

Research on the Impact of Supply Chain Integration on the Quality of Internal Control of Manufacturing Enterprises and Its Improvement Path under Digital Intelligence

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Abstract: Internal control is an important mechanism for all kinds of units to regulate activities, prevent internal and external risks, improve management efficiency and effectiveness, and guarantee the realization of unit goals. As the digital age has given new connotations to supply chain integration, the impact of supply chain integration on the quality of internal controls in manufacturing companies is becoming increasingly significant. The influence of digital-intelligent supply chain integration on the internal control quality of manufacturing businesses is examined theoretically in this paper using the literature analysis approach, and a corresponding improvement route is proposed. The study finds that supply chain integration using digital intelligence technology affects the quality of internal control of manufacturing enterprises in three aspects: information integration, operation integration, and organizational integration. The study's conclusion offers manufacturing companies theoretical direction on how to strengthen internal control through supply chain integration, which is crucial for their ability to transform, upgrade, and become more competitive in the age of digital intelligence.

Keywords: Digital Intelligence; Supply Chain Integration; Manufacture; Internal Control

1. Introduction

Manufacturing enterprises are becoming more and more important in China's economy, and the role they play is growing, especially in terms of national tax revenue and social employment [1]. Since the release of the first document on the quality of internal control,

the Basic Standard for Internal Control of Enterprises, the concept of internal control has gradually come into the limelight [2]. With the State's issuance of the Implementation Opinions on Strengthening the Construction and Supervision of the Internal Control System of Central Enterprises and the Circular on Strengthening the Internal Control Construction of Listed Companies and Enterprises to be Listed and Promoting the Evaluation and Audit of Internal Controls in 2019 and 2023, respectively, internal control has become an important means for leading domestic enterprises to improve their corporate governance level. However, some enterprises have problems understanding and applying the implementation of internal control, and the quality of internal control is seriously affected by poor communication, lack of cooperation, weak sense of prevention insignificant supervisory effect, etc. Some enterprises have formally constructed internal control, though they have not been able to do so. Some enterprises have built internal control mechanisms in the form of internal control mechanisms, but need to improve the internal control environment, the completeness of internal control, and the effectiveness of the implementation of internal control.

Digital Intelligence is a series of innovation combinations centered on the application of digital technology and intelligent manufacturing, through which the innovation combinations can realize the innovation of the enterprise's manufacturing form, product form, and value creation form [3]. Supply chain integration is one of the important ways to reflect supply chain operations. Supply chain integration refers to the strategic cooperation between an enterprise and its supply chain members and the collaborative management of intra-organizational and inter-organizational

processes, and it is the strategic cooperation between suppliers and other enterprises distributed in the supply chain. The maturity of digital intelligence technology has given new connotations to supply chain integration. Using intelligent data applications, supply chain integration under digital intelligence allows nodes to access and share information in real-time, facilitating efficient capital, information, and logistics flow. It also facilitates cross-organizational collaborative operation through the use of digital intelligence platforms and tools, which guarantee information transparency and the best possible resource allocation at each link in the supply chain. Internal control is an internal procedure implemented by the board of directors, managers, and other employees of an enterprise to ensure the efficiency of the enterprise's operation, the reliability of its financial reports, and compliance with relevant laws and regulations, and it is an institutional guarantee system for the survival and development of the enterprise. Internal control emphasizes the comprehensiveness of control, not only to control the process but also to control the personnel involved [4]. Three main benefits that internal control, as an institutional structure within an organization, may provide to a business are: ensuring compliance, avoiding and managing risks, and improving efficiency [5]. For manufacturing companies, relying on supply chain integration with digital intelligence to boost internal control quality has become a crucial transformation and modernization strategy [6]. However, it's still unclear how exactly digital

intelligence technology can be applied to supply chain integration to raise internal control quality.

This paper aims to address the aforementioned deficiencies by using manufacturing enterprises as its research subjects, analyzing through theoretical analysis and field research the effects of supply chain integration on the quality of internal control of enterprises under digital intelligence, and discussing specific measures to improve the quality of internal control from the perspectives of information integration, organizational integration, and operational integration. Finally, it analyzes the improvement path of supply chain integration under digital intelligence to improve the quality of internal control of manufacturing enterprises from the macro level of the government, the meso level of the industry, and the micro level of the enterprises.

2. Analysis of the Role of Supply Chain Integration on Internal Control of Manufacturing Enterprises under Digital Intelligence

In the digital intelligence era, supply chain integration not only improves supply chain management efficiency but also strengthens manufacturing enterprises' internal control systems, allowing them to better respond to market changes and achieve sustained and steady growth. This article examines the impact of supply chain integration on the quality of internal control in manufacturing firms using digital information in six ways, as seen in Figure 1:

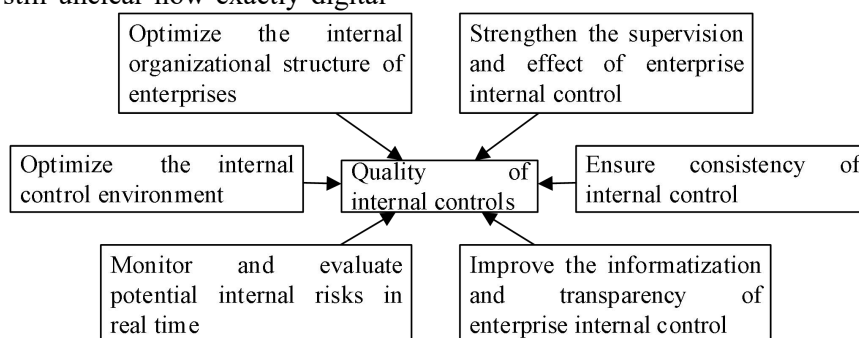


Figure 1. Path of Supply Chain Integration on the Quality of Internal Control in Manufacturing Companies under Digital Intelligence

2.1 Optimising the Internal Control Environment of Manufacturing Companies

The internal environment is the basis for the implementation of internal control, and Digital

Intelligence Supply Chain Integration optimizes the internal control environment through four aspects, as shown in Figure 2. It can be expressed as follows: 1) Clear authority and division of labor. Digital Intelligent

Supply Chain Integration can clearly define and display the responsibilities and authorities of each department and position to ensure that internal control activities can be carried out in an orderly manner. 2) Strengthen the corporate culture. Establish a good atmosphere and environment for internal control, emphasize the importance of teamwork, transparency, and data-driven decision-making, and integrate all these values into the corporate culture to improve the effectiveness of internal control. 3) Optimise human resource

management. The digital-intelligent supply chain system can provide real-time human resources data, including employee performance, training records, job changes, etc., which helps enterprises better manage human resources. 4) Cultivate internal control awareness among business leaders. Make business leaders realize that internal control is an important means to achieve a business strategy, protect business interests, and enhance business competitiveness.

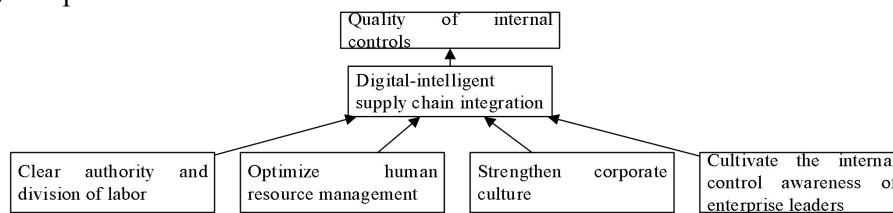


Figure 2. Path of Digital Intelligence Supply Chain Integration on Internal Control Environment

2.2 Improve the Informatization and Transparency of Internal Control in Manufacturing Enterprises

Digital intelligence supply chain integration has greatly improved the information level of internal control in manufacturing enterprises. Firstly, it has promoted the establishment of a unified information platform for manufacturing enterprises, integrated data resources from production, procurement, and sales to service and other links, and strengthened information interoperability among various departments within enterprises, realizing real-time information sharing and circulation. In addition, through the establishment of a data-sharing mechanism, data sharing between upstream and downstream enterprises in the supply chain has been promoted, which promotes the circulation and synergy of information and provides strong data support for internal control. Digital-intelligent supply chain integration can also improve the transparency of internal control, enabling internal and external stakeholders of manufacturing enterprises to have a clearer understanding of the operational status and internal control of the enterprise, thus enhancing the trust and credibility of the enterprise.

2.3 Optimising the Internal Organizational Structure of Manufacturing Companies

Digital-intelligent supply chain integration can

optimize the internal organizational structure to reduce management costs and improve internal control efficiency through four aspects, as shown in Figure 3. Specifically, it can be expressed as follows: 1) Through digital intelligence supply chain integration, manufacturing enterprises establish a more flexible and adaptable organizational structure, and with the help of digital tools and intelligent algorithms, enterprises can quickly respond to market changes and customer demand, and adjust production plans and supply chain strategies. 2) Digital Intelligence improves the efficiency and flexibility of supply chain management, releases more internal resources from traditional production and organizational management, and achieves the integration of internal resource allocation in order to achieve the goal of improving the efficiency of internal control [7]. 3) In the process of digital-intelligent supply chain integration, enterprises can reassess their internal organizational structure and staffing, and through the application of automation and intelligent technology, they can optimize some redundant departments and positions to improve overall operational efficiency. 4) Through supply chain integration enterprises revisit and optimize existing business processes, eliminate unnecessary links and waste, improve process efficiency and quality, reduce operating costs, and improve customer satisfaction.

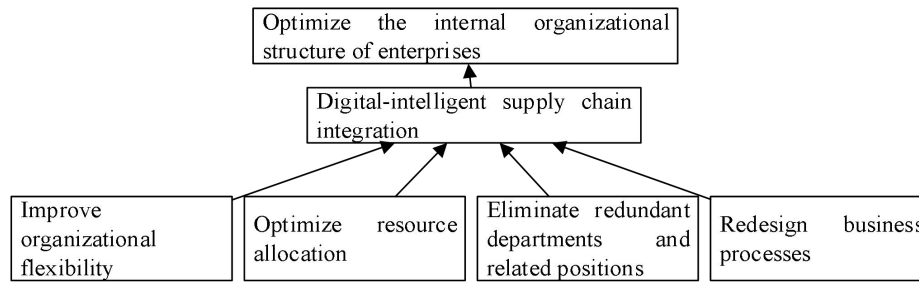


Figure 3. Path of Digital-Intelligent Supply Chain Integration on Internal Organisational Structure

2.4 Strengthening the Supervision and Effectiveness of Internal Control in Manufacturing Enterprises

Internal supervision refers to the reasonableness of the check and balance mechanism of the enterprise's rights and the ability to verify the business process comprehensively [8], the internal control system needs to be supervised, and the manufacturing enterprises use the digital-intelligent supply chain integration to supervise the internal control system, which can help to strengthen the supervision and effect of the internal control, and to ensure the product quality and production efficiency.

Supply chain integration using advanced technology real-time data monitoring and analysis can automate and intelligently complete a series of internal control tasks, such as data monitoring, risk alerts, anomaly detection, etc., so as to comprehensively verify business processes and reduce human errors and omissions. There are several different enterprises and different businesses in the supply chain, and manufacturing enterprises can establish an internal control system based on digital intelligence technology to track the data of each link in the supply chain in real-time, detect and deal with anomalies in a timely manner, and grasp the distribution of various resources in real-time, such as raw materials, semi-finished products, finished products, and so on. Timely detection of problems enables manufacturing companies to take rapid measures to prevent problems from expanding, thus avoiding possible losses. Based on the results of real-time monitoring and data analysis by Numerical Intelligence, manufacturing enterprises can identify bottlenecks and deficiencies in their business processes and carry out targeted optimization to formulate internal control system templates that are in line with their own stage of

development and actual situation, which helps to establish a complete internal monitoring mechanism, improve business efficiency and reduce operating costs.

2.5 Real-time Monitoring and Assessment of Potential Risks within Manufacturing Enterprises

Risk assessment is the combination of management personnel as well as professionals with the enterprise production and operation projects, systematic assessment of the risks that the enterprise will face, and scientific formulate a response program, so as to minimize the risk of the enterprise, which is an important part of the internal control of the enterprise, the integration of the supply chain helps the manufacturing enterprises to more comprehensively monitor and assess the potential risks in the supply chain, such as the supplier risk, logistics risk, market risk, and so on.

Digital intelligence technology is capable of collecting, integrating, and analyzing a large amount of data. Manufacturing enterprises use data analysis and information integration systems to establish risk, and early warning models, to monitor and assess potential risks in real time. Therefore, supply chain integration under digital intelligence enables enterprises to grasp the risk situation of the supply chain as a whole, comprehensively assess and monitor the risks existing in the supply chain, including the assessment of suppliers' production capacity, quality, and delivery date, the supervision of logistics and distribution in terms of timeliness, accuracy, and safety, as well as the monitoring of fluctuations in market demand, competitors' strategies, etc., and formulate the corresponding risk response strategies. This holistic approach to risk management can reduce potential risk losses.

2.6 Ensuring Consistency of Internal Controls in Manufacturing Enterprises

The coherence of internal control in manufacturing enterprises is an important guarantee for the effective operation of an enterprise's internal control system, which ensures the consistency and continuity of internal control activities in time, thus supporting the enterprise in achieving its business objectives. Digital-intelligent supply chain integration in manufacturing enterprises helps to ensure coherent internal control activities by establishing cross-departmental collaboration mechanisms, building intelligent production lines, and establishing internal control standards and processes [9].

Collaboration mechanisms are divided into two types of relationships: internal and external. The digital-intelligent supply chain has a stronger collaborative ability to enable coordination between internal departments of the enterprise to ensure that internal production, communication between employees and other activities are carried out in a coherent manner, preventing potential conflicts and opportunistic risks within the supply chain, and allowing for smoother control activities; whereas, the external collaboration consists of relationships with other participants outside the enterprise in the

supply chain, and through the Numerical Intelligence Supply Chain Integration strengthens the ability to collaborate with suppliers, logistics providers, distributors and other partners, which helps to strengthen the co-operative relationship between enterprises, and manufacturing enterprises can achieve a seamless and coherent supply chain in all segments of the supply chain.

3. The Impact of Supply Chain Integration on the Internal Control Quality of Manufacturing Enterprises under Digital Intelligence and the Path to Improvement

3.1 Impact of Supply Chain Integration on the Quality of Internal Controls

Three dimensions make up manufacturing enterprise supply chain integration. Businesses should develop the three paths in a synergistic way to improve the supply chain's overall competitiveness and efficiency while also directly advancing the caliber and efficacy of internal controls. The specific path is shown in Figure 4, information integration, organizational integration, and operational integration all play a positive role in promoting the quality of enterprise internal control.

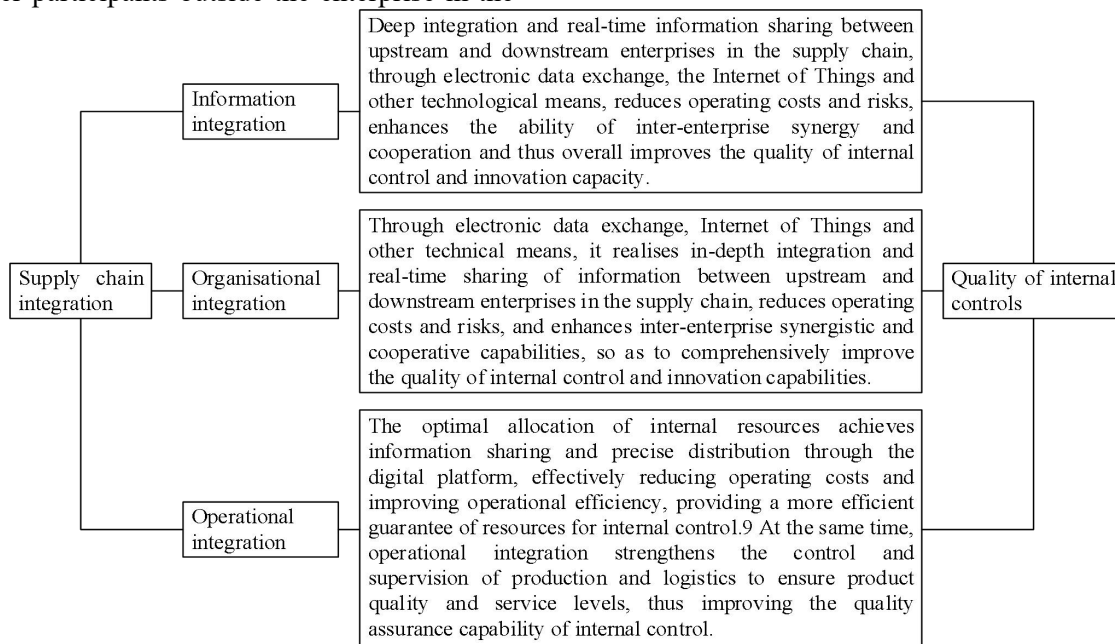


Figure 4. Impact of Supply Chain Integration on the Quality of Internal Controls

3.2 The Influence of Digital Intelligence on Supply Chain Integration

Digital intelligence means that enterprises use

digital and intelligent technology to deeply change and optimize business processes, management models, and business models to achieve more efficient, more accurate, and

more flexible operations and decisions. In the context of the rapid development of digitalization and intelligence, the effective application of digitalization technology in supply chain integration has become the key for manufacturing enterprises to improve the quality of internal control. Supply chain

integration is still divided into three parts: operation integration, information integration, and organizational integration, how to use digital intelligence technology to improve supply chain integration is discussed, respectively, as shown in Figure 5.

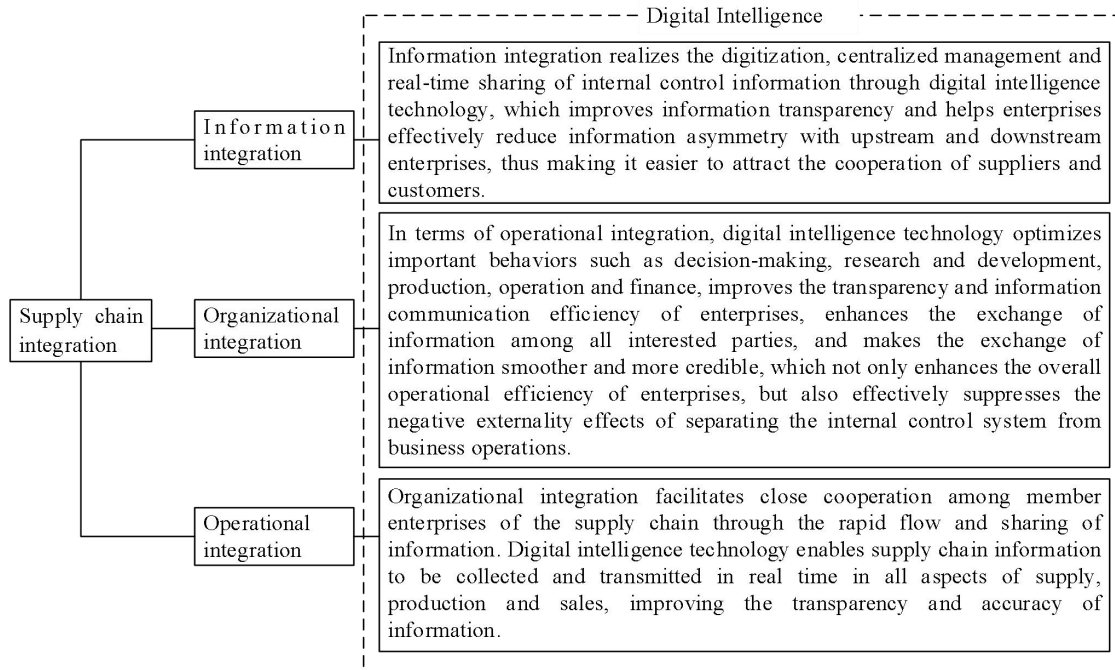


Figure 5. Impact of Digital Intelligence on Supply Chain Integration on the quality of internal control.

3.3 The Influence of Digital Intellectualization on the Quality of Internal Control

Internal control under the background of digital intelligence can effectively improve the quality of internal control of manufacturing enterprises, which is mainly reflected in the improvement of information transparency, the enhancement of risk identification and evaluation ability, the improvement of control efficiency and effect, the strengthening of internal control coordination, and the optimization and improvement of internal control [10]. The information sharing, data analysis, and automatic control brought about by digital intelligence can not only help enterprises find and control risks more effectively but also promote the continuous optimization and improvement of the internal control system, ultimately improving the operating efficiency and efficiency of enterprises and promoting the healthy and stable development of enterprises. Therefore, it can be concluded that the degree of digital intelligence has a significant positive impact

3.4 Lifting Path

In summary, from the government macro level, industry medium level, and enterprise micro level, this paper studies the improvement path of supply chain integration under digital intelligence to the internal control quality of manufacturing enterprises.

3.4.1 Macro level of government

(1) The government formulates relevant policies. Focus on helping, encouraging, and supporting manufacturing enterprises to improve the quality of internal control. Through policy guidance, the government encourages manufacturing enterprises to establish long-term and stable partnerships with suppliers, producers, and distributors in the supply chain so as to promote the integration and development of the supply chain.

(2) The government improves relevant laws and regulations. In order to ensure that the legitimate rights and vital interests of manufacturing enterprises in the transformation are effectively protected, the

government has formulated protection policies and strengthened law enforcement to ensure the effective implementation of policies.

(3) The government will increase the construction and financial support of logarithmic intelligent infrastructure. Providing solid network support for manufacturing enterprises will help enterprises better achieve digital transformation and improve production efficiency and market competitiveness.

(4) The government shall establish a corresponding supervision mechanism. The regulatory mechanism covers all aspects of enterprise operation activities, ensures reasonable and compliant behavior of enterprises, and provides multi-channel and multi-faceted support and guarantee for enterprises to promote the healthy and sustainable development of manufacturing enterprises.

3.4.2 Medium-level of manufacturing industry

(1) Strengthen industry collaboration and information sharing. By establishing an industry information-sharing platform and promoting information sharing and collaboration among all links of the supply chain, the information asymmetry between enterprises can be reduced and the overall operating efficiency of the supply chain can be improved. At the same time, by strengthening industry collaboration, enterprises can jointly cope with market risks and enhance the competitiveness and risk control ability of the entire industry.

(2) Establish a sound internal control system. Enterprises should formulate sound internal control systems and processes according to their actual conditions and the characteristics of intelligent supply chain integration and clarify the responsibilities and authority of each department and post. At the same time, strengthen the supervision and evaluation of internal control to ensure the effective operation of the internal control system.

(3) Strengthen the information construction of risk management and internal control. Through the establishment of a sound risk management information system and internal control information system, strengthen the interconnection and data sharing among information systems, realize real-time monitoring and early warning of risks and internal control activities in all links of the

supply chain, and improve the efficiency and accuracy of risk management and internal control.

3.4.3 Enterprise micro-level

(1) Information integration. By establishing a unified information platform to integrate supply chain information, manufacturing enterprises can realize real-time information sharing and transparency, thereby improving the accuracy and timeliness of internal control. By improving data management systems and enhancing information security, we can help enterprises better identify potential risks and protect trade secrets.

(2) Operation integration. Manufacturing enterprises can optimize the supply chain process by means of digital intelligence, introduce intelligent decision-making systems, strengthen inventory management, improve the efficiency and response speed of the supply chain, reduce operating costs, and enhance the market competitiveness of enterprises.

(3) Organizational integration. By establishing cross-departmental cooperation mechanisms, cultivating interdisciplinary talents, and establishing incentive mechanisms, manufacturing enterprises can break departmental barriers, strengthen communication and cooperation in all links of the supply chain, and improve the overall operational efficiency of the supply chain, providing a strong guarantee for the improvement of the quality of internal control of enterprises.

4. Conclusions of the Study

This paper takes manufacturing enterprises as the research object, and through literature analysis, it is found that the level of enterprise supply chain integration significantly affects the quality of enterprise internal control, and the supply chain integration applies more digitalization technology to improve the quality of enterprise internal control. In terms of information integration, enterprises can improve the information exchange efficiency of the supply chain by increasing the degree of informatization and transparency of the upstream and downstream enterprises in the supply chain, enhancing the ability of inter-enterprise cooperation, and improving the quality of internal control and innovation ability of the enterprise by improving the level

of information integration as a whole; in terms of operation integration, the enterprise realizes the precise allocation of internal resources through the digital platform to reduce the operation cost and improve the operation efficiency, which provides efficient internal control. In terms of operational integration, enterprises can achieve accurate allocation of internal resources through the digital platform, effectively reduce operational costs and improve operational efficiency, and provide efficient resource guarantee for internal control; in terms of organizational integration, supply chain integration enables manufacturing enterprises to achieve rapid access to and sharing of relevant information in the whole process through digital transformation, and enhances the market responsiveness and innovation efficiency of the enterprises. Digital intelligence technology improves enterprise information integration, operation integration, and organization integration capabilities through information sharing, process optimization, and improvement of synergy efficiency, which in turn improves the quality of enterprise internal control by enhancing information transparency, strengthening risk identification capabilities, and improving control efficiency.

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