps China establish good trade relations with countries along the route, promoting regional economic development and achieving industrial structure upgrading. In order to improve the core competitiveness of Chinese enterprises, highlight their advantageous value, and make them adapt to the requirements of international development, enterprises should pay attention to talent introduction. Therefore, enterprises can strengthen in-depth cooperation with colleges and universities to cultivate high-quality and high-skilled talents, better promote industrial innovation and development, enable enterprises to obtain good benefits, and promote the normal development of the regional economy^[3].

2.4. Broadening development space

For students, the talent-training mechanism of school-enterprise cooperation has important application value and is helpful for their future study and development. Deepening the cooperation between higher vocational colleges and enterprises helps encourage students to participate in practical learning, acquire more knowledge, and master key skills. Therefore, school-enterprise cooperation has advantages that other teaching methods cannot match, helping students solve practical problems in the learning process and improving their problem-solving ability^[4].

3. Key factors affecting the school-enterprise cooperation in higher vocational colleges under the “Belt and Road” Initiative

3.1. Factors of local government policies and economic environment

The industrial development in the region where higher vocational colleges are located affects the quality of school-enterprise cooperation. In the process of school-enterprise cooperation, the government is an important promoter. The systems and policies introduced by the government can provide help and support for school-enterprise cooperation, promote the development of colleges and industries, and cultivate high-quality talents in the new era. However, the regional economic construction situation also affects education and teaching work. The regional economic structure influences the setting of teaching majors in local colleges. Local policies also directly affect the basic concepts of colleges, which is helpful for better strengthening and improving educational work. At the same time, it also affects the development of enterprises, improving the overall efficiency of enterprises with talent as the support^[5].

3.2. Factors of the school-running strength of higher vocational colleges themselves

For higher vocational colleges, elements such as talent training and scientific research capabilities directly affect the school-running situation of the colleges. With the implementation of the “Belt and Road” initiative, colleges along the route have strengthened their own construction and gradually improved the quality of school-running. In this process, many colleges have established long-term cooperative relationships with enterprises. During the cooperation process, the scientific research capabilities and teaching levels of colleges will also be continuously improved. Higher vocational colleges have become an important base for cultivating high-quality talents, which can supply a large number of high-quality talents to enterprises. Enterprises also need to cultivate high-quality talents in the new era, according to the scientific research functions of higher vocational colleges to better deepen the in-depth school-enterprise cooperation^[6].

3.3. Restrictive factors of the operation of the top-level system

The cooperation between higher vocational colleges and enterprises is not one-way. It requires the coordination of both sides to achieve two-way communication and development. Their decisions and actions are carried out based on the characteristics of local economic and industrial development, and government policies also directly affect their cooperation. Under the background of the “Belt and Road”, many higher vocational colleges show superficial characteristics in the process of school-enterprise cooperation, which is not conducive to the effective development of school-enterprise cooperation. However, these problems are caused by the imperfect top-level system design. In the face of such problems, enterprises should handle the coordination relationship from a global perspective to promote the development of school-enterprise cooperation^[7].

4. The deep school-enterprise cooperation model in higher vocational colleges under the “Belt and Road” initiative

Under the background of the “Belt and Road” initiative, the deep school-enterprise cooperation in higher vocational colleges faces new opportunities and challenges, and it is urgent to build an innovative cooperation model. On the one hand, during the “going-global” process of industrial enterprises, there is a great demand for a large number of technical and skilled talents suitable for overseas development needs. However, the development of vocational education in countries along the route lags behind, and it is difficult to supply qualified labor forces.

On the other hand, higher vocational colleges shoulder the important task of cultivating international technical talents and need to enhance the pertinence and effectiveness of talent training through in-depth cooperation with enterprises^[8]. Therefore, higher vocational colleges should strengthen in-depth cooperation with enterprises and build a deep-cooperation model from the following aspects.

4.1. Enhancing the policy guidance of local governments and building a development platform

Continuing to carry out educational work under the “Belt and Road” initiative and ensuring the deep integration of schools and enterprises is helpful for promoting regional economic construction and cultivating talents with strong skills and qualities. Therefore, the governments of regions along the “Belt and Road” should, based on the development situation of their own regions and in combination with the development needs of the industry, introduce corresponding institutional policies to encourage enterprises and higher vocational colleges to strengthen cooperation and clarify the responsibilities of both sides. The government can set up corresponding guarantee mechanisms from the perspectives of politics, economy, and culture to promote the long-term development of enterprises. Moreover, enterprises also need to establish a perfect fund-guarantee mechanism, provide more financial and technical support to colleges, offer more preferential policies, build a perfect development platform, break away from traditional development limitations, give full play to the advantages of school-enterprise cooperation, and further promote the development of regional industries^[9].

4.2. Improving the development strength of higher vocational colleges and ensuring the progress of work

The school-running quality and scientific research capabilities of higher vocational colleges will have a certain impact on school-enterprise cooperation. Therefore, higher vocational colleges should pay attention to making up for deficiencies, ensure the joint improvement of school-running quality and professional abilities of talents, enhance the attractiveness of higher vocational colleges, and better meet the development needs of enterprises in the new era. Under the background of the “Belt and Road”, higher vocational colleges should effectively utilize national and local educational resources, optimize the construction of the teaching staff, make breakthrough progress, and strive for more support and recognition. Under the “Belt and Road” initiative, higher vocational colleges should, through in-depth cooperation with enterprises, cultivate talents with strong professional qualities and innovative qualities in the new era^[10, 11].

4.3. Promoting the in-depth development of school-enterprise integration and introducing advanced achievements

In the current era background, higher vocational colleges should seize the development opportunity of the “Belt and Road” and formulate a perfect talent-training mechanism according to the talent needs of enterprises to further ensure that schools and enterprises can obtain more benefits. Enterprises are also the main beneficiaries of deepening school-enterprise cooperation. Enterprises should, in combination with the development characteristics and trends of the industry, invest more resources in the field of talent development, further cultivate high-quality talents, and ensure the cooperation between colleges and enterprises. In the specific practice process, higher vocational colleges also need to introduce real teaching cases according to the characteristics of majors, establish a close connection between corporate culture and school culture, better realize their mutual integration, and promote the development of educational work.

Moreover, higher vocational colleges should strengthen the cultivation of students' comprehensive quality and ability, formulate corresponding development goals according to the construction situation of the "Belt and Road", build a corresponding curriculum system, and strengthen the construction of the teaching staff. Under the premise of in-depth school-enterprise cooperation, higher vocational colleges should also pay attention to the development of industry-education-research work, introduce advanced educational concepts and achievements, and better promote technological innovation. During this period, enterprises also need to continuously achieve technological innovation in the process of operation and development, expand the technology and process of enterprise operation and management, and better ensure the sharing of achievements between higher vocational colleges and enterprises^[12].

4.4. Strengthening teaching practice based on the development characteristics of local enterprises

The purpose of school-enterprise cooperation in higher vocational colleges is to promote regional development and obtain economic benefits. In this case, higher vocational colleges should always set corresponding teaching majors according to the industries in the region, select appropriate teaching content, and optimize teaching methods to ensure the progress of teaching work. Higher vocational colleges should follow the requirements of regional policies, continuously optimize teaching work, further improve the school-enterprise cooperation mechanism, and promote high-quality economic development.

At present, the teaching content of some higher vocational colleges does not match the actual needs of enterprises, and teaching practice is formalistic, with little emphasis on practical teaching, which makes it difficult to fully meet the actual development needs of enterprises. This is because when setting majors and constructing disciplines, higher vocational colleges fail to invite enterprises to participate and do not set up the teaching system in combination with the needs of enterprises. In the process of cooperation with enterprises, some higher vocational colleges also fail to fully recognize the value of school-enterprise cooperation in cultivating international talents and the characteristics of comprehensive education, which is not conducive to the development of students' vocational abilities and innovative awareness. Therefore, in order to better meet the actual needs of enterprises, higher vocational colleges should strengthen major construction, create a compound-talent training model, improve the competitiveness of enterprises, and better promote regional economic development^[13, 14].

4.5. Enhancing graduates' professional identity and improving their sense of responsibility

At present, many graduates have a professional identity crisis after employment. Therefore, higher vocational colleges should help students establish professional identity, enhance their personal sense of honor, and strengthen their personal sense of responsibility through methods such as student surveys, corporate propaganda, and academic exchanges. Higher vocational colleges should conduct surveys on students' employment intentions on and off campus, analyze students' ideas, and formulate a talent-training plan that meets students' intentions and the school-running characteristics of their own colleges, further expanding the scope of internships. At the same time, higher vocational colleges should invite enterprises to give lectures on campus, integrate corporate culture, cross-cultural elements, etc. into the "Belt and Road" initiative, strengthen students' understanding of corporate transnational construction, maximize their familiarity, and better integrate into corporate life. Enterprises also need to fully cooperate with higher vocational colleges in carrying out activities such as art performances, and through material and spiritual rewards, further improve students' work enthusiasm, encourage them to actively participate

in corporate work, enhance their experience during internships, and strengthen their learning of knowledge^[15].

5. Conclusion

To sum up, under the background of the “Belt and Road” Initiative, the school-enterprise cooperation of higher vocational colleges along the route has achieved certain results. However, due to the limitations of external environment and their own development, the depth of school-enterprise cooperation is insufficient. In order to better eliminate the negative impacts, higher vocational colleges, local governments, and individual students should be deeply involved, carry out cooperation and innovation under the premise of the industry-education-research cooperation mechanism, and lay a solid foundation for the implementation of the “Belt and Road” work. It is believed that in the future, efforts will continue to be made to build an international vocational education exchange platform, attract the participation of colleges and enterprises from countries along the route, share educational and industrial resources, and promote the deep school-enterprise cooperation in higher vocational colleges to a new level.

Finding

Research on the Entry Point of School-Enterprise Co-construction of Intelligent Manufacturing Majors to Serve the Construction of the Core Area of the “Belt and Road” (Project No.: BJKY-2024-354)

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Study on Digital Transformation Strategies for Corporate Procurement Management

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Abstract: With the acceleration of the global digital wave, enterprise procurement management is facing multiple challenges such as cost pressure, supply chain collaboration demand, and insufficient information ability. Based on dynamic capability theory, resource-based view, and value chain theory, this paper constructs a four-level research framework of “driving factors-transformation paths-strategic actions-performance evaluation”. Firstly, through literature analysis and case review, it summarizes the internal and external driving factors such as external market competition pressure, supply chain coordination demand, policy and regulatory environment, as well as enterprise information foundation, organizational culture, and talent reserve, and analyzes their mechanism of action on procurement digital transformation. Secondly, the procurement digital transformation path is divided into two types: gradual upgrading and leap-forward reconstruction, and the strategic and tactical level strategies, such as top-level design, data governance, process remodeling, supplier collaboration platform construction, and intelligent decision support, are proposed. Thirdly, the implementation guarantee mechanism was designed from the four aspects of organization management, technology platform, talent culture, and risk control. Finally, the performance evaluation index system covering cost, cycle, quality, risk, and digital maturity was constructed, and the evaluation method and continuous improvement mechanism based on balanced scorecard and ROI/TCO analysis were proposed. The results show that the systematic strategy design and multi-dimensional guarantee can effectively improve the procurement efficiency of enterprises, reduce operating costs, enhance supply chain resilience, and provide theoretical and practical guidance for enterprises to achieve sustainable competitive advantage.

Keywords: Procurement management; Digital transformation; Dynamic capability; Transformation pathways; Performance evaluation

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1. Introduction

Driven by the new generation of information technologies such as big data, cloud computing, and artificial intelligence, enterprise procurement management is evolving from the traditional manual approval and information island mode to the direction of end-to-end transparency and intelligence. Facing the increasingly

fierce market competition, complex and variable supply chain environment, and strict compliance requirements, the informatization level of most enterprises in our country is still in the initial stage, and problems such as process fragmentation, data lag, and insufficient risk early warning need to be solved. Based on dynamic capability theory, resource-based view, and value chain theory, this paper aims to construct a four-level framework of “driving factors-transformation path-strategic measures-performance evaluation”, systematically analyze the influence mechanism of external market pressure and internal capability conditions on procurement digital transformation, and put forward operational paths and strategies. It provides theoretical and practical guidance for enterprises to improve procurement efficiency, optimize cost structure, and enhance supply chain resilience ^[1].

2. Literature review

2.1. Evolution of procurement management theory

Procurement management, a core function within corporate supply chains, has seen its theoretical focus evolve from a “transaction cost perspective” to a “supply chain collaboration perspective.”

(1) Traditional procurement management

From the 1970s to the 1980s, scholars approached procurement management through the lens of transaction cost economics, emphasizing centralized purchasing and economies of scale to reduce transaction costs and gain bargaining power. Williamson’s transaction cost theory suggests firms should balance internalization and outsourcing to minimize costs from information asymmetry, incomplete contracts, and opportunistic behavior. Traditional procurement thus focused on supplier selection, contract negotiation, and standardized processes, prioritizing cost control and risk mitigation.

(2) Modern supply chain procurement management

Entering the 21st century, the rise of supply chain management shifted focus toward overall supply chain performance and collaboration. Christopher’s theories of agile and resilient supply chains highlighted the need for procurement to align with production, logistics, and sales to enhance responsiveness and risk resistance. This era introduced “strategic sourcing,” emphasizing alignment with corporate goals through supplier relationship management (SRM), joint innovation, and risk-sharing mechanisms to build stable, long-term supplier networks.

(3) Procurement innovation in the digital era

In recent years, digital technologies have driven profound changes in procurement management. Leveraging ERP systems, e-procurement platforms, e-tendering, and supplier collaboration tools, scholars have explored pathways and value-creation mechanisms for “digital procurement.” Gunasekaran *et al.* argue that digital procurement goes beyond process automation, enabling data-driven decision-making and dynamic capability enhancement ^[2]. Its core lies in achieving end-to-end transparency, visibility, and intelligence, encompassing real-time demand forecasting, smart negotiations, risk alerts, and performance monitoring. Overall, procurement management theory has progressed from singular cost control to supply chain collaboration and now toward digital intelligence. Building on this, this study integrates dynamic capability theory and resource-based view to explore procurement management strategies in the context of digital transformation.

2.2. Research on digital transformation

In recent years, digital transformation has become a key measure for enterprises to cope with changes in the external environment and improve internal operational efficiency. Digital transformation is not only a simple

information upgrading, but also a deep reshaping of the business process, organizational structure, and business model of enterprises supported by the new generation of information technologies such as big data, cloud computing, Internet of things, and artificial intelligence^[2]. Its core features lie in end-to-end process reengineering, data-driven decision making, and business model innovation. The research shows that the driving factors of digital transformation include not only external factors such as market competition pressure, customer demand changes, and policy and regulation promotion, but also internal factors such as senior leadership's digital vision, organizational agility, technology infrastructure, and data governance capabilities.

To help companies assess their digitalization level, scholars have proposed various maturity models, such as Gartner's five-stage model (Initialize, Enable, Integrate, Optimize, Transform) and Capgemini's Digital Footprint Index. These models assess enterprises from the dimensions of strategic planning, technology application, process management, and customer experience. Provide self-diagnosis and improvement suggestions for transformation pathways^[3]. In terms of implementation path, Westerman *et al.* put forward a three-step strategy of "enlightenment, pilot, and expansion"^[4]: first, formulate digital vision and strategy, second, carry out small-scale pilot in key business areas, and finally promote successful experience to the whole enterprise and continue to optimize.

In addition, the study emphasizes that change management, culture shaping, and talent training should be paid attention to in the process of transformation, so as to reduce organizational resistance, resolve risks, and ensure the implementation of transformation. Although existing studies have systematically expounded the connotation, drivers, maturity assessment, and implementation path of digital transformation, the digital transformation strategy system for procurement management functions has not yet formed a complete framework, which urgently needs to be further explored^[4].

3. Theoretical framework and conceptual definitions

3.1. Core concepts

- (1) Digital transformation of procurement management: This refers to the comprehensive overhaul and enhancement of procurement processes, organizational structures, decision-making mechanisms, and supplier collaboration through digital technologies like big data, cloud computing, IoT, and AI. It aims for transparency, intelligence, and agility in procurement activities, not only improving efficiency and reducing costs but also enabling data-driven strategic decisions and enhancing supply chain resilience and innovation.
- (2) Digital capability: The set of internal resources and competencies required for digital transformation, including technical infrastructure (e.g., cloud and big data platforms), data management and analytics, system integration, and organizational proficiency in digital technologies. Digital capability underpins end-to-end process reengineering and intelligent decision-making, serving as the foundation for dynamic adaptation and continuous improvement.
- (3) Digital platform: The technological backbone supporting procurement digitalization, encompassing e-procurement systems, supplier collaboration platforms, and data analytics tools^[5]. These platforms use standardized interfaces and modular architectures to automate and streamline processes like demand issuance, order management, contract approvals, and performance monitoring, while providing real-time data and decision support.
- (4) Digital process: Optimized business processes reengineered using digital platforms and capabilities. Emphasizing end-to-end visibility, real-time information sharing, and closed-loop management, digital

processes encompass online, automated, and intelligent operations across demand forecasting, supplier selection, price inquiries, contract management, logistics tracking, and performance evaluation. They enable rapid market responsiveness, timely risk detection, and continuous efficiency gains ^[6].

3.2. Theoretical foundations

According to dynamic capability theory, enterprises should maintain competitive advantage through the ability to sense, capture, and reconstruct internal and external resources in a rapidly changing environment. The proposed that dynamic capability consists of three elements: “opportunity identification”, “resource reorganization”, and “organizational learning” ^[6]. In the digital transformation of procurement management, enterprises need to continuously monitor market and technology dynamics, timely introduce and integrate emerging digital technologies, and transform technology advantages into actual performance through internal process and organizational structure adjustments.

The Resource-based view (RBV) emphasizes that a company’s competitive advantage stems from its unique, hard-to-imitate resources and capabilities. In the process of digital transformation, enterprises should build a resource system with data assets as the core, including high-quality procurement data, advanced analysis models, and professional talent teams, so as to form digital capabilities that are difficult to replicate ^[7]. Through long-term investment and protection of these critical resources, enterprises can obtain sustained advantages in procurement efficiency, risk management, and supplier collaboration.

The value chain theory, proposed by Porter, divides enterprise activities into a series of value-added links and emphasizes the coordination and optimization among all links. Under the background of the digital transformation of procurement management, enterprises need to link the procurement process with the upstream supplier management, downstream production and sales process, and break the information island to realize the visualization and optimal configuration of the value stream. By embedding digital processes and intelligent analysis tools in each node of the value chain, enterprises can maximize the overall value, not just a single point of cost reduction ^[8].

3.3. Research framework

Based on the above core concepts and theoretical basis, this paper constructs a four-level research framework of “driving factors-transformation paths-strategic actions-performance evaluation”, as shown in **Figure 1**.

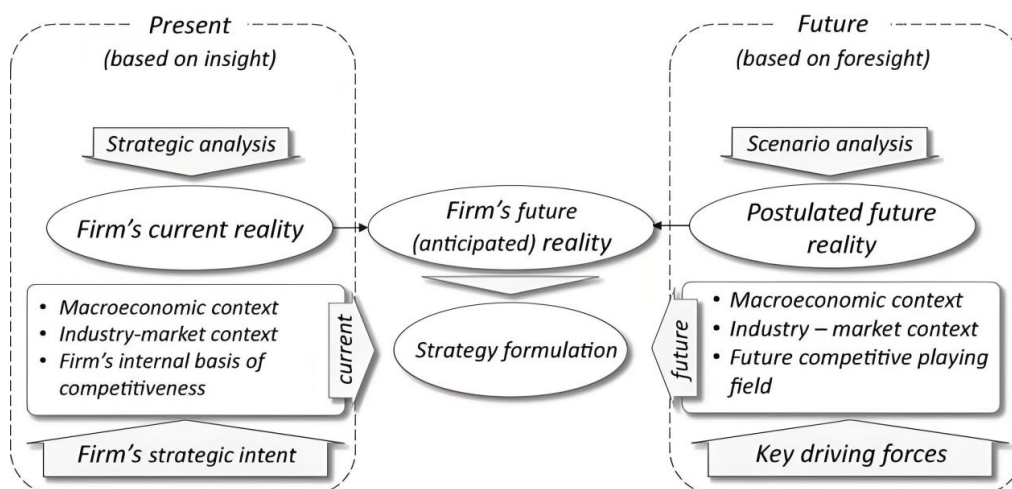


Figure 1. Research framework

As shown in the figure, the first layer of “driving factors” includes external market competition pressure, supply chain coordination demand, policy and regulatory environment, as well as internal information foundation, organizational culture, and talent reserve. The second layer “transformation path” divided the digital evolution of procurement into two modes: gradual upgrade and leap-forward reconstruction. The third layer of “strategic initiatives” put forward key strategies such as top-level design, data governance, process remodeling, supplier collaboration platform construction, and intelligent decision support at the strategic layer, tactical layer, and operational layer, respectively. The fourth layer of “performance evaluation” is based on five dimensions of cost, cycle, quality, risk, and digital maturity, using balanced scorecard, ROI/TCO, and other methods for quantitative evaluation, and continuously optimizing transformation practices through a continuous feedback mechanism. Based on the dynamic capability theory and resource-based view, the framework emphasizes resource integration and capability cultivation, and draws lessons from the value chain theory to highlight the collaborative optimization of the end-to-end value stream, which provides systematic logical support for the in-depth analysis and strategy design of the subsequent chapters ^[9].

4. Analysis of driving factors

4.1. External driving factors

(1) Market competition pressure

As globalization intensifies and industry consolidation grows, enterprises face dual competition from multinational giants and emerging digital firms. The inefficiencies and information asymmetries of traditional procurement models struggle to meet demands for rapid responsiveness, compelling companies to adopt digital tools to enhance bargaining power, shorten procurement cycles, and maintain cost advantages and market agility ^[10].

(2) Supply chain collaboration needs

Modern supply chains extend beyond single enterprises, forming complex networks of multiple nodes and stakeholders. Real-time sharing of demand forecasts, inventory statuses, and logistics progress is essential for optimizing inventory and sharing risks. Digital platforms and processes can dismantle information silos, fostering collaborative decision-making among supply chain partners and boosting overall operational efficiency and resilience.

(3) Regulatory and policy environment

Governments worldwide are rolling out policies to promote digital economies and smart manufacturing, such as China’s “Made in China 2025” and the “14th Five-Year Plan” for digital transformation, offering institutional support and financial subsidies for procurement digitalization. Meanwhile, stricter compliance and audit requirements, covering data security and green procurement, push enterprises to upgrade systems for full-process traceability and risk forecasting.

4.2. Internal driving factors

Internal drivers are pivotal to the success of procurement digitalization, encompassing IT infrastructure, organizational culture and change readiness, and talent and capability reserves. First, IT infrastructure sets the starting point and pace of digital transformation. Robust ERP systems, unified data platforms, standardized interfaces, and stable network architectures provide the backbone for collecting procurement demands, managing

supplier data, approving contracts, and monitoring performance. Conversely, fragmented systems and data silos cause delays, redundant efforts, and cost overruns, hindering the adoption and value of digital tools. Second, organizational culture and change readiness form the “soft power” for transformation success. Strong commitment from top leadership, backed by sustained investment, ensures robust resource allocation and policy support. Effective cross-departmental collaboration—between IT, business units, procurement, and finance—facilitates communication and alignment. A tolerant attitude toward setbacks during pilots encourages employee innovation and participation, breaking entrenched process habits. Third, talent and capability reserves are the “hard core” of transformation. Enterprises need not only IT specialists skilled in system development and maintenance but also analysts adept at data analytics and professionals well-versed in procurement and supply chain management. Ongoing training, job rotations, internal and external exchanges, and incentive programs enhance digital literacy and collaborative innovation, enabling employees to master digital tools, interpret data insights, and translate them into decision-making support. Additionally, building a data-centric resource pool with strong governance, quality control, and security measures creates an enabling environment for talent to thrive. Together, IT infrastructure, organizational culture, and talent capabilities reinforce each other, forming the internal engine for procurement digitalization and ensuring strategies are effectively implemented to deliver expected outcomes.

5. Mechanisms of driving factors on procurement digitalization

External and internal drivers shape procurement digitalization by influencing enterprise cognition, resource allocation, and organizational behavior, affecting pathway choices and implementation outcomes. Externally, market competition and supply chain collaboration need heightened pressures on cost control and responsiveness, prompting senior leaders to prioritize digital transformation, accelerate vision-setting, and allocate budgets, thus sparking organizational change momentum. Regulatory environments provide institutional support and incentives—like subsidies, tax breaks, and compliance mandates—encouraging firms to view digitalization as a means to reduce risks and enhance transparency. Internally, IT infrastructure determines how quickly firms can achieve data collection, system integration, and process automation. Well-equipped enterprises can efficiently reengineer end-to-end processes through low-cost integrations, while those with weaker systems face delays and higher costs for upgrades or redevelopment. Organizational culture and change readiness shape employee acceptance and adoption of digital tools by fostering innovation-friendly environments. Leadership support, cross-departmental collaboration, and tolerance for pilot setbacks create a culture of experimentation and adaptability. Finally, talent and capability reserves decide whether digital technologies translate into productivity. Specialized IT teams and data analysts enable informed decisions in technology selection, platform development, and data governance. Continuous training and incentives ensure employees adopt new tools and processes, building dynamic digital capabilities over time. In sum, external drivers provide the “motivation” for transformation through strategic intent and resource support, while internal drivers supply the “capability” through technical readiness, organizational alignment, and talent strength. Together, they shape pathway choices (incremental or leapfrog), strategy mixes (top-level design, process reengineering, platform building), and ultimate performance outcomes.

6. Transformation pathways and strategy design

When choosing procurement digitalization pathways, enterprises can opt for incremental upgrades or leapfrog

restructuring based on their IT foundations and change needs. Incremental upgrades involve phased, modular adoption of tools like e-procurement, contract management, and supplier collaboration, validated through pilots and gradual rollout to minimize risks and costs. Leapfrog restructuring, guided by top-level design, entails dismantling traditional processes, rebuilding technical architectures, and rapidly deploying integrated digital platforms for end-to-end transparency and intelligence. This suits firms with strong IT capabilities and urgent needs for efficiency and agility. Strategically, enterprises should form a digital transformation leadership group to define the vision, goals, and phased roadmap for procurement digitalization. Optimizing organizational structures to break functional silos, fostering cross-departmental collaboration, and streamlining decision-making are critical. Robust data governance and cybersecurity systems—through data standards, access controls, and quality protocols—ensure data security and reliability across collection, transmission, and storage.

Tactically, the focus is on process reengineering and intelligent applications. Enterprises should map out core processes—demand forecasting, supplier selection, price inquiries, and contract approvals—leveraging robotic process automation (RPA) and workflow engines to automate repetitive tasks. Cloud-based supplier collaboration platforms enable supplier onboarding, performance tracking, information sharing, and joint innovation. Big data and AI-driven tools provide demand predictions, price trend analyses, and risk alerts, delivering dashboards and smart recommendations to enhance decision-making speed and accuracy. Operationally, system integration and standardized interfaces are vital. Microservices and API gateways ensure seamless connections between procurement, ERP, finance, and logistics systems, maintaining data consistency and process continuity. Tailored training programs for executives, key staff, and general users, blending online and offline formats, boost system adoption. Promotional campaigns and incentives strengthen employee buy-in and engagement. A performance metrics system—covering cost, cycle time, quality, risk, and digital maturity—enables regular evaluation, with PDCA cycles incorporating user feedback to refine systems and processes, ensuring iterative upgrades and sustainable competitive advantage.

7. Implementation safeguards

To ensure smooth procurement digitalization, organizational and managerial safeguards are paramount. Enterprises should establish a transformation leadership group with senior executives, IT, procurement, and finance representatives, defining roles and decision-making authority. Regular progress meetings address bottlenecks, while cross-departmental collaboration fosters deep integration between business and technical teams across project phases—planning, requirement reviews, testing, and operations. Robust project management and performance systems tie digitalization goals to departmental KPIs, motivating accountability and continuous improvement.

Technical and platform safeguards form the backbone. Stable, scalable IT infrastructure—leveraging cloud computing, big data, and microservices—ensures procurement systems handle high concurrency and growth. Integrated e-procurement, supplier collaboration, and analytics platforms with standardized interfaces connect seamlessly with ERP, finance, and logistics systems, eliminating data silos for smooth end-to-end workflows. Comprehensive cybersecurity measures—network protection, access controls, encryption, and compliance audits—safeguard data confidentiality, integrity, and availability throughout its lifecycle. Talent and cultural safeguards drive sustained progress. Enterprises should build digital-focused training systems, combining internal programs, external certifications, and academic partnerships to develop hybrid talent skilled in business and

technology. Incentive programs reward standout contributions and innovative solutions, fostering organizational vitality.

Awareness campaigns and change management initiatives cultivate an open, experimental culture, encouraging employees to embrace new tools and processes, steadily accumulating digital capabilities. Risk management and contingency planning underpin steady progress. Early risk assessments identify technical, business, compliance, and supply chain vulnerabilities, with tailored strategies like backups, disaster recovery, approval checkpoints, and third-party audits. Rapid-response contingency plans and drills minimize disruptions from system failures or security breaches. Through these multidimensional safeguards, enterprises can navigate complex environments, steadily advancing procurement digitalization to achieve efficiency gains and value creation.

8. Performance evaluation and feedback

To ensure procurement digitalization achieves its intended outcomes, a performance evaluation system should be established, encompassing five key dimensions: cost, cycle time, quality, risk, and digital maturity. In the cost dimension, metrics such as total procurement costs, discount rates from negotiations, and inventory holding rates before and after transformation quantify savings. The cycle time dimension tracks the average duration from demand submission to order fulfillment, assessing improvements in process automation and approval efficiency. The quality dimension focuses on supplier compliance rates, delivery accuracy, and contract execution rates to gauge supply chain collaboration and risk control. The risk dimension monitors supply disruptions, accuracy of price volatility alerts, and security incidents to evaluate the effectiveness of early warning systems.

In the digital maturity dimension, regular self-assessments based on established maturity models measure the depth of technology adoption, data governance quality, and organizational culture change. For evaluation methods, combining the balanced scorecard with ROI/TCO analysis captures both financial and non-financial performance. The balanced scorecard integrates the five dimensions into four perspectives—financial, customer, internal processes, and learning and growth—for a holistic assessment. ROI and TCO analyses quantify the investment returns and lifecycle costs of digital platforms and tools, guiding future resource allocation decisions. Evaluation results should be shared with senior management and relevant departments through regular reports and visualized dashboards, ensuring transparency and timely feedback. A PDCA (Plan-Do-Check-Act) cycle should be established to incorporate identified issues and improvement suggestions into the next optimization phase, iteratively refining procurement processes and system functionalities. Through this closed-loop feedback mechanism, enterprises can continuously enhance performance at various stages of digital transformation, achieving sustained optimization and value creation in procurement management.

9. Conclusion

Drawing on dynamic capability theory, resource-based view, and value chain theory, this study constructs a four-tier framework of “drivers—transformation pathways—strategic measures—performance evaluation.” It systematically analyzes the roles of external drivers (market competition, supply chain collaboration, regulatory environment) and internal drivers (IT infrastructure, organizational culture, talent reserves) in procurement digitalization. The study proposes incremental upgrades and leapfrog restructuring as pathways, with comprehensive strategies spanning top-level design, process automation, supplier collaboration, intelligent

decision support, system integration, training, and performance feedback. It further outlines safeguards across organizational management, technical platforms, talent culture, and risk control to support implementation. Findings show that integrating strategy systems with robust safeguards, continuously refined through iteration, can enhance procurement efficiency, reduce costs, and strengthen supply chain resilience, delivering sustainable competitive advantage for enterprises.

Disclosure statement

The author declares no conflict of interest.

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Exploration of the Financing Dilemmas of Small and Micro Enterprises and the Paths of Financial Innovation

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Abstract: The prioritization of financial infrastructure construction serves as a crucial guarantee for the high-quality development of small and micro enterprises. However, resolving the financing challenges of small and micro enterprises is not a task to be accomplished overnight. It necessitates the establishment of a long-term mechanism, the acceleration of financial innovation, the gradual enhancement of the vitality of micro-entities, and the creation of a stable and healthy economic development environment. Therefore, the author first analyzes the current financing situation of small and micro enterprises, as well as the problems they face during the process of financial innovation enabling small and micro enterprises to access financing and solve their financing difficulties, such as insufficient technical support, an imperfect risk control system, incomplete information disclosure, and a lack of credit data. Subsequently, targeted paths for financial innovation are proposed, aiming to offer suggestions for solving the financing problems of small and micro enterprises.

Keywords: Small and micro enterprises; Financing; Dilemmas; Financial innovation; Paths

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1. Introduction

Small and micro enterprises are an important part of China's national economy. How to solve their financing problems and stimulate their development vitality has become a focus of market attention. Nevertheless, the problems of expensive and difficult financing still prevail, restricting the survival and development of small and micro enterprises. Relevant data shows that the financing problems of small and micro enterprises mainly include an insufficient scale of financing supply, limited financing channels, and generally high financing costs. Financial institutions need to accelerate financial innovation to solve the financing problems of small and micro enterprises and provide them with broader development space^[1].

2. Current financing situation of small and micro enterprises

2.1. Insufficient scale of financing supply

In the current economic situation, small and micro enterprises in China generally face financial constraints, increased production costs, reduced profits, and insufficient orders. Thus, their loan demands are characterized by being “short-term, frequent, and urgent”. However, small and micro enterprises often have high debts, lack stable repayment sources, have unstable cash flows, have non-standard financial statements and operation management, lack sufficient collateral, and find it difficult to prove their repayment ability and creditworthiness. As a result, they encounter many difficulties when seeking financial support from financial institutions. Under the traditional financial model, the loan support that small and micro enterprises can obtain from financial institutions is very limited, and only a small number of them can get sufficient loans^[2].

2.2. Limited financing channels

At present, commercial banks are the main source of financing for small and micro enterprises. The lack of direct financing channels and the single-channel financing situation have restricted the survival and development of small and micro enterprises to a certain extent. Even though China has been striving to improve the financing environment for small and medium-sized enterprises and continuously promoting the optimization of the financial-side resource supply mode and the construction of the direct financing system, the problem of the lack of financing channels for small and micro enterprises has not been completely resolved. The financing support provided by the bond and stock markets for small and micro enterprises still fails to meet the actual demand. This is mainly because the direct financing market for small and medium-sized enterprises in China is still in the cultivation stage, and the financial support from the bond and stock markets to small and micro enterprises is relatively weak. For example, the Beijing Stock Exchange focuses its services on “specialized, sophisticated, characteristic, and new” small and medium-sized enterprises. The number of small and micro enterprises eligible for financing is small, and the scale of equity financing is relatively small^[3]. Private lending highly depends on the personal relationships of business owners. Small and micro enterprises also face relatively great difficulties in obtaining financial support through this method. In extreme cases of financial shortages, they may even choose some informal channels, which poses greater potential risks to their development.

2.3. Generally high financing costs

Compared with large and medium-sized enterprises, small and micro enterprises have poorer qualifications, and financing institutions assign them a higher risk rating. Consequently, their financing costs are relatively high. Even if some financial institutions are willing to provide loan services to small and micro enterprises, due to their risk ratings, they will require additional fees such as consultation fees and loan guarantee fees as risk premiums. This leads to generally high financing costs for small and micro enterprises. Taking working-capital loans with a term of less than one year as an example, the loan interest rate for large and medium-sized enterprises is generally within 3%. Even if their qualifications are relatively poor, the loan interest rate usually does not exceed LPR + 50bps. However, it is very difficult for small and micro enterprises to obtain such low-interest loans. If they choose private lending, the loan interest rate may be as high as four times the bank’s lending rate for the same period^[4].

3. Paths of financial innovation to enable small and micro enterprises to access financing

3.1. Maintaining an incremental credit supply

The financing difficulties of small and micro enterprises stem from their short establishment time, poor credit records, and light assets. Under the traditional approval model, financial institutions find it difficult to assess their risks, often resulting in low loan amounts and high interest rates. To address this situation, China has implemented a series of policies in recent years. Especially after the establishment of a coordination mechanism in 2024, banks have increased their credit support for small and micro enterprises and promoted financial innovation to precisely meet their needs. The key to maintaining an incremental credit supply and expanding the development space of small and micro enterprises lies in the innovation of the credit-granting model. The traditional model relies on a single internal data source, which cannot meet the development needs. It is necessary to innovate the credit-granting model in light of the economic situation to balance the risk-aversion of financial institutions and the financing needs of small and micro enterprises. Digital technology should be utilized to enrich online credit forms, making financing more convenient, and focusing on first-time loans, loan renewals without principal repayment, and credit loans. For example, the Agricultural Bank of China has provided a new financing path for technology-based enterprises through intellectual property pledge. The Zheshang Bank, in collaboration with multiple departments, has launched products such as “Data Guarantee” and “Bank-tax Loan”, which represent effective explorations in financial support for small and micro enterprise financing.

3.2. Continuously expanding financing channels

In the increasingly competitive market environment, capital is the cornerstone of the healthy development of small and micro enterprises. Whether they can obtain sufficient financing directly determines their market competitiveness, operational status, and even development potential. Currently, commercial banks remain the main financing channel for small and micro enterprises in China, and the financing channels are relatively single. To enhance the functions of the capital market, appropriately increase the proportion of direct financing, and provide small and micro enterprises with more financing options has become a problem that requires in-depth research. Financial institutions need to innovate bond services and products in line with the financing needs of small and micro enterprises to continuously expand their financing channels. For example, the financing support service for small and micro enterprise bonds developed by the Industrial Bank is the first innovative business in the market, benefiting many outstanding small and micro enterprises and providing them with financial support. Sichuan Kelun Pharmaceutical Co., Ltd. and Jiuzhoutong Pharmaceutical Group successfully registered the first batch of privately-owned enterprise asset-guaranteed bonds in the inter-bank market through the Industrial Bank, obtaining funds and creating more development space for themselves. Bond financing can provide small and micro enterprises with new financing channels, expand their financing sources, optimize their financing structure, reduce their financing costs, and help them further overcome financial constraints. However, due to the relatively small operating scale of small and micro enterprises, the capital market generally has a low recognition of them, resulting in a relatively low overall bond-financing scale. Since last year, the bond market environment has been relatively stable, providing an opportunity to promote the registration-based system reform and continuously expand the financing channels for small and micro enterprises. Moreover, with the IPO review process becoming more efficient and transparent, small and micro enterprises can obtain financing through listing. Currently, many high-quality small and micro enterprises have been given green-light access and have become the main issuers. In

the future, expanding the outstanding scale of small and micro enterprise bonds, improving the convenience and availability of bond-financing for small and micro enterprises, and broadening financing channels will be one of the important directions of financial innovation^[5-8].

3.3. Innovating comprehensive financial services

Information asymmetry is one of the main reasons for the difficult and costly financing of small and micro enterprises. In response to the current financing problems of small and micro enterprises, financial institutions are continuously enhancing their comprehensive financial service capabilities to provide new financing channels for small and micro enterprises and meet their diversified financial service needs. For example, they can strengthen the collection and analysis of information related to small and micro enterprises, understand their actual needs and risk characteristics, and provide customized financial solutions. This requires financial institutions to deeply integrate various financial services and explore new financial service projects based on the results of information collection and analysis, breaking through the boundaries of traditional financial services. They should provide small and micro enterprises with comprehensive, one-stop financial solutions that include financial consulting, insurance services, investment and wealth management, and banking services. Currently, some financial institutions have made beneficial attempts in comprehensive financial services for small and micro enterprises, providing references for the implementation of relevant work. For example, the Zheshang Bank has experimented with the financial advisor system for six years. By integrating cross-institutional and cross-industry financial elements, it has constructed a “1 + N” comprehensive financial service system specifically for small and medium-sized and micro enterprises. This system realizes multi-dimensional complementarity and multi-party sharing of information, making up for the shortcomings of enterprises in professional knowledge fields such as law, finance, and accounting, and providing practical experience in solving the information-asymmetry problem between financial institutions and small and micro enterprises^[9-11]. Based on the financial advisor system, the Zheshang Bank has actively promoted the construction of financial advisor studios and conducted research activities relying on these studios to better understand the financing demands of small and micro enterprises and further assist them in solving problems related to enterprise listing, industrial mergers and acquisitions, the construction of supply-chain ecosystems, and liquidity management.

3.4. Improving the credit risk control system of financial institutions

The high risk rating assigned to small and micro enterprises by financing institutions is an important factor contributing to their financing difficulties. Therefore, financial innovation for small and micro enterprises should focus on improving the credit risk control system of financial institutions. For example, innovating their credit-loan system and adopting a digital risk-control model. Financial institutions can optimize the risk-control process through advanced technical means such as artificial intelligence and big data, thereby enhancing their risk-monitoring and early-warning capabilities, accurately identifying credit risks, and making rapid responses. The application of big data technology can improve the ability of financial institutions to obtain, process, and analyze enterprise risk data. Financial institutions can use big data tools to enrich the types of enterprise data collection, expand the scope of enterprise data collection, and achieve batch processing of enterprise data from different types and sources. For example, algorithms can be used to automatically evaluate the lending amount of credit loans within the limit, reducing the risk-control cost and the bad-debt rate. At the same time, financing institutions can also combine big-data analysis, intelligent control, and traditional manual operations. When it comes to issues such

as medium-and long-term loans for small and micro enterprises, mortgage loans, and over-limit lending, financial services can be classified as complex and high-risk credit products, and then the manual credit-approval process can be implemented. Currently, many large and medium-sized financial institutions have started to layout digital financial products, aiming to enhance their digital capabilities and strengthen cooperation with external fintech companies to seek digital transformation. This will enable them to cover more small and micro enterprises with financing needs and provide them with more convenient and targeted financial services^[12, 13].

3.5. Improving the mortgage and guarantee system for small and micro enterprises

Many small and micro enterprises have a high risk rating from financing institutions due to their small operating scale, insufficient operating stability, and lack of rich historical credit records, making it difficult for them to obtain financial support from financial institutions. To address this issue and enable small and micro enterprises to access financing more conveniently through financial institutions, it is necessary to improve the mortgage and guarantee system for small and micro enterprises. First, the government can provide financing guarantees for outstanding small and micro enterprises with financing needs by setting up special funds and establishing policy-based financial institutions. Relatively speaking, government-provided guarantees have a high degree of recognition. By introducing a market-based operation mechanism based on fiscal budget calculations and reviewing small and micro enterprises applying for financing, the government can provide policy-based guarantees for eligible small and micro enterprises, enabling them to obtain financing more smoothly. Second, diverse credit-guarantee institutions should be established. For example, financial institutions can establish cooperative relationships with local small and micro guarantee institutions, improve the joint-guarantee system, guide and encourage them to participate in the mortgage and guarantee for small and micro enterprises, and provide credit enhancement support for small and micro enterprises' financing, thereby reducing the loan risks of financial institutions and improving the financing availability of small and micro enterprises. Finally, corresponding preferential and subsidy policies should be introduced to reduce the losses of small and micro institutions, help them break through financing bottlenecks, and solve the borrowing problems of small and micro enterprises caused by the lack of collateral^[14].

3.6. Implementing supply-chain finance

While continuously expanding the financing channels for small and micro enterprises and improving their mortgage and guarantee system, supply-chain finance should also be implemented, incorporating multiple entities such as core enterprises, distributors, suppliers, and financial institutions into the financial model. Different from the traditional financial model, supply-chain finance emphasizes the coordinated cooperation among all participating entities, forming a strategic alliance relationship and a solid cooperation mechanism to enhance the overall credit level of the supply chain and create conditions for small and micro enterprises to obtain financing. In this model, core enterprises need to play a leading role and guide upstream and downstream enterprises to actively participate in supply-chain finance management activities. Relatively speaking, core enterprises have high market influence and credit ratings and can provide credit guarantees for small and micro enterprises in the supply chain, enhancing the confidence of financial institutions in them. For example, core enterprises can establish a unified financial management system and an ERP business management system to transparently manage their accounts receivable and accounts payable information and share relevant data with upstream and downstream enterprises, improving the information-transfer efficiency and reducing the financing costs of small and micro enterprises^[15]. At the same time, each node enterprise in the supply chain should strengthen risk control and internal management

to ensure the timeliness and accuracy of information updates. This requires financial institutions to strengthen the application of advanced technologies such as blockchain and big data to achieve accurate credit assessment and comprehensive monitoring of each enterprise in the supply chain. Small and micro enterprises should also improve their internal control systems, standardize financial statements, and enhance their management levels.

4. Conclusion

In conclusion, accelerating financial innovation to address the problems faced by small and micro enterprises in financing, such as insufficient financing supply scale, limited financing channels, and generally high financing costs, is the foundation for stimulating the development vitality of small and micro enterprises and promoting the high-quality development of China's national economy. In response to the financing difficulties of small and micro enterprises, it is necessary to promote financial innovation through multiple measures, including maintaining an incremental credit supply, continuously expanding financing channels, innovating comprehensive financial services, improving the credit risk control system of financial institutions, and implementing supply-chain finance, to improve the convenience and availability of small and micro enterprise financing.

Disclosure statement

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A Study of the Association Between Structural Trends Stocks Influenced by Investor Preferences and Broad Market Index Movements

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Abstract: By using the Chinese stock market data from 2018 to 2024, the weak association between structural trends stocks and market index under investors' preference effect in trading cause the market is lack of liquidity and more likely to be dominated by structural trends, as in this market, the willingness to engage in passive trading exceeds that for active trading and investors' preference easy to reverse toward market volatility. The lack of incremental capital in the market often leads to sector-specific rallies rather than broad-based increases, which is one of the key reasons why the Chinese stock market has struggled to achieve overall growth over the long-term period.

Keywords: Preference; Structural trends; Liquidity; Passive trading; Incremental capital

Online publication: July 15, 2025

1. Introduction

In modern financial markets, investor preferences have a profound impact on asset price formation and market trends. The participants of market, influenced by their risk appetites and market expectations, make corresponding investment decisions that subsequently affect the pricing mechanisms and volatility of assets. Their trading behaviors create structural patterns in individual stocks, which manifest through candlestick charts. Certain stocks exhibit a unique structure before breaking upward, which can often show symmetry or extremely irregular movements. It can be considered as a signal before the stock price breaks upward and is often considered as a structure that can generate upward momentum in technical analysis. Stocks that are about to form such a trend structure, or a K-line structure in a series of different time periods that meet the characteristics of such a structure, are considered to have potential upward momentum. From 2018 to 2024, in Chinese stock market, a number of stocks that have exhibited extremely unique and similar price action patterns over a period of time, as the insufficient liquidity cause the market to become structural. Stocks like 000622, 002708, 600604, 002565, 300748,

300313,601919, have experienced significant short-term surges, and share a common pattern: the stock prices of these companies either experienced a prolonged period of stability or fluctuated within a long-term range before rising significantly. The formation of this pattern typically spans several years, and in some cases, can extend beyond a decade.

As a well-known theory, Chan's Theory (a Chinese stock market analysis methodology) has provided the definition of the structural trend of stocks ^[1]. This theory emphasizes that both bullish and bearish trends inevitably develop such central pivot structures for certain stocks, which can be recognized as directional indicators and crucial momentum generators for price movements. Moreover, the Elliott wave theory further states that the movement of stock prices is believed to follow a specific wave pattern, which reflects changes in the psychology of investors ^[2]. The investment decisions made by investors based on their own preferences may become the driving force for stock prices to increase, especially in markets with a large number of retail investors. In the past decades, the Random Walk theory states that the current stock prices already incorporate all available market information, and the fluctuations in security prices are completely random and unpredictable, and the market price trend itself also follows a random pattern ^[3]. In 2018, Bordalo *et al.* discuss how diagnosis expectation theory contributes to individuals' decision-making related to investment ^[4].

However, in 2022, Bordalo *et al.* point out that more precise predictions can be made by evaluating individuals' diagnosis expectations ^[5]. Incorporating diagnosis expectations into rational theories can lead to more efficient decision-making and better economic outcomes, which contributes to mitigating the volatility problem in the economy. Shleifer *et al.* discusses potential impacts on financial markets, as overreaction can be an important source of bubble ^[6]. The investors may highly rely on these kinds of "diagnosis tools" and over-confidently invest an excessive proportion of their fund of their wealth in asset markets and give rise to bubbles. However, one missing block to journals of research is investor's preference effect in their trading decision affect the feedback and outcome of market. Despite the preferences together with expectations can instruct agents in decision-making, the impact of individuals' behaviour is more likely to be based on their preferences. This study aims to explore the functionality of structural trend of stocks under the influence of individuals' preference and its association with China market index (SSE Composite Index).

2. Method

Stock data are collected from Eastmoney trading, Shanghai Stock Exchange, and Shenzhen Stock Exchange; the relevant stocks were selected from five index representing large-cap stocks, mid-cap, and small-cap stocks respectively ^[7-9]. To gain a large and representative sample, the trading period of collecting data is from 2018 to 2024. Among the selected trading periods, January, March, April, July, and October of each trading period are excluded.

2.1. Inclusion criteria

The inclusion criteria include:

- (1) The stock price moves sideways or fluctuate within a range over a period of time (at least over two months), forming multiple central pivot structures.
- (2) Within the selected time period, the stock has increased by 20% or more
- (3) There are no undisclosed significant matters such as financial fraud.

2.2. Exclusion criteria

Sudden news may lead to investors' expectations dominating their trading behaviour. Therefore, stocks whose prices fluctuate sharply due to the influence of sudden news factors within the selected trading period are excluded. Moreover, exclude stocks that have been intentionally manipulated due to unconfirmed news.

The excluded months are the annual crucial policy disclosure and the intensive period for financial performance disclosure. Therefore, to eliminate the expectation effect, the selected period for data analysis has been excluded from these months. Now these selected stocks' performance needs to be tested against the market index (SSE Composite Index), to test the association between them.

3. Results

Table 1 shows the summary of the sample selected stocks for this study, while **Table 2** shows the incremental trading volume of the Chinese market from the year 2018 to 2024. **Figure 1** shows the average return of the sample stock and the Market index if investors invested during the selected trading period.

Table 1. Summary of sample selected stocks

Index	Number of stocks	Period
CSI 300 Index	120	49
SSE 50 Index	10	49
CSI 500 Index	225	49
CSi 1000 Index	635	49
CSI 2000 Index	895	49
Overall	1886	49

Table 2. Incremental Trading Volume of Chinese market from 2018 to 2024

Time period	Increment Trading Volume (Billion)
2018	-24887
2019	37120
2020	79950
2021	50320
2022	-48120
2023	-11780
2024	42600
Average	17886

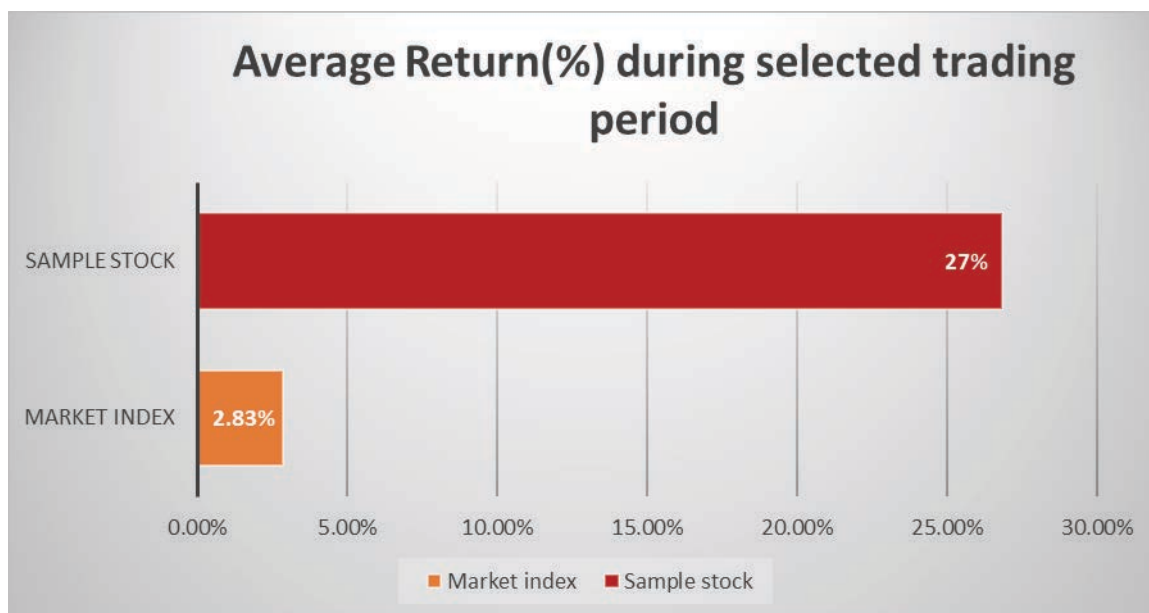


Figure 1. Average Return (%) during selected trading period

Based on the data presented in **Table 1**, **Table 2**, and **Figure 1**, a correlation test was conducted between the sample stocks and the SSE Composite Index, using the equation below.

The results indicate that the market index trend has a limited influence on the selected stocks, as evidenced by a *p*-value below 0.5. The test results show that the correlation is not significant. According to the data from the Shanghai Stock Exchange, by the end of December 2024, there are 5383 stocks listed in the Chinese stock market, while 256 stocks have very low trading volume (lack of liquidity). The sample stocks have occupied around 35% of the total stocks listed on the Chinese stock market. Under the Structural trends in stocks guided by preference, the performance of stocks also differs from the market index and other important index investors prefer to invest.

Based on **Figure 1**, the sample stock achieved an average return of 27%, while the market index only increased 2.83% within the selected trading period. Around 34% of publicly traded stocks have generated returns nine times greater than the market index's growth for investors. To further illustrate the weak association in the Chinese stock market between indices, investors prefer to invest within the selected period.

Within the selected period, by adding the other important indices into comparison, as the **Figure 2** shows that the performance of sample stocks is also better than the Market index and other important indices investors prefer to invest in, with CSI 300, SSE 50, CSI 500, CSI 1000, and CSI 2000 respectively.

As the market reactions during the policy-intensive period and the period of performance disclosure were excluded, the rate of return is more dependent on fundamentals and the capital situation. Under this situation, investors are more likely to make trading decisions based on their preferences. **Figure 2** also indicates that under the preference effect, the market is more likely to be dominated by structural trends, as within a certain time period, stocks in some sectors continue to rise consistently, while the majority either experience minimal growth or even decline.

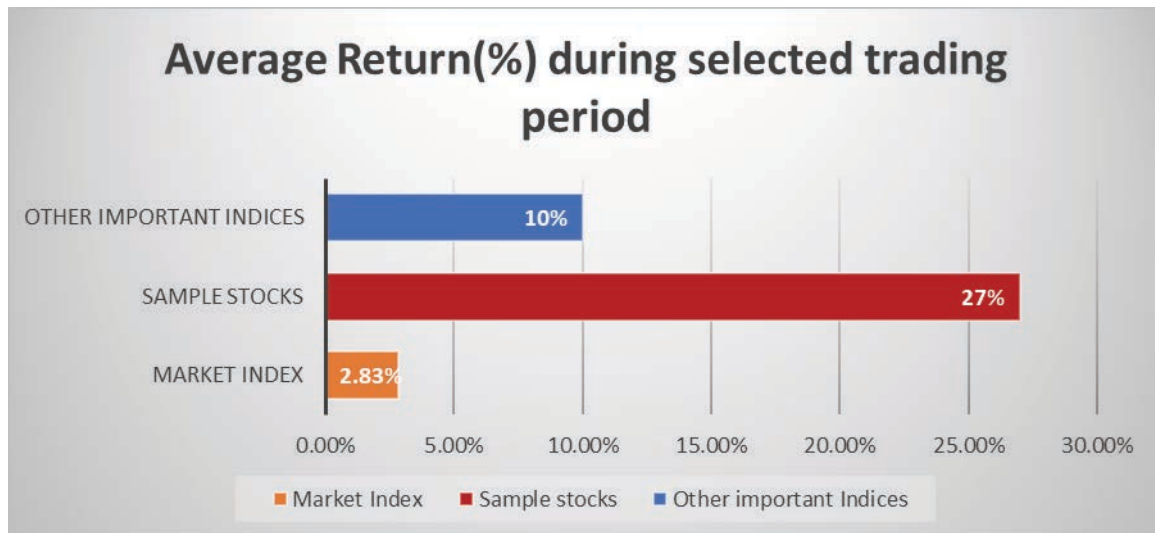


Figure 2. Average Return (%) during selected trading period

4. Preference effect between the structural trend of stocks and the Market index

By the end of December 2024, according to the data from CSDC, the number of investors in the Chinese stock market has exceeded 220 million, and individual investors account for 99.7%, while there are only 50 million individual investors in the US stock market ^[10]. As the retail investor occupies a high proportion in the Chinese stock market, preferences play an important role in their decision-making toward trading.

4.1. Trading mechanism

Under the T+1 trading mechanism, retail investors cannot end their trading within a single trading period, which makes their trading riskier. Most of them have risk-aversion before they try to invest in stocks, but by the time they hold the stocks on hand, they become loss-averse. Their preference changes quickly as the stock prices go up and down. However, most stocks in the Chinese market suffer from low liquidity. As shown in **Figure 3**, the increasing number of listed stocks has further strained overall market liquidity. This issue is exacerbated by the limited implementation of the market maker mechanism, which currently applies to only about 7% of all listed stocks, primarily those on the Sci-Tech Innovation Board and the Beijing Stock Exchange. Bian *et al.* point out that the T+1 trading rules cause the stocks to lack liquidity ^[11]. Investors' preference for liquidity has intensified speculative behaviour in the market. Therefore, the trend of stock is usually different from the market index. Besides, the Securities Lending and Borrowing Mechanism in China stock market enables institutional investors to hold an advantage position in the market, while retail investors may face greater risk in short-term stock investment, as it may enforce the short-selling power in the market, particularly when the market is temporary in a downward trend, and investors were forced to sell stocks out of panic, thereby exacerbating stock market volatility. Based on the data from CSF, on 12 June 2024, a total of 160 million shares were lent out in the margin lending and short selling business on that day ^[12]. At the same time, over 3400 stocks were dropped, which occupied 64% of the total stocks listed in the Chinese stock market.

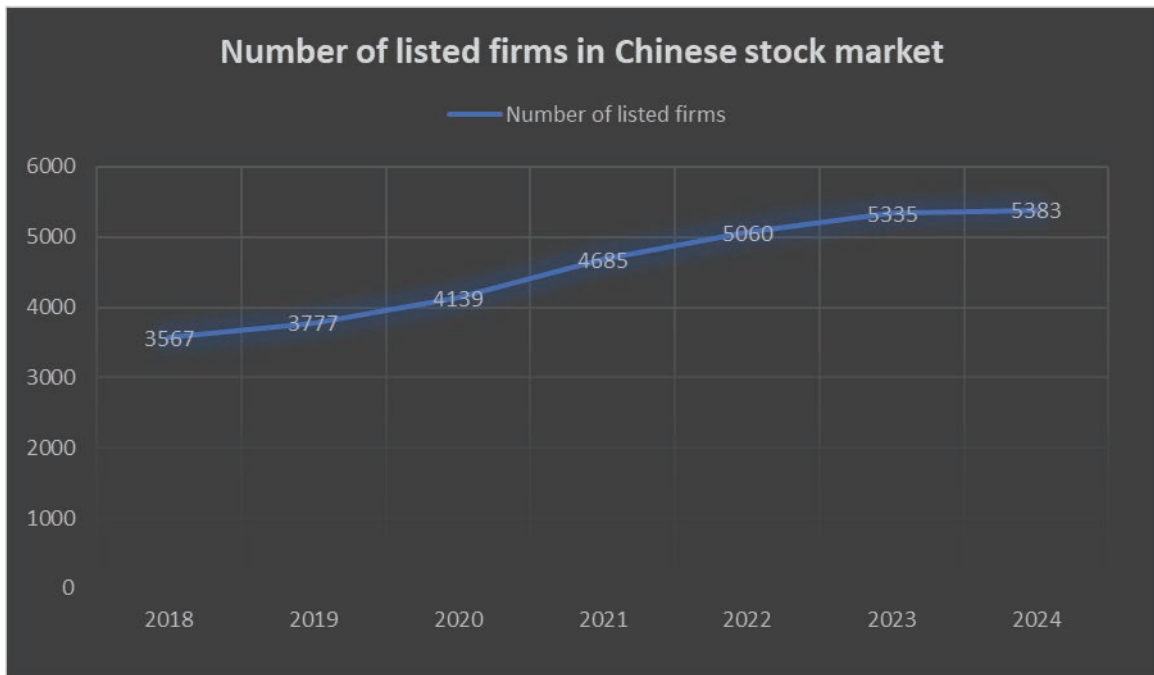


Figure 3. Number of listed firms in the Chinese stock market

4.2. Insufficient market liquidity problem

Preference can be an important source of bubbles when individuals overreact to the market trend. As most of investors in China stock market is individual investors, they are important in providing the liquidity in the market, Based on **Figure 4**, the proportion of retail trading (RTP) in China’s stock market rebounded significantly to 50% by the end of 2024, and they usually account for around 60% of the total market trading volume.



Figure 4. Total market cap and Total trading volume (billion)

However, under the preference effect, retail investors are easy to lose money in short-term trading, while most of retail investors tend to hold stocks less than 5 days, as they prefer to invest in the stock, which prices rise with higher trading volume, these stocks are recognized to have sufficient liquidity, 15% of them prefer to hold stocks for above 6 months. Institutional investors tend to hold the stock for a longer period, as they have the advantage in funds. They can afford to maintain the liquidity for stocks as market maker, like placing orders with a close price or a certain price range. Therefore, stocks stay stable and even show an upward trend. Hu *et al.* states that when market liquidity is poor, retail investors may tend to engage in short-term trading to reduce transaction costs and risks, while when the market liquidity is in a good condition level, retail investors might pay more attention to long-term investment opportunities ^[13]. Under the insufficient liquidity market, the willingness to engage in passive trading exceeds that for active trading, as most of retail investors prefer short-term speculative activities, and there is less incremental funding flowing into the market after 2020. At the same time, the total market value was in a downward trend after 2021. As a result, the market is difficult to achieve an overall rise; instead, it is more about the rotational rise among stocks in different industries. Moreover, this also causes long-term stagnation of the Chinese stock market. This has caused China's stock market growth to nearly stagnate over the long term.

4.3. Preference reversal

Chinese market is a highly speculative emerging market, as the insufficient liquidity causes investors to rarely have the willingness to engage in active trade and hold stocks for the long term in the market. Amihud *et al.* found that insufficient liquidity may lead to the increase in speculative behaviour in emerging markets ^[14]. As the insufficient market liquidity makes it difficult for investors to obtain premiums in their investments, forces them to change their risk appetite. In this case, most of the investors only hold stocks for short-term trading, as they recognize that short-term trading earns a higher return from the high market volatility, and their preference is easy to be reversed. Kim *et al.* found that in the decision-making process, people tend to choose low-risk and low-reward options, whereas in pricing scenarios, they are willing to pay higher premiums for high-risk, high-reward alternatives ^[15]. When investors face the high market volatility, their preference may reverse, as they tend to buy if the market trend is rising and sell when the market is dropping. Therefore, they may misprice their investment and invest moves contrary to their preferences. This often happens in emerging markets, as the investors change their risk preference and make irrational investment moves frequently when they face the intense market volatility and causing the market stability is extremely fragile over a short-term period. At the same time intensified the structural divergence in the stock market.

5. Conclusion

Overall, the Chinese market is a highly speculative emerging market, and most of investors are willing to trade passively in response to market fluctuations, as the market faces the insufficient liquidity. Under investors' preference effect, Structural market trends have gradually become the main market trend, as the performance of stocks has a weak correlation with the market index, which leads to structural or rotational movements in sector-specific stocks, making it difficult for a broad-based rally to occur across the entire market. Besides, under the condition of insufficient market liquidity, investors are more willing to engage in short-term speculation rather than hold stocks for the long term; their preference may reverse toward the market volatility and even affect the stability of the market in short-term. Despite there is a high level of participation among market investors, the lack

of incremental funds results in the Chinese stock market struggles to achieve long-term stable growth.

Disclosure statement

The author declares no conflict of interest.

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Exploration of Control Struggle Issues with JonjeE HI-TECH as an Example

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Abstract: This paper sorts out relevant theories of control struggle, constructs a theoretical model of control struggle from three dimensions of resource dependence, subject relationship, and institutional environment, and deeply explores the causes and strategies of conflicts between shareholders, management, and major shareholders. Taking JonjeE HI-TECH as an example, this paper analyzes the process and causes of its control struggle, and draws a conclusion that enterprises should formulate long-term strategic planning and resource integration ability is the key to capital game, and puts forward suggestions such as capital operation should be aimed at supporting the development of the main business, the stability of corporate governance is the foundation of long-term development of enterprises, and the maintenance of market confidence.

Keywords: Battle for control; Theoretical model of control contest; JonjeE HI-TECH; Long-term strategic planning

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1. Theoretical overview

Current research on control struggle mainly focuses on shareholder relations, corporate governance, resource management, and other issues. This research involves management theories, including principal-agent theory, conflict theory, and resource dependence theory, among others. In terms of shareholder relations, the principal-agent theory was first put forward by Burleigh and Means in the 1930s due to their insights into the significant drawbacks of the practice where owners and operators of enterprises are the same individuals. The core of this theory lies in resolving the conflict of interest between shareholders and management, as well as balancing the interests between major shareholders and minority shareholders^[1]. However, despite the fact that the separation of ownership and management has alleviated these problems to a certain extent, the principal-agent problem still persists in shareholder relationships. Therefore, shareholder relationships often face challenges such as the “tunneling” issue between the ultimate shareholder and minority shareholders, and the principal-agent problem between shareholders and management due to ownership and management issues. As major shareholders increase

their shareholding ratios, corporate performance may gradually improve, but the private interests of major shareholders can potentially harm the interests of minority shareholders, having a strong negative impact on the long-term development of enterprises.

Due to their high shareholding proportions, major shareholders often have a significant influence on enterprise decision-making and can even control the business direction of the enterprise. Such control may be used by major shareholders to seek private gains, thereby damaging the interests of minority shareholders ^[2]. Furthermore, there may be related-party transactions, equity transfers, manipulation of information disclosure, and other methods employed by major shareholders to seize corporate resources and pursue private interests at the expense of minority shareholders ^[3]. By controlling enterprise resources, shareholders can transfer benefits within the enterprise, resulting in short-term improvements in enterprise performance. However, in the long run, enterprise resources will be depleted by shareholders, severely damaging enterprise competitiveness and market value. Regarding corporate governance, conflict theory emphasizes that conflicts among behavioral subjects may lead to the breakdown of harmonious relations within organizations.

However, moderate conflicts can improve the scientificity of decision-making to a certain extent ^[4]. The key to corporate governance lies in managing conflicts and ensuring they play a positive role within a controllable scope. The existing corporate governance model has gradually shifted from “centralism of shareholders’ meetings” to “centralism of the board of directors,” with shareholders resorting to “voting with feet” instead of “voting with hands” ^[5]. With a relatively dispersed ownership structure, it is difficult for any single shareholder to obtain absolute control. To meet the needs of shareholders, the right of control gradually shifted from the ownership of material capital to the right of use of corresponding capital. Consequently, management replaced shareholders as the main body of value creation, reconstructing the traditional agency relationship between shareholders and management, and further enhancing the enterprise’s ability to utilize key resources ^[6]. This transition facilitated the transformation from “capital as the wage-earning factor” to “labor as the wage-earning capital.”

In the traditional agency relationship, shareholders ensured that management’s behavior aligned with shareholders’ interests through incentive and supervision mechanisms. However, under the board-centric governance model, management gradually gained actual control of the company, weakening the influence of shareholders. As a result, shareholders’ roles shifted from direct controllers to indirect supervisors, while management became the core force driving the company’s value creation by mastering the company’s key resources. In terms of resource management, resource dependence theory posits that resources are the foundation of enterprise strategy and can be leveraged to enhance the core competitiveness and value growth of enterprises ^[7]. From the perspective of control struggle, the resources involved often encompass shareholder resources, social capital, and risk capital, among others. Their heterogeneity and dependence contribute to the combination and competition among shareholders. In the actual process of resource management and allocation, differences in the will of multiple actors lead to agency conflicts and interest transfers among shareholders, the board, and operators. The diversity of shareholders’ resource portfolios and the specificity of social capital comprehensively reflect the ability of founders and managers to utilize resources to form technology, marketing, culture, and other aspects of the enterprise.

As owners of the enterprise, shareholders expect to maximize their returns through investment. The board of directors, as the agent of shareholders, is responsible for overseeing the operation and management of the enterprise. Meanwhile, as the operators of the enterprise, management is responsible for specific business operations ^[8]. Due to their differing roles and interest demands, power struggles and interest conflicts may arise within the enterprise. Therefore, a sound governance mechanism is necessary to balance the interest relationships

among shareholders, the board of directors, and management. By leveraging social relationship networks, enterprises can obtain market channels and technical resources, and improve operational efficiency through resource allocation and process optimization.

2. Construction of theoretical model

Based on the above theoretical analysis, to further comprehensively explore and uncover the motivations and game dynamics behind the struggle for control rights, this paper establishes a theoretical model of the struggle for control rights from three dimensions: resource dependence, subject relationships, and institutional environment, and conducts quantitative analysis on each of them respectively. This allows for a clearer understanding of the optimal decision-making direction for corporate holdings and provides relevant pathway guidance for enterprises to achieve sustainable development in the struggle for control rights.

For the dimension of resource dependence, it focuses on the allocation and utilization of key resources in the struggle for control rights. Resources are the foundation of corporate power, and the struggle for control rights often revolves around the acquisition and allocation of resources, including both financial and non-financial resources. When facing issues of resource dependence, it is necessary to consider that the scarcity and specificity of different resources determine their value in the struggle for control rights, and the ability to integrate resources determines the pattern of power distribution. Therefore, the following resource allocation optimization model is constructed:

$$\max_{x_1, x_2} (\alpha U_1(x_1) + (1 - \alpha) U_2(x_2)) \quad (1)$$

With x_1 and x_2 representing the resources allocated to different participating entities, and $U_1(x_1)$ and $U_2(x_2)$ representing the corresponding utility functions, α denotes the shareholder's weight in resource allocation, reflecting their power. In this model, it embodies the power game within the enterprise during the resource allocation process, aiding in discovering the optimal actual control right allocation for the enterprise.

For the dimension of subject relationships, it lies in identifying the specific relationships among the participating entities in the struggle for control rights, generally including shareholders and management, major and minor shareholders, major shareholders and management, and multiple major shareholders. Information asymmetry and conflict of interest among participating entities are the main driving factors. Major shareholders may harm the interests of minority shareholders through "tunneling," management may consolidate their position through equity incentives or strategic adjustments, and multiple major shareholders may influence the allocation of control rights through alliances or competition. Therefore, the following game model among participating entities is constructed:

$$\forall i, s_i^* = \arg \max_{s_i} (\pi_i(s_i, s_{-i}^*)) \quad (2)$$

With S_i represents the policy of the i participating agent, s_{-i}^* denoting the optimal strategies of other participants, and π_i indicating the profit function of the i th participant, the model illustrates the optimal strategy formed through independent decision-making based on the mutual game among multiple participants. It embodies the balance of interests among different participants, which influences the allocation of control rights.

For the dimension of institutional environment, it focuses on the impact of the external environment on the struggle for corporate control rights, generally including the policy environment, economic environment, and competition within industry. These factors constitute external constraints for the struggle for corporate control rights. The policy environment refers to the constraints and guidance imposed on corporate operating behaviors by the government through laws and regulations, industrial policies, and regulatory measures. Changes in the policy environment may directly affect the ways and outcomes of the struggle for control rights. The economic environment refers to the impact of macroeconomic conditions on corporate operations, which may affect a company's financing capabilities, market performance, and the costs of the struggle for control rights. Competition within the industry refers to the impact of the behaviors of other companies in the industry on a company's operations. Competition within the industry may influence a company's struggle for control rights through methods such as competing for market share, technological innovation, and price wars. Based on this, the following quantitative model of the institutional environment is constructed:

$$\begin{cases} P(Y = y|X_{p,e,c}) = f(X_{p,e,c}, \theta_{p,e,c}) \\ X_p = \sum_{i=1}^n w_i \cdot \Delta P_i \\ X_e = \beta_1 \Delta GDP + \beta_2 \Delta Interest + \beta_3 \Delta Market \\ X_c = \sum_{i=1}^n \gamma_i \cdot \Delta C_i \cdot \Delta D_i \end{cases} \quad (3)$$

Y represents the strategic adjustment made by the struggle for control, $X_{p,e,c}$ represents the change caused by the policy environment, economic environment, and industry competition, $f(X_{p,e,c}, \theta_{p,e,c})$ represents the influence function, $\theta_{p,e,c}$ is the parameter. w_i represents the weight of the policy change for item i , and ΔP_i represents the magnitude of its impact. ΔGDP is the change of GDP growth rate, $\Delta Interest$ is the change of interest rate level, $\Delta Market$ is the change of capital market index, and β_1, β_2 and β_3 are the corresponding index weights. γ_i represents the impact weight of the i th firm, ΔC_i represents its market share, and ΔD_i represents its level of technological innovation. This model mainly explains the adjustment of control battle strategies caused by environmental changes and provides more refined decision support for corporate governance practices.

3. Conflict analysis between shareholders and management

In order to further verify the theoretical model of control struggle, this paper will take the conflict between shareholders and management as an example to explore the motivation and related strategies behind the conflict between shareholders and management.

From the perspective of resource dependence, the difference in control rights between shareholders and management is the starting point of the conflict. Shareholders typically control financial resources, while management controls technical and operational resources. The heterogeneity of resources leads to intransigence in strategic decision-making. For example, management may prefer to invest in long-term research and development to consolidate technological advantages, while shareholders are more focused on short-term financial returns, demanding that R&D budgets be cut to increase dividends. Management adds value by pooling resources, but the process can weaken direct shareholder control. When management brings in strategic investors to acquire technology resources, it can dilute the stakes of the original shareholders and trigger a battle for control. According to Formula (1), if the utility difference between shareholders and management is too large, it is difficult to achieve

a balance in resource allocation.

From the subject relation dimension, there is information asymmetry and interest conflict between them. As the owners of enterprises, the core goal of shareholders is to maximize the return on investment, and they expect to obtain rich dividends and capital appreciation through the efficient operation and good financial performance of enterprises. However, as the operator of the enterprise, the objectives of the management are often more diversified and complex. Management may be more inclined to pursue occupational safety and avoid the risk of being fired for bad business decisions. They may also seek to expand their power, increasing their influence by controlling more resources and decision-making power. In addition, the maintenance of personal reputation is also an important consideration for management; they hope to win recognition and praise in the industry through good performance. When management accumulates shares through stock incentive, it may change from “agent” to “actual controller”. For example, at Apple, Steve Jobs had a strong influence on the board through a combination of technical authority and equity.

According to Formula (2), if the management strategy deviates from the optimal solution for shareholders, the battle for control rights will intensify. From the dimension of system environment, mainly from the policy environment, economic environment, industry competition respectively in-depth research. In terms of policy environment, binding policies will limit the management’s space for information manipulation, but also increase compliance costs, which may lead to shareholders’ questions about the efficiency of management. Supportive policies may be used by management to expand personal power and exacerbate agency problems. In terms of economic environment, when the economy is down, shareholders tend to adopt conservative strategies, while the management may resist maintaining organizational stability, and when the economy is up, shareholders may expand the scale more aggressively than the management in an attempt to obtain more profits. In terms of peer competition, when industry competition intensifies, management may require more resources to be invested in the market competition, while shareholders prefer cost control.

According to Formula (3), the implementation of multiple policies may lead to different degrees of conflict between shareholders and management. With the increase of economic fluctuation, the conflict probability between shareholders and management increases significantly. Once the competitive pressure increases, the divergence between the two sides on the allocation of resources will be further widened.

4. Further discussion and analysis of shareholder checks and balances

In various fields, green development has achieved remarkable results, and green development is an important symbol of China’s shift from a speed economy to high-quality development ^[9]. In Xi’an, Shaanxi Province, for example, the government is advocating and implementing energy-saving technologies to promote the goal of energy conservation and emission reduction. By applying digital technologies, the government has improved its ability to manage energy conservation and consumption reduction, successfully reduced energy consumption per unit of product, and significantly improved energy efficiency in industries such as thermal power and cement. These achievements have verified that the concept of high-quality development of enterprises should be centered on green, low-carbon, and environmental protection, and have provided strong support for enterprises to move towards sustainable development.

However, despite the fact that the manufacturing industry has established a relatively well-developed industrial system, its major reliance on traditional manufacturing has led to a relatively low input-output ratio

and still high resource and energy consumption. This may imply that there is still room for improvement in the development and utilization of resources by enterprises, and that the competitiveness of their products and services in the market needs to be improved. Efficient resource utilization and high-quality products and services will be the key to the future development of enterprises, and the realization of the greening of the whole process is also a pressing issue for manufacturing enterprises.

Therefore, in order to improve competitiveness and achieve sustainable development, manufacturing enterprises not only need to further optimize the use of resources and improve the quality of products and services, but also need to integrate the green concept into the whole process. Further promoting green development, focusing on resource conservation and environmental protection in the process of economic development, and promoting technological innovation and industrial upgrading, so as to realize the sustainable development of enterprises, is an inevitable path to promote high-quality economic development. Manufacturing enterprises actively introduce green innovation technology, adhere to resource regeneration and recycling, reduce pollution emissions, strengthen the protection and repair of the ecosystem, achieve green development of enterprises, and help achieve the modernization process of harmonious coexistence between human beings and nature.

In the process of conflict, the board of directors is the main focus of the control battle, and it is the external characteristic of the shareholder conflict behavior, which is generally manifested by the new major shareholders holding the shareholders' meeting to reelect the board of directors and the resistance of the original major shareholders. In the result of the conflict, a new shareholder balance has been formed, which appears to be the victory of one group, but in fact, it is more than one group. On the whole, the conflicts of major shareholders have not produced actual positive benefits for either party. Therefore, how to effectively avoid major shareholder conflicts or control the scale of major shareholder conflicts to form effective shareholder checks and balances is the governance approach for sustainable development of enterprises.

5. Case analysis of JonjeE HI-TECH control battle

5.1. Case introduction

5.1.1. Company profile

JonjeE HI-TECH (Group) Co., Ltd. was established in 1993 and listed on the Shanghai Stock Exchange in 1995 (600872). Its business mainly covers condiment production and sales, national high-tech zone operation and urban development, auto parts, and other fields. Its core business is condiment. Before 2015, Torch Group was the largest shareholder of JonjeE HI-TECH, and the actual control was the Management Committee of Zhongshan Torch High-tech Industrial Development Zone. In 2015, Baoneng quickly increased its shares and became the first major shareholder of JonjeE HI-TECH through its Qianhai Life Insurance, and Yao Zhenhua became the actual controller.

5.1.2. Event introduction

In 2015, after Qianhai Life Insurance held a number of billboards to enter the JonjeE HI-TECH, Baoneng Department through Qianhai Life Insurance in the secondary market to buy a large number of JonjeE HI-TECH stocks, surpassing the Torch Group to become the largest shareholder. In 2018, Foresea Life transferred 24.92% of its shares to Zhongshan Runtian, and Baoneng officially entered JonjeE HI-TECH.

In 2020, Baoneng began to reduce the shares of JonjeE HI-TECH due to the debt crisis, and its shares were repeatedly pledged and enforced, and Torch Group and its concerted actors took the opportunity to increase their

shares. In 2022, the Torch Group has increased its shareholding several times, reaching 15.48%, surpassing the 13.75% of Zhongshan Runtian, and becoming the largest shareholder again. In July 2023, Torch Group dismissed four directors with Baoneng background, including He Hua, Huang Wei, Cao Jianjun and Zhou Yanmei, through an extraordinary shareholders' meeting, and elected three new directors related to Torch Group, marking the loss of Baoneng's control over JonjeE HI-TECH.

On July 12, 2023, Baoneng real-name reported the Torch Group and other shareholders on suspicion of false litigation, manipulation of the securities market, and continued to change their own executives. On July 19, 2023, Yao Zhenhua went to the company for research and was turned away by security guards, which set off an uproar. On July 24, 2023, Baoneng issued a statement saying that the extraordinary shareholders' meeting organized by Torch Group was "illegal and irregular", but failed to stop the Torch Group's action.

5.2 Analysis and discussion

The battle for control of JonjeE HI-TECH is a typical conflict between major shareholders, which is mainly caused by the difference in strategic objectives and fundamental interests. Under the guidance of the encouragement policy, Foresea Life is rich in capital but is forced by high debt cost, so the investment target is mainly short-term returns, and Baoneng intends to expand its business scale through the acquisition of enterprises, while Torch Group, as the former major shareholder, aims at sustainable development and maintaining its own control.

In the dimension of resource dependence, the resource of new shareholders is the core resource of the battle. Baoneng system through the secondary market increase and equity transfer, once became the first major shareholder, mastered the control of the company. The Torch Group regained control by increasing its stake and joining forces with concerted actors. Baoneng entered Torch High-tech with the financial support of Foresea Life from 2015 to 2018, but after 2020, due to its own debt crisis, its capital strength was greatly weakened, resulting in its inability to maintain new control of Torch High. Baoneng was forced to reduce its shares due to debt problems, and even part of its shares were auctioned by judicial authorities, which led to its gradually weakening control over JonjeE HI-TECH. The change of resource dependence directly affects the direction of the scramble. Baoneng lost control due to declining capital strength, and Torch Group regained control of the company through resource integration. In the course of the battle, the utility difference between Baoneng System and Torch Group in strategic decision-making was significantly reversed, which also led to Torch Group's successful introduction of strategic investment to regain the control.

In the subject relationship dimension, as an external capital, Baoneng entered JonjeE HI-TECH by holding a license and increasing its holdings, trying to control the company through capital operation. However, Baoneng's capital operation model is not fully aligned with JonjeE HI-TECH's core business, leading to challenges in corporate governance. Torch Group, as the founding shareholder of Torch High new and the capital force of local government background, Torch Group pays more attention to the long-term development and main business of the company. In the early days of Baoneng's ownership, Torch Group and Baoneng had a brief cooperation, but with Baoneng's debt crisis and differences in business philosophy, the relationship between the two sides deteriorated rapidly, and eventually evolved into an open confrontation. The Torch Group strengthened its capital strength and negotiating power by cooperating with CDH Investment and other concerted actors and finally gained the upper hand in the final battle. The dynamic change of subject relation directly affects the course of battle. The transformation of Baoneng Group and Torch Group from cooperation to confrontation reflects the complexity of profit distribution and power struggle in the capital game.

6. Conclusions

This paper first sorted out the relevant theories and existing studies on the struggle for control rights, and on this basis further constructed the theoretical model of the struggle for control rights from three dimensions of resource dependence, subject relationship and institutional environment, and deeply explored the motivations and strategies of the conflicts between shareholders, management and major shareholders. At the same time, this paper starts with the theoretical model of control struggle, explores the process and causes of control struggle of JonjeE HI-TECH, and reflects the external characteristics and fundamental motivations of major shareholder conflict. Based on this, the following suggestions are obtained:

First, resource dependence is the foundation of the scramble, subject relationship is the core of the scramble, and institutional environment is the rule frame of the scramble. The interaction of the three factors jointly determines the direction of the battle. Enterprises should make clear long-term strategic planning to avoid sacrificing long-term development for short-term interests. Second, in the capital game, the ability of resource integration is the key to determine the outcome. The change of the subject relationship directly affects the course of the battle, and the transformation of cooperation and confrontation needs to be flexibly dealt with. The legal and regulatory environment provides the rule framework for the capital game, and the participant should pay close attention to the change of the regulatory policy to ensure that capital operation meets the regulatory requirements. At the same time, it should be good at finding opportunities and space in the institutional environment. Furthermore, the process from the ownership of Baonengs to the loss of control rights indicates that capital operation should be aimed at supporting the development of the main business, avoiding the damage of the main business caused by excessive financialization. The stability of corporate governance is the basis for the long-term development of enterprises. The game between shareholders should focus on the interests of the company, avoid management turmoil, and pay attention to maintaining market confidence to avoid market fluctuations caused by shareholder games.

Disclosure statement

The author declares no conflict of interest.

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Legal Research on the Protection of the Rights and Interests of Small and Medium-sized Shareholders: Based on the Response of Two-Tier Shareholding Structure

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Abstract: The two-tier shareholding structure, which originated in the United States, has become popular around the world. Unlike the traditional model of “equal shares with equal rights”, the core feature of the two-tier shareholding structure is that the company issues two classes of shares with different voting rights. It enables the concentration and stabilization of corporate control, which has a positive effect on the long-term development of the company and resistance to hostile takeovers. Against the background of the rapid development of the capital market and the continuous innovation of corporate governance structure, the two-tier shareholding structure has begun to be adopted by many enterprises. While this structure can improve the efficiency of corporate governance and promote corporate growth, it also raises a number of challenges. In particular, for small and medium-sized shareholders, their shareholdings may face the problem of limited or no voting rights, as well as the lack of an effective internal and external monitoring mechanism for the company. These issues may lead to the impairment of the rights of small and medium-sized shareholders. Currently, challenges in practice include inadequate laws and regulations, insufficient disclosure of information, and inadequate monitoring mechanisms. Therefore, exploring the path to protect the rights and interests of small and medium-sized shareholders and analyzing their current situation has become an important area in the study of two-tier shareholding structures. This paper starts from the actual situation, analyzes the problems exposed in the operation process of two-tier shareholding structure, and then explores the practical and feasible methods to protect the rights and interests of small and medium-sized shareholders on this basis, with a view to putting forward valuable references for the development of China’s securities market.

Keywords: Two-tier shareholding structure, Small and medium-sized shareholders, Rights and interests protection, Securities law, Sunset clause, Information disclosure

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1. Introduction

1.1. Background and significance of the study

In the era of the deep development of global economic integration and the increasing maturity of China's capital market, the original one-share-one-right approach is no longer applicable to companies with complex shareholder relationships. Since entering the 21st century, since mainland China launched the pilot of preferred shares in 2013, the double-layer shareholding structure has gradually ascended to the stage of securities as an innovative model^[1]. In 2018, the Hong Kong Stock Exchange made adjustments to the Main Board Listing Rules, opening up listing and trading for companies with a double-shareholding structure. Immediately following in 2019, the China Securities Regulatory Commission (CSRC) also opened up the use of dual shareholding structures for innovative companies listed on the Shanghai Stock Exchange. In the same year, the Science and Technology Innovation Board (STB) also clarified for the first time the specific rules and measures for dual shareholding structures. By 2021, in the revision discussion of the company law, it was proposed to allow the issuance of shares with different voting rights as stipulated in the company's articles of association in order to meet the diversified investment needs. The above indications suggest that China will fully introduce a two-tier shareholding structure in the future.

While the two-tier shareholding structure has significant advantages in giving more control to specific shareholders, facilitating corporate financing, and maintaining the control of the founders, it also raises problems such as concentration of control and imbalance of decision-making power, and poses a challenge to the protection of the rights and interests of small and medium-sized shareholders. In today's securities market in China, small and medium-sized investors have long taken up more than 90% of the market, and their size has exceeded 200 million people, which is an important part of the securities market. Protecting the interests of small and medium-sized shareholders is of irreplaceable practical significance to the securities market and is crucial to maintaining the stability and development of the securities market.

Under the guidance of socialist rule of law, the protection of the rights and interests of small and medium-sized shareholders is not only an important embodiment of maintaining the principles of fairness, justice, and openness in the capital market, but also an inevitable requirement for promoting the healthy and stable development of the economy. Therefore, the legal research on the protection of the rights and interests of small and medium-sized shareholders under the double-layer shareholding structure not only has theoretical value, but also has important practical significance.

1.2. Literature review

With the implementation of the domestic dual shareholding system and since the introduction of the first dual shareholding structure company in the United States, more and more listed companies are adopting dual shareholding structure, and this trend has attracted extensive attention from the academic community^[2].

At the level of its concept and characteristics, Li argues that the dual equity system is specifically characterized by the separation of power and decision-making power^[3]. In the opposite direction, that is, the shortcomings of the dual shareholding structure, Zhang pointed out the shortcomings under the current legal framework by analyzing the current status of legislative protection of the rights and interests of small and medium-sized shareholders under the dual shareholding structure^[4]. Zhang's study also focuses on the protection of small and medium-sized shareholders' rights and interests under the two-tier shareholding structure, and she discusses the dilemmas faced by small and medium-sized shareholders under the two-tier shareholding structure and the possible solutions through case studies^[5]. Wang analyzed the impact of double-layer shareholding structure on the

rights and interests of small and medium-sized shareholders in depth from the legal point of view, and put forward suggestions to improve the legal system for the protection of small and medium-sized shareholders' rights and interests^[6].

2. Conceptual analysis of the two-tier shareholding structure

2.1. Concept of two-tier shareholding structure

A two-tier equity structure means that the shares issued by a company have different voting rights and are usually categorized into high-voting shares and low-voting shares. High-voting shares are generally held by the founder or management of the company and have control over the company; while low-voting shares are issued to the public, and their holders, i.e., small and medium-sized shareholders, although they have the economic rights and interests of the shares (e.g., the right to dividends), have their voting rights in corporate decision-making significantly weakened. Simply put, the essence of a two-tier shareholding structure is to divest control and ownership interests in the company, ultimately reinforcing the control of specific shareholders. Such a structure realizes a paradigm shift in the allocation of corporate power from the "majority of the capital" principle of the previous single-shareholding structure to a "consensus minority" mechanism that is more conducive to decision-making.

2.2. Characteristics of the two-tier shareholding structure

(1) Separation of voting rights and income rights

Under the traditional structure, the majority shareholder is also the controlling shareholder, whose voting rights are closely linked to the cash flow rights, and the proportion of shareholding directly determines the size of decision-making power. However, the emergence of the two-tier shareholding structure signaled a trend of diversification of shareholders' roles and interests. Some shareholders choose to voluntarily give up part of their voting rights in exchange for economic benefits under specific conditions (e.g., low share price). At the same time, shareholders with managerial ability are granted excess voting rights, which is more conducive to the long-term development of the company.

(2) Strict restrictions on special voting shares

Under the current capital market rules, the decision of the shareholders' general meeting and the need for a majority of voting rights is an inevitable requirement for a company to adopt a two-tier shareholding structure to be listed or quoted on the stock exchange. Although there is no requirement for the holders of special voting shares in the current legal design, the rules of KTC, NSE, and NSSB specify that they should be natural persons who have made "significant contributions" to the company, and they are also required to hold specific positions. As the voting rights of these shares are much higher than those of ordinary shares and they have a certain degree of "personal dependency", if they are allowed to circulate freely in the market, it may lead to a sudden transfer of control of the company and turbulence in the corporate governance structure. Therefore, many companies with a two-tier shareholding structure will impose strict restrictions on the transfer of special voting shares through the articles of association or shareholders' agreements. Even, these shares may not be circulated in the open market. And even if they do circulate, they will be converted into common shares as a result of the triggering of the sunset clause, and their share price will revert to that of common shares.

3. Status quo of the protection of the rights and interests of small and medium-sized shareholders under the two-tier shareholding structure and the difficulties it faces

3.1. Current situation

(1) Relevant provisions of existing laws and regulations in China

In December 2023, the revision of the Company Law of the People's Republic of China provided a legal basis for the two-tier shareholding structure, which clearly stipulated that the structure could be different from that of an ordinary shareholding company. Article 144, paragraph 1, subparagraph 2 of the Company Law on class shares provides a legal basis for the implementation of the two-tier shareholding structure, but does not provide for further detailed design. Meanwhile, in terms of the protection of the rights and interests of small and medium-sized shareholders, Article 145 and Article 146 of the Company Law provide general and general provisions, which undeniably play a certain role but lack specificity.

(2) Relevant regulations of China's Science and Innovation Board

As an important testing ground for China's capital market reform, STEM takes the lead in allowing companies that are in line with the positioning of STEM and can prevent and control risks well to be listed by adopting a two-tier shareholding structure. According to the "Rules for the Review and Approval of Listing on the Science and Innovation Board" and the "Rules for Listing on the Science and Innovation Board", there are relevant provisions on the differentiated voting rights system for companies with a double-layer shareholding structure.

Firstly, STEM has set strict eligibility conditions for holders of super-voting shares. Such shares must be in the hands of beneficial owners of 10% or more of the company's issued shares. The setting enables the reduction of shareholder liquidity. Secondly, the rules clarify the limitations on the scope of application of super voting rights; super voting rights shall not be applied to major resolutions such as mergers, demergers, and amendments to the articles of association of the company. Further, the exit mechanism for holders of super-voting shares plays an important role. Once the holder no longer meets the minimum shareholding requirements, loses his/her shareholder status, leaves the company, or passes away, his/her super voting shares will be automatically converted into ordinary shares. In addition, there are strict timeframes for companies to implement a two-tier shareholding structure, which are limited to the initial public offering stage and subject to strict scrutiny by the exchange. Finally, a special disclosure mechanism has been established for listed companies adopting a two-tier shareholding structure.

3.2. Difficulties faced

Despite the fact that China's existing laws and the relevant provisions of the Kechuan Board and the Stock Exchange have regulated the protection of the rights and interests of small and medium-sized shareholders under the two-tier shareholding structure in various aspects, the following difficulties are still faced in actual operation:

(1) Defects of the sunset clause

Sunset clause is a mechanism to automatically terminate special voting rights. According to the provisions of the KTC Listing Rules, the Shanghai Stock Exchange specifies three circumstances that trigger the sunset clause: equity dilution, inability of the special voting rights holder to fulfill his/her duties, and transfer of voting rights. However, from the comprehensive analysis of relevant practices and theories, these three situations are of an unavoidable ex post facto nature, which makes it difficult to predict the damage to the rights and interests of small and medium-sized shareholders in a timely manner^[7].

In addition, due to the enumerative nature of the provision, special voting rights cannot be effectively converted into ordinary equity when the special voter tries to abuse the voting rights or circumvent the general provisions. Therefore, in practice, its triggering conditions and enforcement standards are often difficult to meet, leading to difficulties for small and medium-sized shareholders to seek effective legal remedies in the event of abuse of power by special voting rights shareholders ^[8].

(2) Uncertainty about the definition of “significant contribution” of the holder of super equity.

China’s relevant rules for special equity holders only require “significant contribution” to the development of the company, but does not give specific criteria to determine the definition of “significant contribution”. The ambiguity of the criteria is likely to cause disputes, making it difficult for small and medium-sized shareholders to defend their rights when their interests are jeopardized. In reality, companies with a two-tier shareholding structure often grant special voting rights to founders or management in recognition of their “significant contribution” to the company.

Take the first two-tier shareholding structure company in China as an example ^[9]. In its prospectus, the description of the holder’s qualifications is only manifested in the form of “yes” and “no” answers given by the holders of the special voting shares to prove that they are in compliance with the listing rules. This makes it difficult to determine the exact materiality of their “significant contribution”.

(3) Weak information disclosure system in the securities law

The information disclosure system is a system whereby listed companies report their financial and operational status to the stock exchange to the public in accordance with regulations. In practice, the penalties for violating information disclosure are light, with a maximum fine of less than ten million yuan for listed companies violating the information disclosure rules. This fine amount is low, and it is difficult to play an effective deterrent and punitive role. At the same time, except for the disclosure items and the amount of penalty, the other provisions are mostly principle-based and lack practical operability. Ultimately, this leads to selective disclosure or concealment of important information by some enterprises, further aggravating the information asymmetry problem for small and medium-sized shareholders.

(4) Regulation to be strengthened

Under the two-tier shareholding structure, the internal regulatory mechanism is weak and the external regulatory body is unclear. At present, the regulatory subjects of listed companies in China are divided into exchange, industry regulation, legal regulation, and administrative regulation. There is a lack of a unified and coordinated mechanism among the three types of regulatory bodies, making it difficult to regulate effectively at the same time. In terms of internal supervision, most of the internal supervisory bodies of listed companies in China are independent directors and supervisory boards, but it is difficult for these two bodies to play a supervisory role in practice. Because special voting rights holders often have high voting rights, they can usually decide the appointment and dismissal of independent directors and supervisors, resulting in the independence and effectiveness of independent directors and supervisory boards are insufficient, and it is difficult to give full play to their supervisory role.

(5) Lack of fiduciary duty of controlling shareholders

Under the two-tier shareholding structure, controlling shareholders often have greater voting and control rights, but their fiduciary obligations (i.e., the obligation to be accountable to all shareholders) have not been effectively implemented. Currently, the third paragraph of Article 180 of the newly revised Company Law of China provides that shareholders shall assume fiduciary obligations based on their de facto

directorship under certain circumstances. However, this provision merely stipulates that shareholders shall assume fiduciary obligations based on their status as controlling shareholders. The indirect nature of this provision does not effectively curb situations in which controlling shareholders jeopardize the interests of the company as a whole and the interests of small and medium-sized shareholders for the sake of their personal interests.

4. Suggestions for improving the protection mechanism of the rights and interests of small and medium-sized shareholders under the two-tier shareholding structure

4.1. Improve the connection between the two-tier shareholding structure and the protection of the rights and interests of small and medium-sized shareholders in terms of legislation

Improve the Company Law and the Securities Law to clarify the legality of the double-layer shareholding structure and provide detailed operational rules and regulatory requirements. In the legal liability section of the Company Law, include the abuse of rights by controlling shareholders or other high-voting shareholders under the double-layer shareholding structure against the rights and interests of small and medium-sized shareholders, so as to increase the penalties for shareholders violating the law. At the same time, accurately limit the scope of application of special voting rights holders under the two-tier shareholding structure in the Securities Law. Summarizing the practice of various countries and the reality in China, the restriction that special voting rights holders must be natural persons and must be qualified to be directors at the time of listing of the company is the most reasonable and effective.

4.2. Improvement of sunset clauses

The core feature of a fixed sunset clause is that a company adopting a two-tier shareholding structure must specify in its articles of association the duration of the structure. This pre-set time limit prevents special voting shares from enjoying privileges for a long period of time, thus preventing governance problems caused by excessive concentration of power, while promoting flexible adjustment and improvement of corporate governance mechanisms.

4.3. Strengthening market regulation

The special voting rights holders under the two-tier shareholding structure are likely to abuse their power; therefore, a strict external supervision mechanism must be established. Considering the special characteristics of China's market and legal environment, strengthening the dual supervision of the Securities and Exchange Commission (SEC) and the capital market is a feasible path, which not only helps to optimize corporate governance, but also protects the interests of small and medium-sized shareholders. As the core institution of market regulation, the SEC needs to improve its regulatory rules and increase penalties for non-compliance. For example, the SEC can set up a professional regulatory team to conduct regular inspections of the corporate governance structure and the behavior of special voting rights holders to ensure the legal compliance of their behavior^[10].

5. Conclusion

It is undeniable that double-layer shareholding structure is a double-edged sword. While this special structure can

effectively resist hostile takeovers and maintain the stability of business operations, it may also jeopardize the interests of small and medium-sized investors, which may in turn undermine the performance of the company. In the face of the trend of popularization of double-layer shareholding structure, we should not only face up to its disadvantages, but also make efforts to improve the relevant system design. It is foreseeable that with the soundness of the supporting mechanism of the double-layer shareholding structure, China's capital market will make great progress in enterprise equity trading and corporate governance, laying a solid foundation for future high-quality economic development.

Disclosure statement

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Research on Internal Control and Financial Management of Administrative Institutions and Public Institutions under the New Situation

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Abstract: With the development of modern society, the functions of administrative institutions and public institutions are constantly evolving. Under the background of comprehensively deepening reform, higher requirements are put forward for the financial management of administrative institutions and public institutions. The financial management status of administrative institutions and public institutions will directly affect the quality of public services. Therefore, it is necessary to strengthen the internal control of financial management. By leveraging the constraints and supervision mechanisms of internal control, the transparency and credibility of financial management can be effectively enhanced. However, in the actual internal control and financial management of administrative institutions and public institutions, there are still some problems, which make it difficult to improve the level of financial management and affect the sustainable development of administrative institutions and public institutions. By analyzing the internal control and financial management of administrative institutions and public institutions under the new situation, this article proposes plans such as strengthening the construction of professional management teams, deeply using information technology means, and improving the internal control system, effectively enhancing the management efficiency of administrative institutions and public institutions and better adapting to the development of the times.

Keywords: New situation; Administrative institutions and public institutions' internal control; Financial management

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1. Introduction

By strengthening internal control, it is possible to effectively guarantee the safety of fiscal funds of administrative institutions and public institutions, enhance the prevention of financial risks, and promote the healthy development of administrative institutions and public institutions, which has strong practical significance. However, at present, in the internal control and financial management of administrative institutions and public institutions, there exist problems such as insufficient professionalism of management personnel, a lack of application of

information technology, and the need to improve the internal control system. These not only reduce the level of financial management but also fail to fully exert the constraining role of internal control, affecting the reform of the management system of administrative institutions and public institutions. Therefore, it is necessary to deeply explore the issues of internal control and financial management, actively introduce new concepts, new technologies, and new models, build a comprehensive and perfect internal control and financial management system, and promote the high-quality development of administrative institutions and public institutions.

2. Current situation of internal control and financial management in administrative institutions and public institutions

This article takes administrative institution A as the research object. Through questionnaire surveys, it analyzes the understanding, views, and opinions of the personnel in the finance and accounting department on the operation of the internal control system, and analyzes the operation of the financial management work of administrative institutions under the guarantee of the internal control system^[1]. A total of 13 questionnaires were distributed, and 13 valid questionnaires were retrieved. The validity rate of the questionnaires was 100%.

2.1. The management personnel lack professionalism

In the internal control and financial management of administrative institutions and public institutions, the professionalism of management personnel is insufficient, and there is a lack of higher-quality and more professional management talents^[2]. This is not conducive to improving the level of financial management and affects the effective implementation of the internal control mechanism. First, Unit A seldom organizes professional training. Although there are certain training activities, the actual results are not good. Most of them are theoretical knowledge explanations, which are difficult to effectively improve the professional level of management personnel and cannot effectively deal with the complex financial risks under the new situation^[3].

In addition, administrative institutions and public institutions lack vigorous publicity of the new accounting policies, making it difficult for them to update the knowledge reserves of financial management personnel, handle new financial management problems efficiently, and improve the internal control system based on the new policies^[4]. As can be seen from **Figure 1** below, in the finance and accounting department of Unit A, the awareness of the internal control system among the finance and accounting personnel still needs to be improved. Nearly 21% of the personnel are not very familiar with the internal control system, and even 1.5% of the personnel are very unfamiliar with it, making it difficult to exert the restrictive and supervisory role of the internal control system on financial management.

Secondly, administrative institutions and public institutions lack complete online communication channels, which reduces the communication efficiency among managers, makes it difficult to share internal control and financial management experiences, is not conducive to summarizing effective management plans, lowers the quality of financial management work, and affects the improvement of fund utilization efficiency^[5]. Thirdly, administrative institutions and public institutions have not improved the treatment level of their management personnel, making it difficult to attract high-quality and versatile talents to take up positions, reducing the professionalism of the management team, and being detrimental to promoting the transformation and upgrading of financial and accounting work^[6].

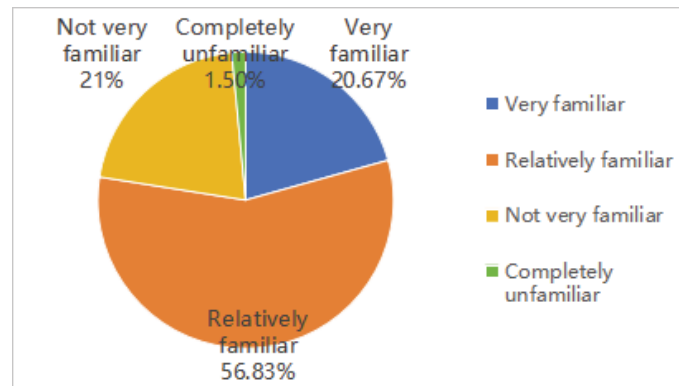


Figure 1. The understanding of the internal control system by the financial and accounting personnel of Unit A

2.2. Lack of application of information technology

In the internal control and financial management work of administrative institutions and public institutions, the application of information technology is lacking and the role of advanced technology has not been fully exerted. This not only reduces the efficiency of financial management but also affects the internal control system from keeping pace with The Times. Firstly, in some administrative institutions and public institutions, there is a lack of more advanced and intelligent software and hardware equipment, which makes it difficult to meet the financial management demands of the new era ^[7]. As a result, they are unable to handle massive financial data efficiently, which affects the subsequent decision-making of the units.

Secondly, within administrative institutions and public institutions, there is a lack of efficient and collaborative information systems among various departments, making it difficult to achieve data interaction and sharing. This increases the difficulty of management personnel's work and reduces the efficiency of financial management. Then, managers seldom use big data and cloud computing technologies, making it difficult to deeply explore potential financial risks under financial data. They are unable to provide an effective basis for the optimization of financial management processes, thereby reducing the level and effectiveness of financial management ^[8].

As can be seen from **Figure 2** below, in the internal control and financial management work of Unit A, 47% of the financial and accounting personnel believe that the utilization rate of information technology is very low, and they have not deeply utilized advanced technological means, which has reduced the efficiency and level of financial management ^[9]. Finally, in a complex information environment, administrative institutions and public institutions are confronted with certain cybersecurity risks. Without adequate protective measures, it will be difficult to ensure the security of financial data, which will affect the stable operation of administrative institutions and public institutions.

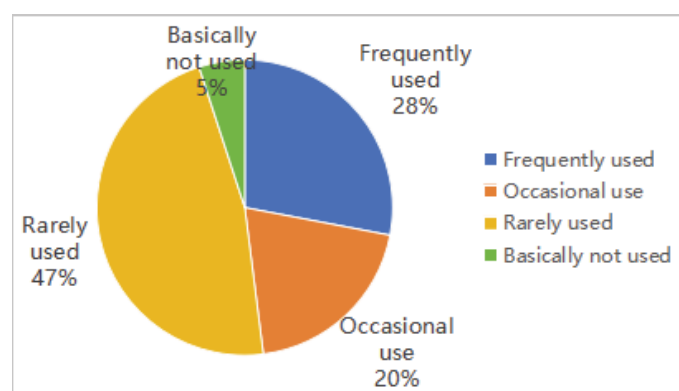


Figure 2. The application of information technology in internal control and financial management in Unit A

2.3 The internal control system needs to be improved

The internal control system of administrative institutions and public institutions needs to be improved, which is not conducive to providing institutional guarantees for financial management, reducing the standardization and systematic operation of the units, and also affecting the management reform of administrative institutions and public institutions. Firstly, in the internal control systems of some administrative institutions and public institutions, they have not been fully integrated with their own actual situations, resulting in a lack of pertinence and operability in the systems ^[10]. Moreover, the system regulations are not detailed enough, and the division of responsibilities and authorities is not clear, which easily leads to management loopholes and affects the healthy development of administrative institutions and public institutions ^[11]. Secondly, although many units have formulated relatively complete internal control systems, the actual implementation effect is not good. Leaders fail to supervise the implementation of the systems effectively, fail to discover and correct violations in a timely manner, and cannot play the due role of restraint and supervision ^[12]. Thirdly, in the internal supervision departments of administrative institutions and public institutions, their independence and authority are insufficient. During the supervision process, they may be disturbed, making it difficult to carry out work objectively and impartially, and reducing the effectiveness of the implementation of the internal control system. Fourth, the unit has not improved the system evaluation system, lacking an objective and comprehensive assessment of the operation effect of the internal control system. As a result, it is difficult to accurately judge the effectiveness of the system implementation, which affects the subsequent improvement of the internal control system.

3. Innovative strategies for internal control and financial management of administrative institutions and public institutions under the new situation

3.1. Strengthen the construction of professional management teams

In the internal control and financial management of administrative institutions and public institutions, it is necessary to strengthen the construction of professional management teams, improve the professional capabilities of management personnel, provide talent guarantees for internal control and financial management, accurately identify and prevent various risks, and promote the healthy development of administrative institutions and public institutions. First, organize diversified training. Administrative institutions and public institutions should invite experts in the field to hold special lectures on “Internal control + Financial Management”, sharing more novel and scientific financial management concepts and methods, achieving effective coordination between internal control and financial management, and promoting the standardized development of administrative institutions and public institutions. Second, enhance communication among talents ^[13]. Administrative institutions and public institutions should improve online communication platforms to facilitate mutual communication among management personnel, share experiences in internal control and financial management, summarize feasible and practical innovative solutions, effectively prevent financial risks, and improve the efficiency of fund utilization ^[14]. Third, optimize the personnel structure. Administrative institutions and public institutions should improve the treatment level of management personnel, attract innovative and compound talents to take up positions, enhance the professionalism of the financial management team, and combine the concept of internal control with professional knowledge of financial management to provide assistance for the reform and innovation of administrative institutions and public institutions.

3.2. Make in-depth use of information technology means

Administrative institutions and public institutions should deeply utilize information technology means and draw on various advanced technological means to provide technical support for the efficient operation of financial management and enhance the pertinence and effectiveness of the internal control system^[15]. Firstly, administrative institutions and public institutions should attach great importance to information construction, introduce more advanced and intelligent software and hardware equipment, including financial management software, information systems, etc., add modules such as budget management and asset management, provide convenience for management personnel, improve the efficiency and accuracy of data processing, and provide scientific basis for unit decision-making. Secondly, administrative institutions and public institutions should improve digital collaboration platforms to facilitate data sharing among personnel from various departments, provide a favorable environment for the implementation of internal control systems, and further enhance the efficiency of financial management^[16]. Thirdly, managers should flexibly apply big data, AI technology, and other technologies to efficiently analyze massive financial data, deeply dissect potential financial risks within it, and more specifically, improve financial management processes and rationally allocate financial resources.

3.3. Improve the internal control system

Administrative institutions and public institutions should improve the internal control system, keep the system up-to-date, intensify supervision, ensure the effective implementation of the internal control system, and provide institutional guarantees for the efficient operation of financial management. First, the organization should comprehensively review its business processes, organizational structure and management requirements, formulate internal control systems that suit its own circumstances, fully consider the risk points in key business links, clarify the responsibilities and authorities of each department and position, refine work processes and operation norms, and enhance the rationality and operability of the system. Administrative institutions and public institutions should innovate the “internal + external” supervision model, establish internal supervision teams, and introduce third-party supervision institutions externally to conduct all-round and refined supervision over the implementation of the internal control system, thereby ensuring the effectiveness of the supervision mechanism. Second, administrative institutions and public institutions should optimize the reward and punishment mechanism, incorporate the implementation of the system into the performance appraisal system of employees, give commendation and rewards to employees who strictly abide by the system, and impose serious penalties on those who violate the system, to form an effective incentive and restraint mechanism, ensure the full implementation of the internal control system, and improve the standardization of financial management.

4. Conclusion

To sum up, in the internal control and financial management of administrative institutions and public institutions, there still exist problems such as insufficient professionalism of management personnel, a lack of application of information technology, and the need to improve the internal control system. In response to this, measures such as strengthening the construction of professional management teams, deeply using information technology means, and improving the internal control system have been proposed to make improvements in terms of personnel, technology, and system. Ensure the effectiveness of internal control and financial management work.

Disclosure statement

The author declares no conflict of interest.

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An Empirical Study of the Factors Influencing Grain Yield: The Case of Sichuan Province, China

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Abstract: In this study, in order to analyze the multiple factors affecting grain production in Sichuan Province, grain production data and its related variables from 1982 to 2022 were selected as the object of the study and empirical research was conducted. The unit root test and cointegration test were applied to ensure the smoothness of the data, heteroskedasticity and autocorrelation tests were performed, and the model was adjusted to finally select a feasible generalized least squares model. The results show that all the examined influencing factors have a significant impact on grain yield in Sichuan Province, especially the sown area of grain crops, which has the most significant effect. Based on these findings, this study proposes the following recommendations: ensure sufficient sown area and high-quality arable land resources, accelerate the process of agricultural mechanization and intelligence, and use chemical fertilizers rationally, in order to enhance the grain production capacity of Sichuan Province and guarantee food security.

Keywords: Multiple linear regression; Grain yield; Influencing factors; Feasible generalized least squares

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1. Introduction

Food has always been fundamental to supporting human survival and social development, as well as key to national stability and security. In the implementation of the rural revitalization strategy, ensuring the supply of important agricultural products, especially food, is the most urgent task. An in-depth investigation of the factors influencing crop yield is not only very necessary, but also of great significance in guiding agricultural production practice, optimizing resource allocation, and sustainable development.

As an important grain production base in Southwest China, the steady growth of grain production in Sichuan Province plays an important role in national food security. The growth of grain production in Sichuan Province is not only due to its rich agricultural resources and favorable climate conditions, but also closely related to the improvement of infrastructure and scientific and technological progress^[1]. The aim of this study is to investigate the influencing factors of grain yield in Sichuan Province, with a view to providing a basis for food security and sustainable development of agriculture in Sichuan Province, and further providing a reference for increasing grain production in the whole country.

2. Literature review

In studies exploring the impact of agricultural infrastructure construction on grain yield enhancement, there have been numerous scholars and experts who have explored the various influencing factors of grain yield increase in different regions, including infrastructure, land, and irrigation, from both theoretical and practical perspectives.

Liu constructed a comprehensive grain production capacity evaluation system, and through the entropy method, found that grain sown area, labor input, fertilizer use, and the level of digital economic development are the main positive factors of regional grain production ^[2]. Liao *et al.* assessed the impact of land use change on food production potential and concluded that food production in Guangdong Province is highly correlated with the coordination of population and economic development ^[3]. Shen *et al.* examined the drivers of eco-efficiency in food production and found that the level of economic development, agricultural production structure, urban-rural income gap, and labor-per-sown-area ratio all had a significant positive effect on eco-efficiency in food production ^[4]. Cao *et al.* used the stochastic frontier production function to measure the output elasticity of factors and the technical efficiency of food production, and found that the location of arable land was positively correlated with food production and the technical efficiency of food production ^[5]. Li constructed a threshold model by measuring the total factor productivity of grain greening, the change in the efficiency of grain greening technology (GECCG), and the change in the progress of grain greening technology, and found that greening technology would have a sustainable impact on grain yield ^[6]. Li, through spatial autocorrelation analysis, found that the positive influence of the agricultural labor force on grain yield gradually decreases, showing a decreasing trend from Southwest to Northeast. The promotion effect of agricultural mechanization on grain output increases year by year, with the spatial distribution characteristics of high in the northeast and low in the Southwest ^[7].

Overall, scholars generally agree that agricultural infrastructure and land management are important factors in boosting food production, and land factors such as sown area and agricultural labor migration are also considered to be critical in influencing food production ^[8].

3. Variables and data

This paper examines grain output and its influencing factors in Sichuan Province from 1982 to 2022, with data from the China Statistical Yearbook and other sources. The study considers six key variables: grain output (GrainYield), sown area (SArea), total power of agricultural machinery (AMP), fertilizer application (FAmt), and rural electricity consumption (REU). The sown area reflects the impact of changes in arable land on yield; the total power of agricultural machinery and rural electricity consumption reflect the level of agricultural modernization and mechanization; and the amount of fertilizer applied is indicative of the efficiency of water management and fertilizer use, respectively. These variables work together to influence grain production in Sichuan Province.

4. Empirical analysis

4.1. Unit root test

The smoothness of a time series means that the statistical pattern of the time series does not change over time. In order to avoid the pseudo-regression problem, it is necessary to test the smoothness of the time series data of the observations, and this paper uses the unit root test to test the smoothness of each variable.

From the results of the unit root test of each variable, it can be seen that the data selected in this paper are all non-stationary time series. In order to further determine its single integer order, each variable is differentiated

once, and the differentiated time series are tested again, respectively.

Table 1. First order difference unit root test results

Variables	<i>t</i> -statistic	<i>p</i> -value
GrainYield	-7.417	0.000
SArea	-4.282	0.008
AMP	-4.609	0.004
FAmt	-4.530	0.004
REU	-5.982	0.000

From the above table, it can be seen that all the variables are smooth time series after one difference, i.e., all the variables selected in this paper are first-order single integer time series.

4.2. Cointegration test

Cointegration describes the possibility that a linear combination of non-stationary variables may form a stationary series, thus revealing the equilibrium relationship between the variables and avoiding pseudo-regression. In this paper, the EG two-step method to conduct the cointegration test and OLS estimation of the benchmark regression is used to obtain the residual series:

$$e_t = \text{GrainYield} - (\hat{\beta}_1 + \hat{\beta}_2 \text{SArea} + \hat{\beta}_3 \text{AMP} + \hat{\beta}_4 \text{FAmt} + \hat{\beta}_5 \text{REU})$$

Next, determine whether the residual series e_t is smooth. If e_t is smooth, the variables are cointegrated. On the contrary, it is not cointegrated. According to the results, it can be seen that the *t*-statistic is -5.684 and the *p*-value is 0.000, which indicates that there is no unit root in the residual series, i.e., the variables selected in this paper affecting the grain production in Sichuan Province and the grain production show a more stable cointegration relationship in the long run, and there will be no pseudo-regression.

4.3. Linear regression

4.3.1. Model setting

In this paper, a multiple linear regression model is developed as follows:

$$\text{GrainYield} = \beta_1 + \beta_2 \text{SArea} + \beta_3 \text{AMP} + \beta_4 \text{FAmt} + \beta_5 \text{REU} + u_t$$

Where *t* denotes the time, GrainYield denotes the grain output in Sichuan Province, SArea denotes the sown area of grain crops, AMP denotes the total power of agricultural machinery, FAmt denotes the amount of fertilizer applied, REU denotes the amount of electricity consumed in rural areas, and u_t denotes the random perturbation term.

4.3.2. Regression results

Using Eviews software, OLS was used to estimate the model parameters and the regression results were obtained as shown below:

Table 2. Regression results

Variables	Coefficient	Standard error	t-statistic	p-value
constant	-2917.210	2056.808	-1.418	0.165
SArea	0.992	0.200	4.962	0.000
AMP	0.193	0.134	1.441	0.158
FAmt	1.295	1.226	1.057	0.297
REU	2.388	2.698	0.885	0.382

The regression results show that R_2 is 0.506 and \bar{R}^2 is 0.435, and the regression equation is significant as a whole, and the variables combined have a significant effect on grain production in Sichuan Province. To ensure that the estimation results of the econometric model are valid and reliable, the heteroskedasticity test and autocorrelation test are then performed.

4.3.3. Heteroscedasticity and autocorrelation test

In time series data, the heteroskedasticity that can be considered to exist is the ARCH process, and the presence or absence of heteroskedasticity in the time series is determined by testing whether this process holds. Calculate the residuals e_t resulting from the estimation of the original model parameters and use the squared residual series e_t^2 , $e_{t-1}^2, \dots, e_{t-p}^2$ as an estimate of σ_t^2 , $\sigma_{t-1}^2, \dots, \sigma_{t-p}^2$, respectively, where p is the order of the ARCH process. Make the following regression of the ARCH process:

$$\hat{e}_t^2 = \hat{\alpha}_0 + \hat{\alpha}_1 e_{t-1}^2 + \dots + \hat{\alpha}_p e_{t-p}^2$$

In the large sample case, the statistic $(n-p)R^2$ asymptotically obeys the chi-square distribution when $\alpha_1 = \alpha_2 = \dots = \alpha_p = 0$. Eventually, in the case of $p=1$, the test for heteroskedasticity is: statistic $(n-p)R^2 = 9.405 > \chi_{0.05}^2(1) = 3.84146$, so the model is considered to have heteroskedasticity.

The presence of autocorrelation was further verified by the Breusch-Godfrey test. The presence of autocorrelation in the error term is considered to be absent by performing an auxiliary regression analysis of the OLS estimated residuals of the model on the explanatory variables and several period lagged residuals, if these lagged residuals adequately explain the variation in the current residuals.

The results show a chi-square distribution statistic of 11.521 and a p -value of 0.003, thus the model estimates are biased and autocorrelation is present.

4.4. Applications of feasible generalized least squares

From the above test, it can be seen that the data have both heteroskedasticity and autocorrelation, at this point, using the feasible most generalized least squares method to solve the model heteroskedasticity and autocorrelation problems at the same time was considered. Here the Newey-West consistent standard error method was used.

Newey-West is known as the HAC standard error, and it provides a more accurate estimation method for the model. This standard error estimation method improves the accuracy and reliability of the standard error by using a weighted average. It gives a consistent estimate of $\widehat{Cov}(\hat{\beta}_{OLS})$:

$$\widehat{\text{Cov}}(\hat{\beta}_{OLS}) = \sigma^2(X'X)^{-1}X'\hat{\Omega}X(X'X)^{-1}$$

This helps us to obtain robust estimation results. The regression results obtained by applying this method are as follows:

$$\text{GrainYield} = -4056.77 + 0.98\text{Area} + 0.14\text{AMP} + 1.24\text{FAmt} + 1.28\text{REU} + u_t$$

From the regression results, the modified decidable coefficient \bar{R}^2 is 0.441. At the given significance level $\alpha = 0.05$, $F = 8.905 > F_{0.05}(4, 36)$, indicating that the regression equation as a whole is significant, and that the variables of sown area of grain crops, total power of agricultural machinery, and other variables jointly have a significant effect on grain production in Sichuan Province.

5. Conclusions and recommendations

Focusing on grain production in Sichuan Province during the period from 1982 to 2022, this study empirically explored the key factors influencing grain production in the province. The results reveal that sown area, agricultural machinery power, fertilizer use and rural electricity consumption are the four main drivers of grain production in Sichuan Province, and these factors have a significant impact on grain production in the province.

Based on the above findings, the following recommendations are made:

First, sown area is a key factor influencing grain production in Sichuan Province. In order to guarantee food security, it is necessary to promote the construction of high-standard farmland, improve the farmland management system, and enhance the quality of arable land under the rural revitalization strategy. Meanwhile, agricultural mechanization and fertilizer application are also crucial to increasing grain output. The government should support the development of agricultural mechanization, rationalize the application of chemical fertilizers, and strengthen soil quality monitoring to prevent problems such as declining soil strength and soil acidification, in order to increase grain production and safeguard farmland ecology. It is also necessary to scientifically plan and manage the construction of farmland in conjunction with territorial spatial planning and water resource utilization, establish a hierarchical, regional, and typological farmland management system, strengthen the construction of high-quality farmland, and improve the relevant elements in accordance with local rural development.

Disclosure statement

The author declares no conflict of interest.

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Short-Term Spillover Effects in High-order Moments of Stocks, Foreign Currency Exchange and Bitcoin with Intraday Data

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Abstract: This paper employs Granger causality analysis and the generalized impulse response function (GIRF) to study the higher-order moment spillover effects among Bitcoin, stock markets, and foreign exchange markets in the U.S. Using intraday high-frequency data, the research focuses on the interactions across higher-order moments, including volatility, jumps, skewness, and kurtosis. The results reveal significant bidirectional spillover effects between Bitcoin and traditional financial assets, particularly in terms of volatility and jump behavior, indicating that the cryptocurrency market has become a crucial component of global financial risk transmission. This study provides new theoretical perspectives and policy recommendations for global asset allocation, market regulation, and risk management, underscoring the importance of proactive management measures in addressing the complex risk interactions between cryptocurrencies and traditional financial markets.

Keywords: Higher-order moments; Intraday data; Spillover effects; Bitcoin; Risk management

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1. Introduction

The cryptocurrency market has experienced rapid growth, with Bitcoin reaching a market capitalization of over \$2 trillion in 2023. This growth has led to the increasing integration of cryptocurrencies into the global financial system, with Bitcoin playing a key role. Bitcoin's unique characteristics, such as its limited supply and high volatility, have drawn significant attention from both investors and researchers. As Bitcoin continues to mature, its interactions with traditional financial assets like stocks and foreign exchange have become increasingly complex. Understanding how Bitcoin's price movements transmit risk across these markets, particularly in times of economic uncertainty, is essential.

Bitcoin's price behavior, which often shows high volatility and fat-tailed distributions, suggests that it may play a significant role in the transmission of financial risks. This study explores Bitcoin's spillover effects, particularly how its higher-order moments affect traditional assets like stocks and exchange rates. Given Bitcoin's 24/7 unrestricted trading

and high sensitivity to external shocks, this study uses high-frequency 5-minute intraday data to analyze short-term spillover effects.

The primary objective of this study is to examine the spillover effects of Bitcoin's higher-order moments—volatility, jumps, skewness, and kurtosis—on traditional financial assets in the U.S. market. By using a vector autoregression (VAR) model and Granger causality tests, alongside generalized impulse response functions (GIRF), the study investigates the dynamics of these spillovers and their implications for financial risk transmission.

The empirical results show that in the U.S. market, significant bidirectional spillover exists between Bitcoin and traditional financial assets, particularly in higher-order moments. Bitcoin not only absorbs risk but also transmits it to other markets, particularly during extreme market events. These findings underline the growing importance of Bitcoin's role in financial markets, particularly during times of market instability.

2. Related studies

Many studies have explored intraday spillover effects in traditional asset markets and cryptocurrency markets. Mensi *et al.* examined the intraday volatility spillover between oil, gold, and stock markets during the COVID-19 pandemic, finding significant spillovers from oil and gold to stocks during the crisis ^[1]. Shakeel *et al.* investigated intraday volatility spillovers among exchange rates, gold, and crude oil, using a DCC-GARCH model, and found stronger spillover effects from gold and oil to exchange rates in high-frequency data ^[2].

Mensi *et al.* analyzed intraday volatility spillovers between Bitcoin and other cryptocurrencies, revealing complex interactions, particularly in higher-order moments, using high-frequency data and multiscale analysis ^[3]. Esparcia *et al.* explored high-frequency volatility and connectedness in the cryptocurrency market after the FTX collapse, noting a sharp increase in market volatility following financial events ^[4].

The volatility spillovers between Bitcoin and traditional financial markets have garnered significant academic interest, especially given the rapid development of the Bitcoin market. Mensi *et al.* used high-frequency asymmetric volatility models to study spillovers between Bitcoin and major precious metals, such as gold and silver, revealing significant connections, particularly during financial market turbulence ^[5]. GKillas *et al.* examined higher-order moment spillovers between crude oil, gold, and Bitcoin, highlighting intricate transmission effects in terms of volatility, skewness, and kurtosis, with intensifying spillovers during market turbulence ^[6].

Using high-frequency data, Zhang *et al.* demonstrated dynamic spillover effects between stock and foreign exchange markets in emerging markets, indicating that market sentiment and policy changes can rapidly impact asset price volatility ^[7]. Bouri *et al.* explored spillover effects between Bitcoin and traditional assets using a VAR-DCC-GARCH model, noting that Bitcoin's volatility is influenced not only by its own supply and demand but also significantly by fluctuations in other financial assets ^[8]. Kang *et al.* further confirmed the importance of high-frequency data in revealing dynamic spillover effects between foreign exchange and stock markets, emphasizing the impact of high-frequency trading on market volatility ^[9].

In this context, the stock market is typically viewed as the risk taker, while the foreign exchange market acts as the risk provider, reflecting macroeconomic changes and policy dynamics that subsequently affect stock market performance. Future research will focus on incorporating Bitcoin into this model and examining how it influences the original spillover behaviors, using high-frequency intraday data to capture more nuanced effects in realized volatility, skewness, kurtosis, and jumps.

3. Methodology

This study examines spillover effects on realized distribution moments, including realized volatility, jumps, realized skewness, and realized kurtosis, among Bitcoin, stock, and exchange rate markets. It starts with an overview of the intraday data, detailing the adjustments and methodology used to compute daily realized moment estimators.

Daily returns were derived using intraday 5-minute data for three assets to capture daily fluctuations. The dataset covers 1,805 calendar days from January 1, 2020, to August 31, 2024. High-frequency intraday data for Bitcoin was sourced from Binance, reflecting activity in several liquid Bitcoin markets. For stock market volatility, we used the S&P 500, CSI 300, and Nikkei 225 indices, representing the U.S., China, and Japan, respectively. The S&P 500 data was obtained from Bloomberg, CSI 300 from iFinD, and the Nikkei 225 from Wenhua Financial. The exchange rates analyzed include EURUSD, USDCNY, and USDJPY, with 5-minute data provided by UBS.

Daily returns for each price series are calculated using the logarithmic difference between consecutive prices. Specifically, the daily return for the t -th observation on the t -th day is given by:

$$r_{t,i} = \log(P_{t,i}) - \log(P_{t,i-1}) \quad (1)$$

where $r_{t,i}$ denotes the daily returns, and $P_{t,i}$ is the price for the i -th observation on day t , with i ranging from 1 to T .

For each day t , the daily realized volatility RV_t was calculated using all intraday returns from the dataset. This RV_t serves as an estimator of the second realized moment, reflecting the dispersion risk associated with the price process and measuring the average deviation of observed returns from the mean return. The calculation method for RV_t for each day t is described as follows:

$$RV_t = \sum_{i=1}^T r_{t,i}^2 \quad (2)$$

Jumps are detected by analyzing the realized volatility through the method suggested by Duong *et al.* This detection process relies on choosing a jump-robust realized volatility estimator. Here, the threshold bi-power variation ($TBPV_t$) estimator is utilized, following the approach of Corsi *et al.*, to maintain robustness in the presence of jumps. The jump statistic ($ZJ_t^{(TBPV)}$) is formulated as follows:

$$ZJ_t^{(TBPV)} = \sqrt{T} \frac{(RV_t - TBPV_t)RV_t^{-1}}{[(\xi_1^{-4} + 2\xi_1^{-2} - 5)\max\{1, TQ_t TBPV_t^{-2}\}]^{1/2}} \quad (3)$$

In this context, TQ_t denotes the realized tri-power quarticity, which is computed using the following formula:

$$TQ_t = T\xi_{4/3}^{-3} \sum_{i=1}^T |r_{t,i}|^{4/3} |r_{t,i+1}|^{4/3} |r_{t,i+2}|^{4/3} \quad (4)$$

which converges in probability to the integrated quarticity. To estimate the jump-free volatility, the threshold bi-power variation ($TBPV_t$) is employed, as defined by the following formula:

$$TBPV_t = \sum_{i=2}^T |r_{t,i-1}| |r_{t,i}| I_{\{|r_{t,i-1}|^2 \leq \theta_{i-1}\}} I_{\{|r_{t,i}|^2 \leq \theta_i\}} \quad (5)$$

In this context, $I_{\{\cdot\}}$ denotes the indicator function, with $r_{t,i}$ representing the daily return series and t indicating

time at a daily frequency. A jump is deemed statistically significant when $ZJ_t^{(TBPV)}$ exceeds the critical value from the standard Gaussian distribution. Therefore, the jump component of daily realized volatility is defined accordingly. Here, $I_{\{\cdot\}}$ functions as an indicator to determine whether $ZJ_t^{(TBPV)}$ exceeds a specified critical threshold ϕ_α from the Gaussian distribution at a chosen significance level.

$$J_t = |RV_t - TBPV_t| I_{\{ZJ_t^{(TBPV)} > \phi_\alpha\}} \quad (6)$$

Realized skewness (RS_t) measures asymmetry risk and indicates potential crash risk by assessing the conditional skewness of daily returns. The daily realized skewness is calculated as follows and normalized by dividing by $RV_t^{3/2}$.

$$RS_t = \frac{\sqrt{T} \sum_{i=1}^T r_{t,i}^3}{RV_t^{3/2}} \quad (7)$$

The calculation of intraday realized kurtosis RV_t is described in Equation 8. This metric measures kurtosis risk in a univariate price process, indicating the thickness of the tails around the mean. To normalize the measurement, it is divided by RV_t^2 .

$$RK_t = \frac{T \sum_{i=1}^T r_{t,i}^4}{RV_t^2} \quad (8)$$

Next, Granger causality tests are performed within a four-variable vector autoregressive (VAR) framework to assess the directional relationships between the four markets being analyzed. A k -dimensional VAR model can be generally expressed as follows:

$$Y_t = v + A_1 Y_{t-1} + \dots + A_p Y_{t-p} + \varepsilon_t \quad (9)$$

where Y_t represents a $K \times 1$ vector of variables, v denotes the $K \times 1$ intercept vector, is the $K \times K$ coefficient matrix, and ε_t refers to the $K \times 1$ error term vector.

After verifying stationarity and cointegration using the ADF unit root test and Johansen test, we conducted the Granger causality analysis and generated Generalized Impulse Response Function (GIRF) plots. The model's lag order was selected based on AIC and BIC. However, a very low lag order (e.g., lag of 1) can cause a rapid decline in GIRF responses, limiting the capture of dynamic interactions. In such cases, we prefer the lag order determined by the LR test.

The analysis of the Generalized Impulse Response Function (GIRF) provides insights into the causal relationships among Bitcoin, stocks, and exchange rates. Specifically, the GIRF measures the system's response to a one-standard-deviation shock in the j -th variable at time t , as observed at time $t+h$. This response is calculated using the formula:

$$\hat{\psi}_j(h) = \sigma_{jj}^{-1/2} \prod_h \sum_{\varepsilon} e_j, h = 0, 1, 2, \dots \quad (10)$$

Here, $\sum_{\varepsilon} = \{\sigma_{ij}\}$ represents the $K \times K$ variance-covariance matrix related to the error term ε_t , where ε_j is a $K \times 1$ vector with the j -th element set to 1 and all other elements set to zero, applicable for $i, j = 1, 2, \dots, K$. The term Π_i refers to a $K \times K$ coefficient matrix, obtained from the infinite moving average form of the previous equation.

Additionally, the matrix Π_i can be derived recursively using the formula for Π_0 , which is equivalent to I_K , denoting a K -dimensional identity matrix.

$$\Pi_i = \begin{cases} \sum_{j=1}^i \Pi_{i-j} A_j, & i = 1, 2, \dots, p \\ \sum_{j=1}^p \Pi_{i-j} A_j, & i > p \end{cases} \quad (11)$$

4. Empirical results

Using the methodology from Section 3, Granger causality tests and GIRF analyses are performed. The results for the realized moment estimators of Bitcoin, the S&P 500 index (S&P500), and the EURUSD exchange rate are presented in tables, with p -values noted in parentheses. Each panel shows dependent variables on the vertical axis and explanatory variables on the horizontal axis, while accompanying graphs illustrate response trajectories over 10 lag periods following an external shock.

Table 1 outlines spillover effects among the three assets using daily data to assess Granger causality between realized volatility (RV), jump statistics (ZJ), realized skewness (RS), and realized kurtosis (RK), with each panel corresponding to a different moment indicator.

Table 1. VAR Granger causality tests among intraday realized estimators of Bitcoin and US markets

Variables	Bitcoin	S&P500	EURUSD	All
Panel A: realized volatility				
Bitcoin	-	145.53***	34.03***	177.82**
	-	[0.000]	[0.000]	[0.000]
S&P500	221.91***	-	13.7	250.53***
	[0.000]	-	[0.133]	[0.000]
EURUSD	59.886***	55.848***	-	141.91***
	[0.000]	[0.000]	-	[0.000]
Panel B: jumps				
Bitcoin	-	18.23***	2.3212	26.534***
	-	[0.000]	[0.508]	[0.000]
S&P500	172.52***	-	9.3846**	188.55***
	[0.000]	-	[0.025]	[0.000]
EURUSD	11.624***	62.817***	-	72.031***
	[0.009]	[0.000]	-	[0.000]
Panel C: realized skewness				
Bitcoin	-	1.8734	0.8090	2.5402
	-	[0.171]	[0.368]	[0.281]
S&P500	0.5862	-	0.3005	0.7871
	[0.444]	-	[0.584]	[0.675]

Table 1 (Continued)

Variables	Bitcoin	S&P500	EURUSD	All
EURUSD	0.0078 [0.930]	6.498** [0.011]	- -	6.7463** [0.034]
Panel D: realized kurtosis				
Bitcoin	- -	3.9583 [0.555]	2.4771 [0.780]	6.9003 [0.735]
S&P500	9.7007* [0.084]	- -	3.7375 [0.588]	13.672 [0.188]
EURUSD	2.0131 [0.847]	2.9425 [0.709]	- -	5.1055 [0.884]

In Panel A, significant bidirectional Granger causality is found between the RVs of Bitcoin and S&P500, indicating mutual volatility transmission. Bitcoin's RV significantly influences EURUSD's RV and vice versa. EURUSD also impacts S&P500's RV, though the reverse effect is not significant, highlighting EURUSD's critical role in overall market volatility transmission.

In Panel B, the spillover effects of jump statistics (ZJ) show significant bidirectional causality between Bitcoin's and S&P500's ZJ. EURUSD also has bidirectional causality with S&P500 and is a Granger cause of Bitcoin's ZJ, highlighting the exchange rate market's role in jump behavior transmission.

Panel C examines realized skewness (RS), revealing that EURUSD's RS significantly influences S&P500's RS, while Bitcoin's RS does not significantly impact other markets. Changes in EURUSD's skewness have a more pronounced effect on the stock market.

In Panel D, S&P500's realized kurtosis (RK) significantly influences Bitcoin's RK, but Bitcoin's and EURUSD's RKs do not significantly affect other markets, indicating the stock market's stronger influence on extreme risk events.

Overall, significant bidirectional causality exists between Bitcoin and S&P500 in both RV and ZJ dimensions, while EURUSD has a notable spillover effect on both in the ZJ dimension. The markets interact differently across higher-order moment dimensions, reflecting complex relationships in the transmission of volatility, jumps, and asymmetry risks.

Figure 1 to Figure 4 illustrate the dynamic interactions among Bitcoin, the S&P500, and the EURUSD exchange rate through generalized impulse response analysis over 10 lag periods. Each subplot shows lag periods on the horizontal axis and response magnitudes on the vertical axis, with a shaded gray area indicating the 95% confidence interval.

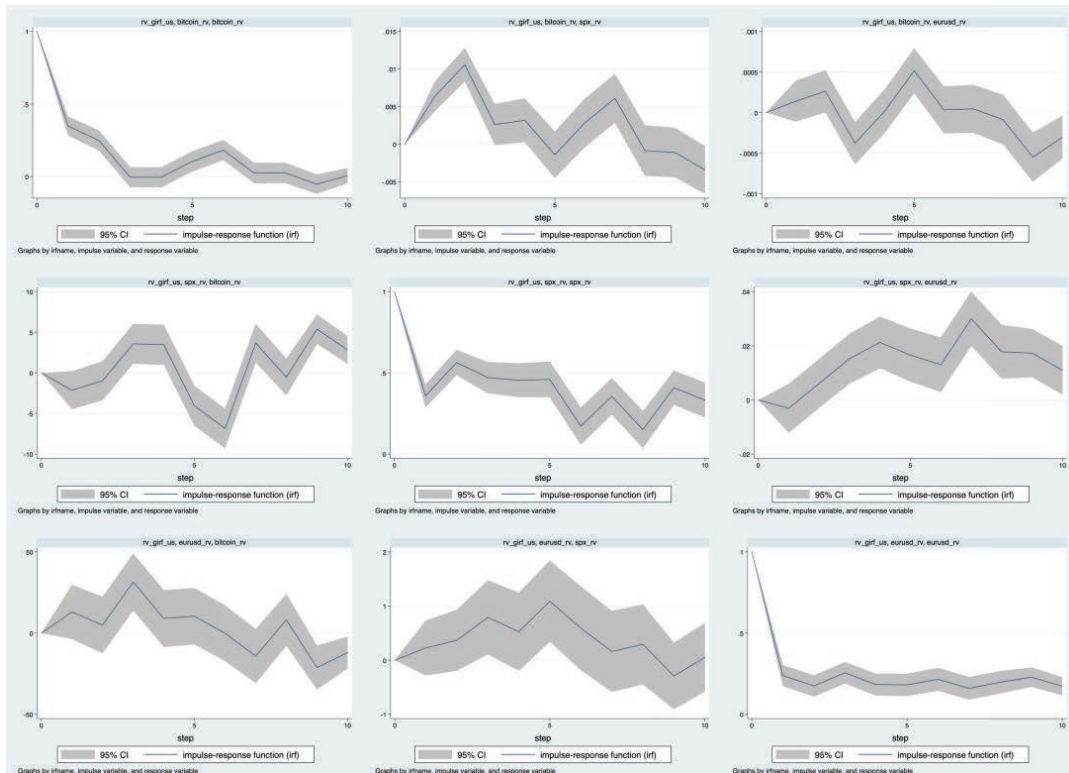


Figure 1. GIRF for a shock to Bitcoin, US stock, and USDJPY (Panel A: Realized volatility)

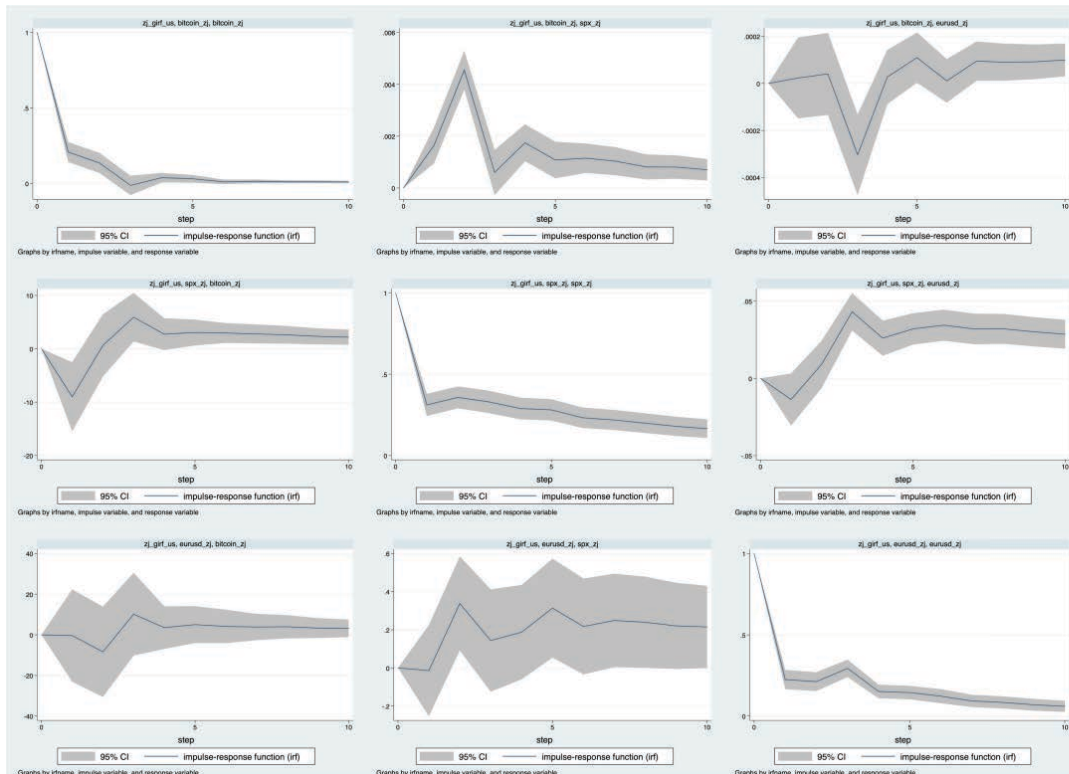


Figure 2. GIRF for a shock to Bitcoin, US stock, and USDJPY (Panel B: Jump)

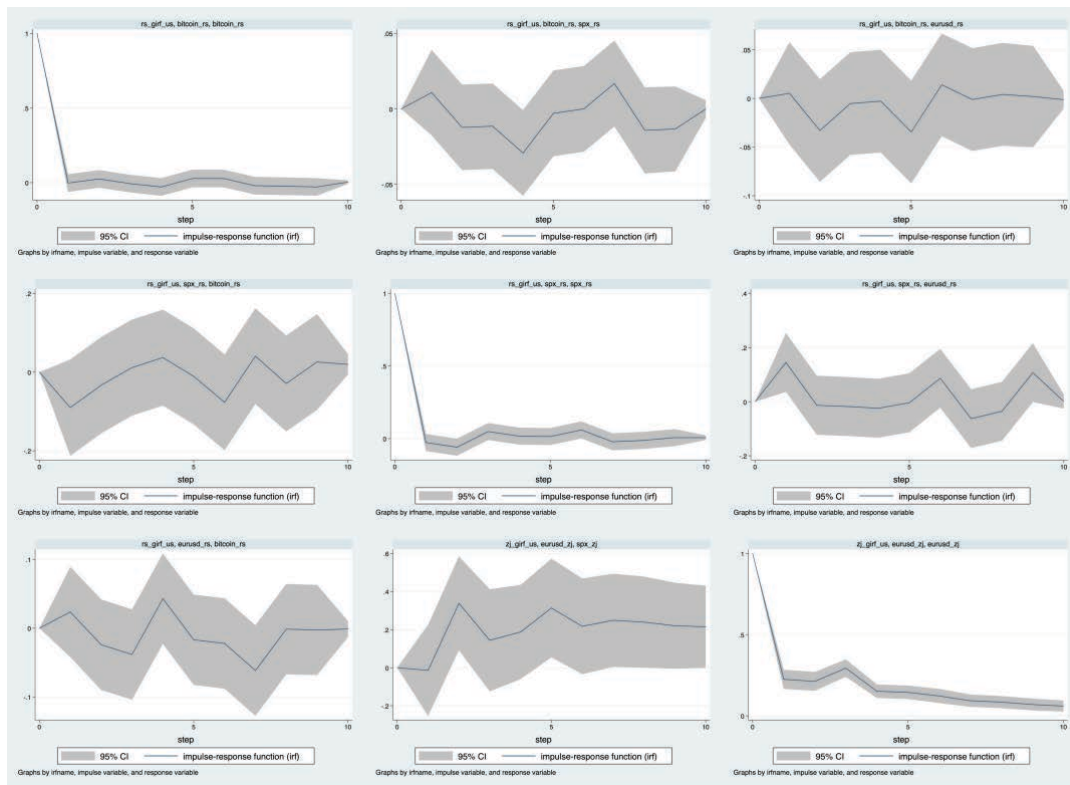


Figure 3. GIRF for a shock to Bitcoin, US stock, and USDJPY (Panel C: realized skewness)

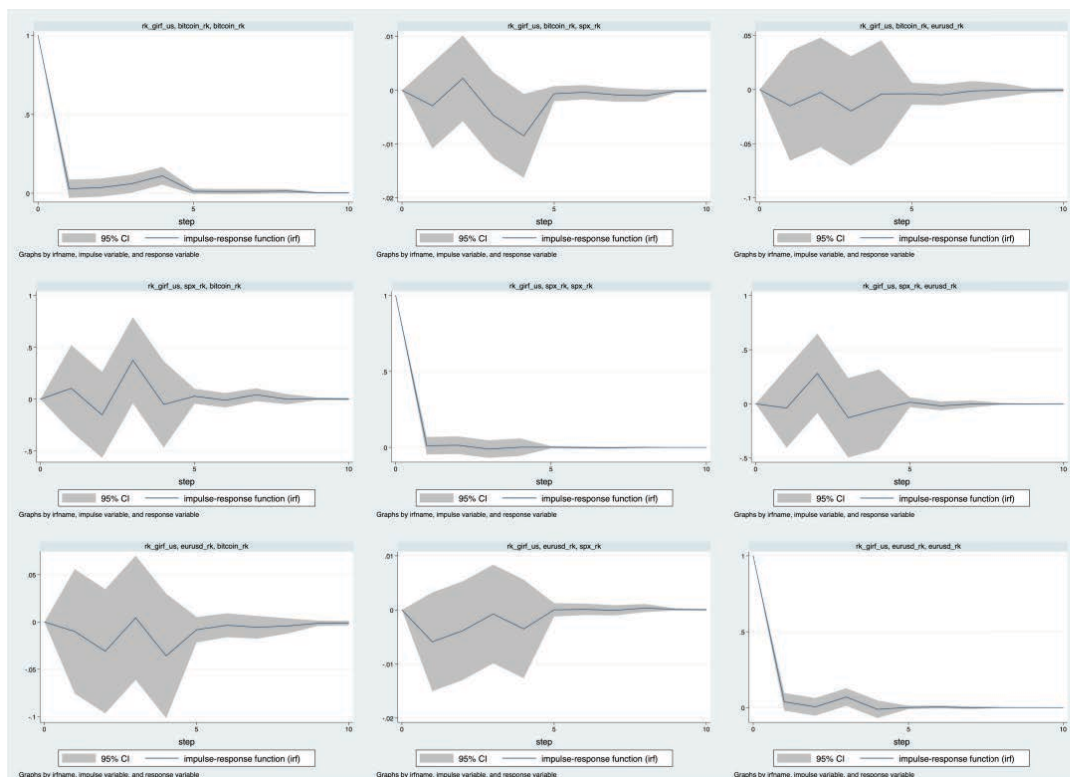


Figure 4. GIRF for a shock to Bitcoin, US stock, and USDJPY (Panel D: Realized kurtosis)

In Panel A, Bitcoin initially reacts positively to its own shocks, with the effect diminishing over time. It positively influences the S&P500 at first, but this shifts to a negative influence as lag periods increase. Bitcoin's response to EURUSD shocks is weak, indicating less transmission to the foreign exchange market compared to the stock market.

The S&P500 exhibits significant responses to shocks from both Bitcoin and itself, showing strong self-feedback. Its response to EURUSD shocks is small but notable. Conversely, EURUSD has limited influence on the other markets, resulting in minor volatility spillovers to Bitcoin, though it demonstrates persistence in responding to its own shocks, suggesting stronger volatility transmission within the foreign exchange market.

In Panel B, Bitcoin, S&P500, and EURUSD each show significant initial responses to their own jump shocks, stabilizing over several lag periods. The S&P500 demonstrates a strong positive response to Bitcoin's jump shocks, indicating that volatility in Bitcoin significantly affects the U.S. stock market. In contrast, EURUSD exhibits a negative response to Bitcoin's jump shocks, with a rapid initial decline that stabilizes over time. When Bitcoin experiences shocks from the S&P500, it sharply decreases, showing significant negative feedback before returning to positive values. The influence of EURUSD on S&P500's jumps is relatively weak, with some initial fluctuations. Bitcoin's response to EURUSD shocks is minimal, while S&P500 shows a positive response that persists over several lag periods, suggesting clearer transmission of jump behaviors from the foreign exchange market to the stock market.

Panel C shows that Bitcoin's skewness shocks significantly affect the skewness of both the S&P500 and EURUSD, with notable fluctuations around zero over the lag period. This indicates the U.S. stock market and exchange rates are sensitive to changes in Bitcoin's skewness. In contrast, Bitcoin and S&P500 exhibit relatively mild responses to skewness shocks from EURUSD, with only minor initial fluctuations. Each market displays a significant initial response to its own skewness shocks, highlighting stronger internal transmission within each market.

Panel D shows that the S&P500 and EURUSD exhibit volatility in response to shocks in Bitcoin's daily realized kurtosis (RK), with EURUSD experiencing noticeable initial fluctuations that diminish over time. Both Bitcoin and EURUSD have significant positive initial responses to shocks in the S&P500's RK, but these responses quickly decline. In contrast, both Bitcoin and the S&P500 initially react negatively to shocks from EURUSD's kurtosis before stabilizing. Each variable's kurtosis experiences a sharp initial decline upon its own shocks, followed by stabilization, indicating strong internal stability in kurtosis within each market.

5. Conclusion

This paper employs Granger causality and generalized impulse response function (GIRF) analyses to investigate spillover effects among Bitcoin, stock markets, and foreign exchange markets in the U.S. across various higher-order moment dimensions (volatility, jumps, skewness, and kurtosis).

Significant bidirectional spillover exists between Bitcoin and the S&P 500 regarding volatility and jumps, indicating strong risk transmission between cryptocurrency and traditional stock markets. EURUSD significantly impacts both Bitcoin and the S&P 500 in these dimensions, with its skewness also affecting the S&P 500, highlighting the foreign exchange market's critical role in volatility transmission. In the kurtosis dimension, the S&P 500's influence is more pronounced, especially during extreme risk events, where it exerts a stronger impact on Bitcoin.

Both intraday and monthly analyses show significant spillover effects, indicating a tightening connection between Bitcoin and traditional financial markets. Intraday data captures higher-frequency fluctuations and immediate market reactions, while monthly data reflects longer-term trends, resulting in smoother manifestations of volatility transmission. The monthly analysis demonstrates greater predictive power regarding the persistence of market responses to shocks. Additionally, daily data allows for sharper detection of immediate fluctuations, revealing that exchange rate skewness significantly impacts Bitcoin, while S&P 500 kurtosis emerges as a new contributor to Bitcoin's risk.

In summary, this study provides insights into risk transmission mechanisms between Bitcoin, stock markets, and foreign exchange markets, particularly concerning higher-order moment spillover effects in intraday data. It offers valuable theoretical support and policy recommendations for future global asset allocation, market regulation, and risk management.

Disclosure statement

The author declares no conflict of interest.

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The Impact of Bank Credit on the Financing Constraints of Small and Medium-sized Enterprises in the Background of Digital Inclusive Finance

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Abstract: The rapid development of digital financial inclusion is profoundly changing the financing environment for small and medium-sized enterprises (SMEs). As an important driver of economic growth and innovation, SMEs account for a significant share of employment and GDP globally. However, the traditional bank credit model has long failed to effectively meet the financing needs of SMEs due to issues such as information asymmetry, high cost, and difficulty in risk assessment, resulting in serious financing constraints. Digital financial inclusion, through technological innovation and big data analysis, has significantly reduced credit costs, alleviated information asymmetry, and provided SMEs with more flexible and efficient financing channels. Research shows that digital financial inclusion can not only ease the financing constraints of SMEs, but also promote their innovation and growth, providing important support for building a more inclusive and sustainable financial ecosystem.

Keywords: Digital financial inclusion; Small and medium-sized enterprises; Bank credit; Financing constraints

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1. Introduction

Small and medium-sized enterprises (SMEs) play an important role in the global economy, driving innovation and economic growth. However, these enterprises have long faced the problem of difficult and expensive financing, mainly due to the asymmetric information in the traditional bank credit model, the high cost of risk assessment, and the lack of flexibility, resulting in SMEs facing many obstacles when accessing funds. These financing constraints not only limit the growth and innovation of enterprises but also affect the sustainable development of the economy to a certain extent.

The rise of digital financial inclusion offers new opportunities to alleviate these financing problems. Through big data analysis and technological innovation, digital financial solutions have significantly improved SMEs' access to credit, enabling them to access the funds they need in a more efficient and low-cost manner ^[1-2]. Innovative

platforms such as digital lending, peer-to-peer lending, and supply chain finance are reshaping the traditional financing landscape, providing SMEs with more flexible and diverse financing channels^[3].

2. The current financing situation of SMEs

Small and medium-sized enterprises (SMEs) play a crucial role in the economic development of both developed and emerging economies. As the backbone of national economies, they make a huge contribution in creating jobs and driving innovation. However, while their importance cannot be overlooked, SMEs often face significant challenges in accessing appropriate financial services, which constrains their growth potential and resilience.

Financing constraints for SMEs mainly come from the demand side and the supply side. From the demand side, many SMEs lack adequate collateral or financial transparency, which makes it difficult for them to get loans. Most SMEs lack fixed assets that can be used as collateral, and owners are often reluctant to give up control of their business in exchange for additional capital. Supply-side financing constraints stem from factors such as high risk, asymmetric information, and an unfavourable regulatory environment, which further exacerbate financing difficulties^[4]. In addition, traditional banks are usually more inclined to provide loans to large enterprises, which leads to limited financing options for SMEs. To address these challenges, fintech solutions are increasingly becoming an important alternative route to financing for SMEs. Innovative financing methods such as digital lending, supply chain finance platforms, and investment-based crowdfunding are gradually providing SMEs with tailor-made financing solutions. At the same time, digitization of business processes, such as e-invoicing and the application of blockchain technology, can help reduce barriers to financial entry and improve the efficiency of financing. These technological advancements not only improve the operational efficiency of SMEs, but also attract the attention of more alternative lenders and investors, thus broadening their financing channels^[5].

The availability of financing for SMEs varies significantly between countries and regions. Research shows that factors such as business size, type of ownership, and strength of legal rights play a key role in determining the availability of finance^[6]. In the West African subregion, for example, differences in access to finance are influenced by a combination of these factors and have an important impact on policy formulation. Another factor that influences the availability of finance is the age of the firm. Compared with start-ups, more mature enterprises tend to face more prominent financing constraints, which makes the financing landscape of SMEs more complicated in different contexts.

3. Digital financial inclusion

Digital financial inclusion has become a transformative force in bridging the financing gap for SMEs. By leveraging technology and big data analytics, digital financial solutions have improved SMEs' access to credit, enabling them to access necessary funds more efficiently and cost-effectively. Platforms such as digital lending, supply chain finance platforms, and peer-to-peer lending are reshaping the financing landscape for SMEs, giving them access to the financial resources they need.

Digital finance is changing the way SMEs are financed. In fact, with the development of technologies such as big data, cloud computing, and artificial intelligence, the credit process of the traditional banking sector is also evolving rapidly^[7]. This transformation has led to more efficient ways of obtaining credit, while also placing higher demands on the precision of credit risk assessment.

The rise of digital financial inclusion has not only increased the availability of financing for SMEs, but also