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Enhancement of Audit Closed-Loop Management for Optimal Audit Results Transformation

Wenjun Zou*

Guangdong Yuehai Land Holdings Limited, Guangzhou 510000, Guangdong Province, China

***Corresponding author:** Wenjun Zou, wenjunzou@hotmail.com

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Abstract: The process of converting audit findings into actionable improvement measures within an enterprise is pivotal for achieving the "value-added" objective of internal audits and fostering sustainable business development. By elucidating the definition and significance of transforming internal audit results, this study underscores the imperative of applying and effectively converting these findings. Additionally, it seeks to streamline the value assessment framework for internal audit result transformation and delineates key factors that impede this transformation. Furthermore, this study explores strategies to bolster the closed-loop audit management system and outlines specific methods for enhancing the transformation of internal audit results within the enterprise, thereby contributing to its overall progress.

Keywords: Internal audit; Achievement transformation; Enterprise management

Online publication: October 20, 2023

1. Defining the essence of enterprise internal audit result transformation

Enterprise internal audit result transformation involves the conversion of issues, risks, and loopholes identified during the audit process by the internal audit department. These are translated into concrete improvement measures and recommendations, which are then conveyed and executed within relevant departments and among personnel. The ultimate objective is to enhance overall enterprise management, elevate operational efficiency, and mitigate risks [1]. The scope of internal audit result transformation encompasses two fundamental aspects:

(1) Conversion of issues and recommendations: During the audit process, internal auditors unearth a variety of problems, including discrepancies and omissions within financial reports, deficiencies in internal control, and operational risks. These issues necessitate translation into specific improvement measures and recommendations to rectify existing problems and forestall their recurrence. This entails actions such as adjusting financial statements, fortifying internal control systems, and strengthening risk management protocols.

(2) Transformation of organizations and individuals: The transformation of internal audit results including the rectification and implementation of issues discovered during the audit process, along with their ripple effects and changes within the entire organization and among individual personnel. This

transformation enables enterprises to continuously enhance their management systems, governance structures, overall quality, and competitive edge. Concurrently, it fosters employees' awareness and comprehension of internal audit procedures, elevates their consciousness of risk and internal control, and augments their comprehensive capabilities and professional competence.

2. The imperative of applying and transforming enterprise internal audit results

2.1. Safeguarding enterprise risk mitigation and operational oversight

Integral to enterprise risk management, internal audits play a vital role in promptly rectifying errors and curtailing the expansion and dissemination of risks. By pinpointing issues and loopholes, audits aid in identifying and preventing potential pitfalls [2]. Simultaneously, the transformation of internal audit results converts these identified problems and loopholes into precise improvement measures and recommendations. This process elevates the enterprise's management framework and governance structure, enhancing overall quality and competitiveness. Therefore, the application and transformation of enterprise internal audit results are essential for risk prevention, control, and operational oversight.

2.2. Enhancing the value-added dimension of enterprise internal auditing

The value-added aspect of internal audit mainly manifests in providing valuable improvement recommendations that empower enterprises to reduce costs, enhance efficiency, and augment value. The transformation of internal audit results reshapes issues, risks, and loopholes unearthed during audits into tangible improvement measures and recommendations. These measures and recommendations, in turn, assist enterprises in cost reduction, efficiency improvement, value augmentation, and realization of the value-added role of internal audit. Consequently, the application and transformation of enterprise internal audit results also reflect the added value of internal auditing within enterprises.

2.3. Elevating internal control system and standardizing management

Internal audit is an integral part of an enterprise's internal control mechanism. The issues and loopholes identified through audits reflect the flaws and inadequacies in the internal control system. Meanwhile, the transformation of internal audit results reshapes the issues and loopholes discovered during the audit process into previse improvement measures and recommendations. This not only enhances the company's internal control system but also fortifies standardized management practices. Thus, the application and transformation of enterprise internal audit results are equally imperative for improving internal control systems and promoting standardized management.

3. Value assessment framework for the transformation of enterprise internal audit results

3.1. Evaluation focus

The value assessment framework for transforming enterprise internal audit results is meticulously tailored to gauge the efficiency and impact of internal audit endeavors. Consequently, the primary entities under evaluation are the enterprise's internal audit department and the audit committee. The internal audit department bears the responsibility of executing audit procedures and identifying/reporting potential risks and issues. In parallel, the audit committee oversees internal audit operations and assesses their efficacy and efficiency [3]. Internal audit results, including audit reports, audit recommendations, and enhancement measures, constitute the subject

of value assessment. These outcomes serve as a testament to the internal audit department's dedication to inspection, supervision, and consultation roles, as well as their proficiency in issue identification and resolution.

3.2. Methodology for internal audit evaluation

The assessment of internal audit result transformation occurs through diverse modalities. Firstly, it adopts a synergistic approach by combining self-assessment with external evaluation. The internal audit department engages in self-appraisal of its activities while concurrently enlisting external audit institutions or experts for impartial external evaluations. This approach enhances comprehension of the value derived from internal audit result transformation. Secondly, the framework merges routine appraisals with ad-hoc assessments. Routine appraisals incorporate comprehensive value appraisals conducted annually or biennially, while ad-hoc assessments are triggered by exceptional circumstances, such as substantial policy or procedural modifications within the internal audit department. Thirdly, it integrates qualitative assessment with quantitative evaluation. As previously noted, quantitative evaluation indicators (e.g., audit project coverage, count of audit findings, and satisfaction levels with audit reports) and qualitative assessment methods (e.g., case analysis and practical testing) collectively provide a more precise gauge of the worth derived from the transformation of internal audit results.

4. Key factors constraining the transformation of audit results

The transformation of audit results constitutes the fundamental essence of audit operations, entailing the transformation of issues, risks, and loopholes unearthed during audits into specific improvement measures and action plans to achieve risk control and organizational compliance [4]. Nonetheless, practical execution often encounters a spectrum of factors that impede the transformation of audit results.

Firstly, there are factors linked to audit findings and issue analysis. Auditors may require assistance in accurately identifying and categorizing the issues detected during audits. Constrained by audit scope and resource limitations, auditors may not be capable of comprehensively detecting and categorizing issues, potentially leading to the neglect or misclassification of critical issues. This, in turn, affects the translation of audit results. Furthermore, in-depth analysis of identified problems, particularly those rooted in complex business processes and systems, may necessitate support. The auditor's skillset and experience can limit their ability to precisely analyze the root causes and the extent of issue impacts, consequently hampering their capacity to provide robust problem-solving support and, thereby, affecting the transformation of audit results.

Secondly, there are factors related to audit recommendations and action plans. The quality of audit recommendations can exhibit variability. There may be instances where recommendations require greater relevance and operational effectiveness to effectively address real-world issues. This, in turn, can impact management's acceptance of the recommendations, thereby influencing the translation of audit findings. Simultaneously, challenges may arise in the implementation of action plans [5]. Resource, time, and technological constraints may necessitate adherence to planned schedules and requirements, which can lead to delays or plan failures, further affecting the translation of audit results.

Thirdly, organizational and communication factors come into play. In certain scenarios, communication and collaboration hurdles between distinct departments can impede the efficiency of audit result transformation. The sharing of information and cooperation among various departments may falter in the absence of an effective coordination mechanism, thereby obstructing the transformation of audit results. There are also instances where swift communication of audit results and management feedback to relevant departments and personnel is imperative. Delays in conveying this information can hinder timely understanding and responses

to problems, subsequently impacting the transformation of audit results. In addition, the absence of an effective feedback mechanism can hinder the continuous enhancement and adjustment of audit result transformation, thereby influencing the effectiveness and quality of audit work [6].

5. Specific strategies for enhancing the transformation of audit results through strengthened closed-loop audit management

5.1. Augmenting transparency and accountability in auditing

Enhancing audit transparency and accountability stands as a pivotal avenue for enhancing the transformation of audit results. As a vital element of supervision and management within enterprises and organizations, auditing mandates not only the comprehensive disclosure of audit findings but also the establishment of a robust accountability system, ensuring fairness and the authority of audit results.

Initially, enhancing audit transparency fosters heightened awareness and comprehension of audit activities among internal employees and the public, ultimately enhancing the credibility and authority of the audit process. During audits, enterprises and organizations should strive to disclose information such as audit plans, results, and reports, thereby enabling employees and the public to gain insight into the audit's specifics. This transparency, in turn, nurtures trust in the audit results.

Simultaneously, the implementation of a well-structured accountability system encourages all levels of management within the enterprise or organization to heed and execute audit results and recommendations [7]. For issues and loopholes identified during audits, prompt rectification is imperative, and those responsible must be held accountable, fostering an effective pressure and motivation mechanism. Furthermore, a corresponding reward system should be established to incentivize departments or individuals actively engaged in rectifying issues, implementing audit recommendations, and achieving positive results. These measures encourage active participation in and cooperation with the audit process, thereby elevating the efficiency and quality of the audit result transformation. Compliance with pertinent laws, regulations, and normative documents is equally essential to ensure information's authenticity and legality. The formulation of an accountability system and information disclosure policy tailored to the enterprise or organization's specific circumstances prevents unwarranted misunderstandings and conflicts.

5.2. Implementing continuous issue audits and process node monitoring

Continuous problem audits are founded on a cyclical or random auditing approach that involves multiple audit cycles to persistently monitor and scrutinize an organization's operational status and promptly uncover and resolve potential issues. A fundamental aspect of implementing continuous issue audits is establishing a rational audit cycle, aligning with the organization's operational conditions, and employing systematic methodologies and procedures for the audits. In the course of ongoing issue audits, it is essential to develop a well-structured audit plan, pinpointing issues and risk areas that warrant attention [8]. Subsequently, appropriate audit methodologies and procedures should be chosen to undertake a thorough and impartial evaluation of the organization's operations. During this process, identified issues must be promptly discovered and documented, with a subsequent in-depth analysis to ascertain the root causes. Depending on the issue's nature and its potential impact, corresponding rectification measures should be proposed, detailing those responsible, timeframes, and expected outcomes. The implementation of these measures necessitates vigilant monitoring. For issues requiring further resolution, continued tracking and audits should be conducted to ensure complete resolution.

Process node follow-up revolves around monitoring and managing business processes to ensure their

smooth operation and achievement of intended objectives. This approach primarily supervises and controls key nodes within the business process, promptly identifying and addressing issues during process operation. In the pursuit of process node follow-up, the initial step involves clarifying key nodes and potential risk points within the business process [9]. Subsequently, it is essential to establish sensible monitoring indicators and early warning thresholds for each key node while formulating corresponding countermeasures. During process operation, the prompt collection and summary of key node operation data are necessary, with an analysis and assessment of this data. Any identified abnormalities or issues warrant swift early warnings and the implementation of corresponding countermeasures to prevent issues from escalating or causing unnecessary losses. Moreover, regular reviews and optimizations of business processes are crucial to improving efficiency continuously within the organization.

5.3. Enhancing auditor's professional competence and sense of responsibility

Improving the professional competence and sense of responsibility among auditors is of paramount importance in guaranteeing audit quality and efficiency. The professional competence of auditors directly impacts the quality and transformative impact of audit results, while their sense of responsibility serves as an important motivator and assurance for the diligent performance of their duties.

To improve the professional competence of auditors, an initial prerequisite is the establishment of a comprehensive selection and employment mechanism to ensure the sourcing of auditors with impeccable professional competence and a holistic skill set. Subsequently, the reinforcement of auditor training and continuous education is imperative to keep their knowledge and skills current, ensuring they adapt to the evolving market and economic environment. In addition, incentive mechanisms, such as offering rewards and promotional opportunities to outstanding auditors, can be instituted to kindle enthusiasm and innovation [10].

In terms of improving auditors' sense of responsibility, it is essential to establish a comprehensive responsibility system and accountability mechanism. First of all, it is crucial to delineate the responsibilities and rights of auditors, ensuring their ability to execute their work autonomously, objectively, and judiciously within their purview. The supervision and management of internal auditing should also be intensified, swiftly detecting and rectifying violations, and applying stringent measures against auditors who fail to fulfill their duties, thereby upholding the authority and credibility of the audit process.

6. Conclusion

In summary, the application and transformation of internal audit results within enterprises hold substantial importance in the realms of risk mitigation and operational oversight, amplification of the value delivered by internal audits, refinement of internal control mechanisms, and the promotion of standardized management. Through the sustained reinforcement of the transformation and application of internal audit results, enterprises can swiftly pinpoint issues, rectify errors, enhance their management practices, boost efficiency, create added value, and drive sustainable and robust development within the enterprise.

Disclosure statement

The author declares no conflict of interest.

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Cloud Computing Standardization: Fueling Digital Economy Industry Advancements

Shunhui Li*

Fuzhou University, Fuzhou 350108, Fujian Province, China

Corresponding author: Shunhui Li, haliyo2020@163.com

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Abstract: In recent years, China's information technology sector has witnessed rapid growth. The development landscape of cloud security, storage, servers, and data centers, all linked to the cloud computing industry, has seen continuous expansion. The significance of cloud computing standardization in driving the development of the digital economy industry has grown notably. This article aims to present the fundamental concepts of cloud computing, provide an overview of its application in fostering the digital economy industry, analyze the current status and principal challenges in cloud computing standardization research, explore strategies for leveraging cloud computing standardization to empower the digital economy industry and offer a range of application scenarios. The goal is to summarize experiences and offer valuable reference material for relevant stakeholders.

Keywords: Cloud computing; Standardization; Digital economy; Industrial development

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1. Introduction

China has entered a new stage of economic development with the information industry at its core. The scale of the digital economy industry continues to expand and has become a new engine for China's economic and social development. Cloud computing, as an intelligent and data-driven infrastructure, can swiftly analyze and process massive data, offering high-quality network services across various industries. In the era of the digital economy, cloud computing standardization has the potential to empower the digital economy industry, revolutionize its development model, and consequently promote the stable and healthy growth of China's economy.

2. Basic concepts of cloud computing

Cloud computing falls under the category of distributed computing. Its primary feature involves breaking down extensive data computing processing programs into multiple smaller programs through the "cloud" of the Internet. Subsequently, a system comprised of multiple servers is used to analyze and process the results of these smaller programs, providing relevant information to the user [1]. The author asserts that cloud computing

is a network capable of providing a variety of resources. Within this network, users can readily access resources in the "cloud" as needed. Furthermore, cloud computing is a service connected to software, the Internet, and information technology. It can utilize a shared pool of computer resources within the "cloud" to aggregate multiple computer resources through cloud computing. This allows for the automatic management of resources using software, facilitating swift and secure data storage and cloud computing services. Simultaneously, cloud computing can expedite the transformation of traditional IT businesses. Users can address complex and diverse underlying IT architecture and perform tasks such as development, operation, and maintenance, all conducted via the Internet, shared data storage, and software services.

3. Overview of the application of cloud computing in the development of digital economy industries

Currently, cloud computing application models encompass Platform as a Service (PaaS), Software as a Service (SaaS), and Infrastructure as a Service (IaaS). Foreign markets predominantly favor SaaS as the primary model, along with the underlying IaaS framework. While this model offers substantial advantages, further research is needed to assess its compatibility with the centralized architecture of governments and enterprises. Additionally, China's cloud computing and related technologies are still in development, necessitating ongoing adjustments and enhancements. To cater to enterprises' demands for sensitive data resources, it is imperative to bolster technology research and development while promoting a model that combines public and private clouds. This involves continuous expansion of the public cloud SaaS industry, optimizing user experiences, automating maintenance, and ensuring smooth private cloud upgrades. In doing so, cloud computing can more effectively empower the digital economy [2]. Furthermore, the development of cloud computing hinges on robust security services. This entails reinforcing infrastructure, including networks, storage, and servers, actively developing cloud security services, and enhancing traditional security tools.

4. Current status and main problems of cloud computing standardization research

4.1. Current status of cloud computing standardization research

Most Western developed countries have devised cloud computing development plans, with research institutions, enterprises, and communities collaboratively advancing critical technology research. Over years of development, cloud computing has yielded favorable results in finance, healthcare, education, government affairs, and small to medium-sized enterprises [3]. Organizations such as the Distributed Management Task Force, the Open Cloud Computing Alliance, the Cloud Security Alliance, and the International Organization for Standardization are actively involved in cloud computing and cloud service standardization. Their work has borne fruit in areas such as cloud interfaces, cloud services, and cloud security. However, the pace of cloud computing standardization research may be impeded by factors such as competition among cloud computing service providers, limited application scope, and technical hurdles.

China's cloud computing research began relatively recently but has achieved significant progress in recent times. Key organizations involved in cloud computing standardization in China include the Cloud Computing Expert Committee of the China Electronics Society, the China Communications Standards Association, and the National Information Technology Standardization Technical Committee. These entities refer to the cloud computing standardization framework, analyze existing communications and information technology standards, formulate new national standard research and development directions, and integrate multiple regional achievements [4].

4.2. Problems existing in cloud computing standardization research

An assessment of current research domestically and internationally reveals several primary issues in cloud computing standardization research. First, there is a lack of organizations and enterprises actively participating in the formulation of cloud computing standards, and a dedicated institution with the requisite scale and research capabilities has yet to be established. Second, during cloud computing standardization research, the problem of fragmentation persists. While most computing resources are integrated into the cloud, forming a resource pool with vast data, many suppliers do not open interfaces for data transmission and connection. Various industries and institutions are hesitant to promote open-standards research [5]. Third, research directions in cloud computing subdivisions need harmonization. Although some progress has been made in areas such as definition, architecture, security, timeliness, structure, and interoperability, more fundamental standardization is required to establish a comprehensive standard system for cloud computing.

5. Strategies for cloud computing standardization to empower the development of digital economy industries

5.1. Breaking down technical barriers

To ensure the effective role of cloud computing standardization in advancing the digital economy industry, it is essential to dismantle technical barriers, foster resource sharing, and expedite research and development processes. Some cloud computing service providers currently possess significant independent research and development capabilities. Market leaders in cloud computing solutions, such as Citrix and Vmware, can execute tailored research and development for cloud computing businesses while endorsing open-source solutions for enterprises. They can construct relatively mature cloud computing services, product standards, and technical solutions. Nevertheless, the focus of cloud computing standards' research and development should extend beyond the system and concentrate on external interfaces. Thus, during specific research and development phases, the real-world situation should be considered, with a focus on enabling dedicated or private cloud interface platforms to provide valuable reference data for cloud computing standardization research [6].

5.2. Strengthening business standardization research

At this stage of cloud computing standardization research, most organizations prioritize security, interoperability, and migration services. In addition to ensuring compatibility between similar services offered by different operators, cloud computing service providers must interconnect to establish a more rational and comprehensive market competition framework. Within the realm of interoperability, standardization requirements emerge in the relationships between storage clouds and computers, as well as between infrastructure clouds and software clouds [7]. In the field of migration business, the aim is to prevent issues such as user lock-in and business monopolies through cloud computing standardization research, preserving a healthy market environment. This involves addressing standardization needs in areas such as resources, data description, and business definitions through cloud computing standardization research to empower the digital economy industry. In the realm of security, cloud security research entails privacy protection and necessitates the establishment of a robust regulatory and legal framework to ensure the anticipated outcomes of security protection and data encryption on cloud platforms while averting potential security risks associated with interfaces.

5.3. Actively promote IaaS standard research

A comprehensive analysis of the digital economy industry reveals that the IaaS-related industry chain is relatively mature. It provides a convenient and effective route for traditional enterprises to transition their

data centers to cloud computing. From a technical perspective, IaaS-related concepts and technologies are relatively mature and comprehensive. Goals and forms are reasonably consistent in fields such as distributed storage and host virtualization. Consequently, there is a substantial market demand for IaaS standardization, and it is technically feasible. Relevant institutions can prioritize IaaS as a pivotal focus of cloud computing standardization research and apply the findings to stably and healthily advance the digital economy industry [8].

5.4. Raising awareness of cloud computing standardization

The application scope of cloud computing-related fields continues to expand. To encourage its standardized, sustainable, and open development, there is a need to heighten awareness of standardization and substantially reinforce research in migration services, interoperability, and other areas. It is crucial, in the course of cloud computing standardization research, to stimulate creativity and enthusiasm among research institutions, enterprises, and suppliers while providing ample space for industry-related enterprises to ignite endogenous growth and standardize cloud computing. This will empower the development of the digital economy industry. Currently, organizations worldwide attach significant importance to cloud computing standardization. Microsoft and Intel are both members of the Distributed Management Task Force (DMTF) board of directors, and Google actively engages in the Internet Engineering Task Force (IETF) discussions related to cloud computing standardization. Numerous companies in China are actively participating in cloud computing standardization research. Huawei is a member of DMFT, Lenovo holds a leadership role in the DMFT, and Zhongxing Telecom Equipment (ZTE) organized a cloud computing Birds of a Feather (BOF) under IEFT. China Telecom partook in the Open Cirrus global cloud computing R&D test platform. Through the collective efforts of these institutions, cloud computing standardization has reached a consensus. In the future standardization research processes, it is imperative to delve into the needs of the digital economy industry, conduct personalized cloud computing standardization research, and actively advance the stable and healthy development of the digital economy industry [9].

6. Analysis of cloud computing standardization empowering the development of the digital economy industry

To propel the development of the digital economy industry, pertinent departments in China have devised the “Guidelines for the Construction of a Comprehensive Standardization System for Cloud Computing.” This document outlines the ideas, principles, and guiding ideology for building cloud computing standards. It is based on the products, technologies, services, and products within China’s cloud computing system, with the aim of forming a cloud computing standardization framework for the digital economy industry.

The cloud computing standardization framework aligns with the actual needs of the digital economy industry’s growth. Its primary components encompass cloud security, cloud services, cloud resources, and cloud foundation.

Firstly, in cloud security, the central function of the standards is to ensure information security, service security, network security, and system security in cloud computing environments. These standards cover security technologies, service security, security management, and security foundations.

Secondly, cloud services standards serve to standardize and enhance various aspects of cloud service design, delivery, operation, and procurement. These standards determine the requirements in fields such as service procurement, service quality, service measurement, billing methods, and service capability evaluation.

Thirdly, cloud resources standards guide and standardize the development of cloud computing software and hardware products. They establish standards for the use and management of cloud computing resources,

improve the rapid elasticity and scalability of cloud computing, and clarify the standards for critical cloud computing technologies, resource maintenance, and resource management.

Lastly, cloud foundation standards have a unifying role in establishing common cloud computing concepts and providing effective support for determining other standards. Their primary content includes cloud computing guidelines, terminologies, and architecture standards.

The cloud computing standardization framework is developed with the needs of the digital economy industry in mind. It draws inspiration from both domestic and foreign experience, outlining the research and development direction for cloud computing standardization. This consolidated effort is expected to foster sustainable and healthy development for cloud computing and related fields in China, providing favorable conditions for growth and promoting the stable and healthy development of the digital economy industry.

7. Conclusion

Cloud computing stands as a fundamental manifestation of innovative achievements in new information technologies and a potent driving force behind the growth of the digital economy industry. To sustain and nurture the development of cloud computing, pertinent institutions must vigorously intensify research and promotion efforts in cloud computing standardization. This includes dismantling technical barriers, reinforcing security, standardizing interoperability, and advancing migration business standards. It also requires the active promotion of IaaS standard research and an effective enhancement of awareness regarding cloud computing standardization. By doing so, cloud computing standardization can fulfill its intended role and contribute to the advancement of the digital economy industry.

Disclosure statement

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Exploring a Typical Regional Model for Rural Industrial Revitalization: Using Shimen Township as a Case Study

Yueyun Liu*

Woosong University, Daejeon 34606, Korea

***Corresponding author:** Yueyun Liu, 623027831@qq.com

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Abstract: Implementing the strategy of rural revitalization and embarking on the path of socialist rural revitalization with distinctive Chinese characteristics are essential steps in addressing existing gaps in agricultural and rural modernization. These steps aim to swiftly increase farmers' incomes, enhance agricultural production capabilities, foster high-quality rural economic development, and rectify issues related to uneven development. Revitalizing rural areas and alleviating poverty among the majority of farmers represent major decisions made by the state regarding the "three rural issues." This paper conducts an analysis and discussion centered on Shimen Township in She County within the context of the agricultural and rural development revitalization strategy. The objective is to identify prevailing challenges and propose relevant solutions.
Keywords: Rural industrial revitalization; Farmers; Geographical model; Shimen Township

Online publication: October 20, 2023

1. Introduction

The implementation of the rural revitalization strategy serves as an effective means to address the loss of rural talents, land, capital, and other critical factors, representing a necessary response to the multifaceted challenges faced by rural areas. However, it is important to acknowledge that rural issues can manifest differently across various regions, underscoring the need to explore tailored rural revitalization strategies that facilitate the execution of these initiatives and foster integrated urban-rural development [1]. Within the context of China's development, the urban-rural divide remains stark, with rural areas experiencing significant underdevelopment. Among those affected most profoundly by this imbalance are farmers.

In light of the strategic backdrop of rural revitalization, this paper takes Shimen Township in She County, Anhui Province as an illustrative case study. It aims to analyze the current developmental status, existing constraints, and potential pathways for optimization in order to contribute to the high-quality development of Shimen Township.

2. Geographical development model

The rapid economic and social development, coupled with synchronized industrialization and urbanization, have led to significant transformations in interpersonal dynamics. By employing a scientific and rational approach to harness the multifunctional aspects of space, it is possible to optimize the utilization of regional areas and facilitate the diverse fulfillment of societal needs. This reorientation steers rural areas towards accommodating multifaceted demands, as they inherently possess objective attributes encompassing production, habitation, economic activities, culture, ecology, and more [2].

Effectively situating the roles of rural areas, establishing a harmonious urban-rural relationship, realizing the complementary functions of both spheres, demonstrating the functional worth of rural regions, and fostering the revitalization and development of rural economies tailored to local conditions represent essential strategies for implementing the rural revitalization initiative and comprehensively advancing rural reform.

3. The development status of Shimen Township

Situated at the northern base of the Baiji Mountain Range, which serves as the headwaters of the Bailang River, Shimen Township in She County boasts a picturesque landscape characterized by majestic mountains, verdant forests, abundant bamboo groves, and briskly flowing clear streams, making it an ideal destination for leisure tourism. This region is relatively resource-rich, featuring 227 hectares (3,421 mu) of tea plantations with medium and high yields, yielding an annual tea production of 80 tons, including nearly 20 tons of renowned teas such as Maofeng and Longjing. Additionally, moso bamboo cultivation and timber production are distinctive industries within the township, encompassing a vast expanse of approximately 1,000 hectares (15,000 mu) of moso bamboo groves.

In recent years, Shimen Township has embraced the philosophy of “green water and green mountains are gold mountains and silver mountains,” emphasizing the harmonious interplay between cultural and economic benefits, the fusion of tradition and modernity, and the balance between conservation and development. Capitalizing on the synergy between the breathtaking natural landscape and the ancient Huizhou cultural heritage, the township has leveraged its traditional ancient villages as a foundation, diligently crafting the brands of “idyllic Huizhou” and “foggy drizzling Huizhou” countryside. This ongoing endeavor seeks to continually explore innovative avenues to transform the “green water and green mountains” into “golden mountains and silver mountains.”

To facilitate these transformations, Shimen Township has introduced bamboo product processing facilities to handle the preliminary processing of existing raw bamboo, enabling residents to easily market their moso bamboo. Drawing inspiration from successful development models in more advanced regions, the township has initiated the bamboo forest carbon sink project, fostering the growth of the moso bamboo carbon sink economy and establishing an innovation hub for advancing the “two mountains” concept in She County.

3.1. Prioritizing ecological livability in rural areas and embracing green development principles

The Shimen Township government has augmented its financial commitment to foster the construction of ecological civilization in rural areas, channeling dedicated financial support to bridge the urban-rural divide. They have championed the promotion of green agriculture development by harnessing innovative energy sources like biogas and solar energy. Their focus extends to bolstering the overall enhancement of rural environments, encompassing waste management, ecological restoration of disused mines, domestic wastewater treatment, and other essential infrastructure initiatives.

Presently, Shimen Township boasts substantially improved infrastructure, with the successful completion of water and sanitation enhancement projects. The enhancement of the rural habitat environment is being actively pursued, leading to significant improvements in areas such as villages, rivers, ponds, ditches, residential surroundings, rural roadways, and major intersections, all of which have undergone comprehensive cleaning and refurbishment efforts. The township is steadfast in adhering to the concept of prioritizing ecological development and has proactively raised funds to support forestry-based ecological projects. In terms of financial oversight, the township government has streamlined approval processes, established disbursement timelines, reinforced monitoring and management, and enhanced the efficiency of financial fund utilization.

The cornerstone of ecological industry green development lies in source prevention and control, and Shimen Township has devised a comprehensive program for reducing pesticide and fertilizer usage while enhancing their efficiency. They utilize the national pesticide information management system to standardize the management of high-quality tea plantations, implementing systematic controls [3]. The distribution of sticky yellow boards to the populace has aided in achieving the goal of substituting organic fertilizers over 800 hectares (12,000 mu) of land, resulting in a remarkable 90.4% coverage of green prevention and control measures within tea plantations.

Furthermore, the Shimen Township government actively mobilizes diverse organizations to participate in rural ecological civilization development and opens avenues for financing. These organizations not only offer insights and recommendations for ecological environment construction but also actively raise funds to support these initiatives. Simultaneously, the government encourages college-educated youths to return to their hometowns for entrepreneurship endeavors, vigorously providing employment and entrepreneurship services for rural youth. They have devised a series of preferential policies aimed at incentivizing college graduates to return to their hometowns for employment, thereby bolstering the willingness of these individuals to contribute to their local communities.

3.2. Strengthening the advancement of rural spiritual civilization with the civilized countryside as a cornerstone

The concept of a “civilized countryside” carries substantial benefits, including the augmentation of industrial market competitiveness, the realization of eco-friendly production and living, the provision of essential support for grassroots-level governance, the promotion of grassroots-level civilization, and the establishment of a robust foundation for social harmony and stability. The Shimen Township government has intensified its efforts to preserve traditional culture [4]. Leveraging the distribution of cultural relics and monuments, and considering their cultural and historic significance, they have expanded the scope of designated protection units at all administrative levels. Moreover, they have delineated protection responsibilities for ancient trees associated with cultural relics that fall outside the purview of established protection and construction control zones, thereby ensuring comprehensive safeguarding measures [5].

4. Challenges in the development of the model for rural industrial revitalization in Shimen Township

4.1. Limited industrial strength and the need for enhanced market competitiveness

The revitalization of rural industries hinges on meeting market demands, leveraging natural resources, harnessing modern technology, capital, and talent, and upgrading the structure and resource allocation within rural industries. This transformation paves the way for the transition to modern agriculture, encompassing the dissemination of contemporary agricultural knowledge among farmers, which forms the foundational

framework for rural revitalization [6]. However, Shimen Township grapples with several issues in both governance and practical implementation.

From an industrial interest standpoint, Shimen Township lacks a comprehensive and scientifically informed industrial plan, impeding effective development. Traditional agriculture faces inherent challenges such as relatively low income, small-scale operations, limited product diversity, a lack of collective endeavors, meager processing and transformation capabilities, subpar product quality, and inadequate promotional efforts. These factors collectively contribute to limited capital attraction [7]. While the digital economy has spurred the emergence of digital agriculture in more developed regions, rural industries in remote areas continue to rely heavily on traditional agricultural practices, characterized by minimal technological integration. Digital technologies remain underutilized, with the government not actively promoting new agricultural techniques. Leading agricultural enterprises predominantly concentrate on traditional agricultural products. Locally initiated enterprises among villagers suffer from product homogeneity, insufficient promotion, inadequate brand recognition, a lack of market competitiveness, minimal integration with secondary and tertiary industries, and unequal footing in market competition [8]. Enhancing farmers' capability to initiate and nurture their businesses and nurturing new entrepreneurial entities can lead to increased income for farmers and provide a valuable labor force for industrial development.

4.2. Shortage of human resources and the need to boost development momentum

Agricultural professionals are grappling with diminished enthusiasm for their roles. Special funds allocated for agricultural technology are insufficient, resulting in a lack of financial support for agricultural technicians engaged in specialized tasks. Consequently, many individuals associated with rural agriculture prefer office-based roles, as they lack incentives to conduct on-site inspections in rural areas [9]. This issue persists due to the absence of effective institutional mechanisms to compel government personnel to engage in agricultural work.

The government's attention to talent development is notably inadequate. Investments in talent development remain meager, with township leaders primarily relying on personal connections with successful expatriates who have launched businesses abroad to support hometown development efforts. The capacity of rural grassroots organizations to nurture talent is limited. The government tends to overlook local rural entrepreneurship, often favoring the idea of attracting so-called major corporations to foster local growth. Consequently, many young entrepreneurs who return to their hometowns encounter insufficient support and eventually depart, disheartened by the experience.

Township party cadres face challenges in organizational proficiency. They often work tirelessly without respite, juggling numerous responsibilities related to poverty alleviation and environmental protection. Due to a dearth of long-term strategic awareness, these cadres struggle to organize themselves effectively and contemplate how to excel in industrial revitalization [10]. Vital considerations, such as industrial development planning and talent attraction strategies, are often overlooked.

5. Development strategies for a model rural industrial revitalization in Shimen Township

5.1. Nurturing distinctive industries

Leveraging the unique attributes of the Shimen Township area, a multifaceted approach has been devised, promoting the integrated development of retirement, tourism, and vacation sectors. Recent years have witnessed the widespread emergence of innovative rural forms, particularly retirement and leisure activities coupled with rural tourism. These avenues not only create numerous employment prospects for rural residents but also

offer opportunities for older and more vulnerable individuals to secure employment. In addition, villagers can augment their income by renting out properties, freeing them from economic uncertainties. This integration of primary, secondary, and tertiary rural industries not only forges connections between urban and rural development factors but also empowers rural residents to experience economic growth in their own backyard.

5.2. Emphasizing contextual relevance for enhanced vitality in rural distinctive industries

Building upon Shinmen Township's geographical advantages, there is a continuous commitment to cultivating and expanding high-efficiency agricultural ventures that align with the region's natural conditions and resources. This entails a meticulous selection of industries and species based on factors such as natural conditions, available resources, existing industrial foundations, and inherent strengths. Agriculture, forestry, and fisheries are strategically chosen and aligned with Shimen Township's geographical endowments, transforming them into industrial strengths and product excellence.

Harnessing cultural resources is another focal point, driving the vigorous development of Shimen Township's distinctive cultural industries. By leveraging regional advantages such as unique cuisine, specialized crafts, red tourism attractions, and the historical "red ancient road," brand recognition is cultivated through targeted promotional efforts. This "focus effect" ensures that each distinctive local cultural industry becomes a powerful catalyst for rural revitalization.

5.3. Promoting innovative approaches

The development of rural industries is intricately linked to the cultivation of distinctive agricultural products. Elevating the regional cultural worth of these distinctive products, introducing innovative methods for their dissemination, and establishing regional brands represent pivotal initiatives for industrial advancement and serve as potent tools for prosperity [11].

To this end, the Shimen Township government should periodically conduct training in new media marketing. They should embrace inventive promotional techniques and mediums, harnessing platforms like TikTok, Xiaohongshu, and live streaming sessions with social media influencers. These live broadcasts should offer real-time insights into the growth, production, and packaging processes of distinctive products. Local enterprises can collaborate with popular online influencers through platforms such as Taobao and TikTok to jointly promote their products through live commerce. This collaborative approach can stimulate engagement, drive local e-commerce enterprises, and encourage live commerce initiatives in farming and breeding bases. This strategy aims to establish multiple online product bases, nurture rural social media influencers, support various specialized industries, and ultimately expand the sales channels for agricultural and sideline products.

5.4. Cultivating regional brands for distinctive products

The Shimon Township government's creation of product brands can reduce expenses and propel the growth of related industries [9]. Firstly, brand development must be driven by market demand. The Shimen Township government should diligently study market requirements, integrating local characteristics to shape a brand image that aligns with mainstream values, garners recognition, and resonates with the public. Agricultural products often find themselves embroiled in price wars, but to transcend this competitive landscape, they should shift focus towards emphasizing product value. This entails moving up the value chain, offering distinctive qualities, and commanding premium prices. Secondly, the Shimen Township government should construct a rural brand anchored in the ethos of integrity and sincerity. Employing creative cultural thinking, they can infuse the brand with charisma that resonates with consumers, creating a warm and heartfelt connection with the product. Capitalizing on the unique attributes of rural areas, they should enhance the visibility of several

derivative products to forge a stronger brand identity.

6. Conclusion

In contrast to the historical underpinnings of rural enterprise development in the past, there have been profound transformations in the fundamental conditions, human capital, objectives, tasks, operational mechanisms, and primary constraints associated with rural industries development. The prevailing trend emphasizes certain factors such as a shorter industrial chain for agricultural products, limited deep processing of agricultural and livestock goods, a low degree of digitization in rural industries, inadequate internationalization avenues for agricultural products, and the drive for elevating the quality of rural industry development [12]. Central to the pursuit of high-quality rural industry development is innovation, serving as the cornerstone of progress.

At the grassroots level, it is observable that rural enterprises that have reached a certain scale are actively embracing innovation, often cultivating unique technological systems. In addition to technical support aimed at ensuring product quality, these well-developed enterprises consistently allocate resources towards research and development, attract talented individuals to join their ranks, and foster an environment conducive to innovation-driven growth, thereby attaining sustainable development.

While economic development may vary across regions, adhering to the principle of fact-based decision-making and harnessing the enthusiasm, initiative, and creativity of local communities can lead to the formulation of rural industrial revitalization models tailored to the local context. Such approaches can steadily expand opportunities for rural labor migration, ensuring stable employment prospects that, in turn, contribute to the enduring growth of farmers' incomes. In the broader context of rural revitalization, the revitalization of rural industries, as the foremost component among the "five revitalizations," holds the key to effectively implementing the rural revitalization strategy. It represents the fundamental prerequisite for addressing the challenges of internal and sustainable development in rural areas. Therefore, comprehensive advancement in rural revitalization, aligned with the leadership of the Party Central Committee under the guidance of the General Secretary, is essential to expedite the realization of a robust agricultural nation.

Disclosure statement

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Exploring the Internal Audit Practices of Electric Power Enterprises in the Context of the New Economic Normal

Yi Huang*

Zhanjiang Electric Power Co., Ltd., Zhanjiang 524099, Guangdong Province, China

***Corresponding author:** Yi Huang, 754729860@qq.com

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Abstract: In the current economic landscape characterized by a decelerating domestic economy, rising investments, and an extended project construction timeline, power generation enterprises must enhance their internal audit efforts to sustain their competitive edge in business development. Addressing systemic shortcomings methodically and practically can enhance the internal audit effectiveness within electric power enterprises and contribute to the steady enhancement of their production and operation performance.

Keywords: Electricity; Economy; New economic normal; Internal audit

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1. Introduction

The rapid expansion of the national economy has heightened the demand for electrical energy, leading to increased expectations for the production management of electric power enterprises. However, in the current economic landscape marked by an evolving market economic system, the internal audit practices of thermal power enterprises are presented with unprecedented opportunities. To continually enhance the oversight and assessment of financial activities in power generation enterprises and foster their healthy and sustainable growth, enterprises must harness innovation as a driving force, proactively depart from conventional audit methods, and engage in systematic research to address prevailing issues in the internal audit processes of electric power enterprises. This approach ensures the consistent and stable enhancement of business efficiency.

Through ongoing research, it has been determined that the operational environment of electric power enterprises is notably intricate [1]. Yet, certain business leaders have not fully grasped the significance of internal audit work, thereby allowing issues and vulnerabilities uncovered in internal audits to go unaddressed. Neglecting these issues could pose significant risks to the enterprise's compliance, asset management security, and the accuracy and integrity of financial reports. To effectively manage the risks mentioned above, electric power enterprises must first acknowledge the shortcomings in their internal audit processes and proactively implement measures to elevate their governance standards, thus facilitating the steady enhancement of their

internal audit efficiency. This study, which assesses the current state of the internal audit practices of a thermal power enterprise, suggests practical measures for improvements aimed at promoting more precise management in domestic electric power enterprises.

2. Basic situation of a thermal power enterprise

Located in the southern region, this is a large-scale coal-fired power generation enterprise boasting four coal-fired units with a combined installed capacity of 1320 MW. In line with the ongoing evolution and progress within China's electric power sector, this power enterprise steadfastly upholds the principle of prioritizing economic development. It actively drives internal reforms and innovations while diligently implementing market development criteria centered around the "four orientations" and an innovative social power supply service model based on the "five practices" [2]. Notably, the enterprise places a strong emphasis on enhancing its internal audit processes, resulting in the achievement of commendable social and economic outcomes during its continued growth.

3. Current situation of internal audit in the power enterprise

3.1. Internal audit management system

Regarding the development of its system, the enterprise successfully caught up comprehensively and revisited the audit components related to power engineering construction. This effort was undertaken in conjunction with national and group guidelines on audit practices and pertinent documents. Collaborating with the engineering department, marketing department, and financial department, the enterprise collectively designed an internal audit management system centered around risk prevention and control. This comprehensive system encompasses a performance appraisal framework, a human resource management system, and a financial management system, all of which contribute to fostering an equitable and vigorously monitored audit environment [2].

3.2. Contents of the internal audit business

The internal audit efforts within the enterprise primarily encompass financial management audits, material management audits, and marketing audits. In the practice of internal auditing, the audit department staff strictly adhere to a comprehensive audit approach, thoroughly reviewing pivotal projects throughout their lifecycle, and monitoring and addressing instances of regulatory violations and breaches to uphold the integrity of the electricity market and ensure electricity production safety.

(1) Financial management audit: The audit department conducts a comprehensive evaluation of the enterprise's financial revenues and expenditures. This includes a comprehensive examination on project construction expenses, operational profits, financial records, bank account details, and other pertinent data. They delve deeply into any issues unearthed during the audit, issuing audit reports and remedial recommendations promptly. This approach minimizes the financial risks faced by the enterprise and maximizes its operational efficiency.

(2) Material management audit: Material management audits primarily involve scrutinizing the enterprise's financial records and inventory to uncover any issues, such as imprudent material storage, incomplete material ledger, and suboptimal storage procedures. This ensures that the management aligns with the enterprise's development strategy.

(3) Marketing audit: In the marketing audit, the audit department of the enterprise focuses on the audit of

customer relationship management by the marketing department checking whether there are problems such as untimely and incomplete customer psychological entry, lagging installation of electricity meters, missed payment of electricity bills, and taking timely and effective measures to deal with them, to guarantee the primary benefits of users and enterprises.

3.3. Common methods of enterprise internal audit

The enterprise frequently employs various audit methodologies, including interview audits, data analysis techniques, and audit sampling procedures during internal auditing.

(1) Interview audit method: When conducting internal audits, auditors engage in in-depth discussions related to specific audit concerns. They gain a comprehensive understanding of the enterprise's internal operational processes from multiple perspectives, identify key areas of risk, and conduct thorough investigations into critical aspects of the enterprise's internal audit. This approach furnishes a more robust theoretical foundation for subsequent audit activities.

(2) Data analysis method: This auditing technique mainly pertains to the economic evaluation of corporate financial revenues and expenditures, economic contracts, and the departure of executives. By meticulously scrutinizing the enterprise's financial statements, auditors can obtain insights into the overall profitability and competitive landscape of the enterprise. They can promptly identify potential business risks and implement relevant measures for prevention and control. Simultaneously, they analyze financial data with significant fluctuations and investigate the causes of anomalous data. Utilizing appropriate algorithms, they deduce project profitability and losses and employ relevant technical methods to enhance the accuracy of financial data [3].

(3) Audit sampling method: This method finds more extensive application in auditing projects involving executive departures or financial data design. Auditors carry out audits by selecting samples from extensive databases to gain a foundational understanding of the enterprise's accounts receivable and cash flow. In the context of executive departure audits, the primary focus is on the performance of departing executives over the past two years, with an emphasis on identifying any behaviors that contravene laws and regulations.

4. Challenges in the internal audit of electric power enterprises

Even though the enterprise's management department has acknowledged the importance of internal audit work and has implemented innovative models and methods to execute audits in practical work, the actual outcomes have fallen short of the anticipated standards. Several issues persist, including a lack of clear positioning for the audit work, outdated audit techniques, and insufficient quality control.

4.1. Unclear positioning of internal audit work

The primary responsibilities of the internal audit department within an electric power enterprise involve overseeing the implementation of various departments' business activities to ensure their legality and compliance. Additionally, they are tasked with providing recommendations for rectifying issues identified in the enterprise's business management activities. Auditors must accurately define their roles and align them with work conditions, as discrepancies between audit work and actual requirements have hindered the achievement of desired goals [4].

4.2. Incomplete internal audit system and lack of an effective incentive mechanism

While the electric power enterprise has established management systems to both regulate and motivate employees, the practical implementation of supervisory and evaluation functions needs improvement. The internal audit's supervision and inspection system, as well as its incentive mechanisms, could be enhanced. This deficiency has resulted in a lack of enthusiasm among the internal audit staff.

4.3. Outdated audit methods and a lag in internal audit

Enterprises focus predominantly on operational and project management, emphasizing cost control, quality management, and the enhancement of core competitiveness. Conversely, internal audit work relies heavily on conventional interview and sampling methods, such as the walk-through test method, while failing to integrate advanced software or methods utilized by subsidiary institutions. These discrepancies distort audited data and information, rendering it incapable of providing theoretical support for internal audit work within the enterprise.

4.4. Insufficient quality control in audit

The electric power enterprise has not prioritized quality control during internal audits. This has led to inadequate data collection, and insufficient evaluation and response capabilities, preventing the systematic handling of various risks inherent in internal audits. Consequently, the quality of internal audits falls short of industry standards. The enterprise's internal audit management lacks proper organization, resulting in redundant audits and blind spots. Furthermore, some auditors overlook thorough pre-audit investigations, failing to define the scope and depth of audits comprehensively. These issues collectively hamper the overall effectiveness of the enterprise's internal audit work, preventing it from realizing its full potential.

5. Effective strategies to enhance internal auditing in electric power enterprises amid the new economic landscape

In alignment with their strategic development objectives and the current internal framework within the new economic context, electric power enterprises are taking measures to strengthen their internal audit work, aiming to mitigate financial risks and improve economic benefits through the judicious implementation of optimization measures.

5.1. Clarity in positioning and paradigm shift

In light of the evolving landscape, the development of internal audit practices within electric power enterprises necessitates a shift from conventional audit methods and concepts. Whilst conventional audit practices mainly focused on monitoring and evaluating financial accounting data and the financial activities of the enterprise, the new normal requires internal audit to reassess its role. Firstly, enterprises must adopt a "people-oriented" internal audit philosophy, consistently improve and optimize the internal control system, and fortify the internal auditors' grasp of the enterprise's internal control mechanisms, thereby laying the groundwork for elevating financial management standards and bolstering the healthy growth of electric power enterprises. Secondly, under the new paradigm, electric power enterprises should maximize their supervisory roles, establish clear positioning, and actualize the functional objectives of internal auditing.

5.2. Augmenting the independence of internal auditing

Internal audits in electric power enterprises serve as a vital instrument for overseeing and assessing financial activities, and independence is fundamental to preserving its objectivity. Electric power enterprises should

continue to reinforce the independence of their internal audit function. Enhancements should be made to the internal audit organization, bolstering communication and collaboration with other enterprise departments. Independence is crucial to ensuring objectivity and fairness in supervising and evaluating the financial activities of the enterprise, thus advancing the development of the internal audit work.

It is imperative to ensure that internal auditors possess high professional competence. To enhance the efficiency and quality of internal auditing in electric power enterprises, investing in the training of internal auditors is essential. Under the new economic normal, electric power enterprises should prioritize the training of internal auditors, establish rational training plans, and elevate the professional competence and skills of auditors. Initial training must be an integral part of daily work, progressively advancing professional expertise and knowledge through ongoing training [5]. Electric power enterprises should design rational training plans and relevant incentive policies to actively engage internal auditors in various learning initiatives. Additionally, continuous post-training and re-education of internal auditors are vital in the new economic normal, with a focus on routine professional knowledge acquisition and the exploration of new theories and knowledge to ensure alignment with the evolving pace of internal audit work in electric power enterprises. Last but not least, the enterprise should regularly convene internal auditors for communication and discussion to promptly identify any prevailing issues and propose practical recommendations, ensuring comprehensive and in-depth audit work.

5.3. Enhancing the internal audit organizational structure

Primarily, the internal audit department of the electric power enterprise should establish an audit organizational structure that aligns with state requirements for internal audit and the enterprise's specific circumstances. This step will further enhance the operational efficiency and quality of the internal audit department. In practical work, the enterprise should synergize the internal audit department with other enterprise divisions, fostering coordination and management, and unleashing the full potential of the internal audit department to promote the development of electric power enterprises. Additionally, enterprises should tailor internal audit work to their development and operational characteristics and fully comprehend the pivotal role of internal audit in financial management. Finally, while conducting internal auditing, enterprises should devise rational audit models and methods commensurate with their operational traits, making the most of their strengths and attributes. Actively aligning with international standards and innovating internal auditing models and methodologies is essential to ensure consistent development.

5.4. Pioneering innovative internal audit methods and enhancing audit quality

Amid the new economic paradigm, electric power enterprises must perpetually innovate their internal audit techniques and elevate the quality of their audit work to adapt to the evolving normal. Enterprises should formulate scientifically grounded internal audit strategies suited to their unique context. This includes methodically structuring audit plans, selecting pragmatic audit methods, and upholding audit quality. A robust risk management and control system should be established, allowing risk management to permeate every aspect of production and operation, ultimately advancing the realization of the enterprise's strategic objectives. Simultaneously, enterprises should fortify their internal control and supervision mechanisms to ensure business operations adhere to the law and regulations. During internal audit endeavors, it is paramount to focus on monitoring and inspecting the implementation of company policies, intensifying the oversight of corporate decision-making and business activities, and guaranteeing the effective execution of various rules and regulations. For any issues prevalent in the internal management of electric power enterprises, prompt supervision and implementation are imperative, with diligent post-inspection of the business activities. In

practical operations, it is crucial to actively contribute to the functional role of ensuring the enterprise's economic activities are lawful and compliant, fostering standardized and efficient business management.

6. Conclusion

With mounting competitive pressure in the Chinese market, the progress of electric power enterprises has encountered certain obstacles. To navigate these challenges successfully, it is imperative to continuously enhance the optimization of internal auditing within these enterprises. This entails fostering a deeper appreciation for the importance of internal audit work, restructuring the autonomous status and functions of internal audit, and tailoring audit methods and approaches to align with the specific circumstances of electric power enterprise development. Guided by the economic development goals of the new era and grounded in the practical context of electric power company growth, it is essential to refine the structure and functions of internal audit institutions and fortify the internal audit system. Furthermore, a concerted focus on personnel training is indispensable, with an emphasis on elevating the overall competence of internal auditors. To this end, a robust training regimen and incentive framework should be established to attract top-tier talents to the ranks of the electric power enterprise's internal audit team, capitalizing on the enterprise's human capital advantages. By nurturing a high-caliber internal audit team, electric power enterprises can mitigate business risks and ensure the robust and sustainable development of their operations.

Disclosure statement

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Investigating the Evolution of Human Resource Management in Enterprises in the Era of Big Data

Chunsun He[1,2]*

[1]SolBridge International School of Business, Woosong University, Daejeon 34613, Korea
[2]Suzhou City University, Suzhou 215000, Jiangsu Province, China

***Corresponding author:** Chunsun He, szcuhrm@163.com

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Abstract: Human resource (HR) management plays a crucial role in the overall management of enterprises, exerting a significant influence on their growth and development. With China now firmly entrenched in the era of big data, the conventional HR management approach is no longer adequate to meet the evolving demands of enterprise progress. Therefore, there is a pressing need to actively revamp the management strategies to improve the quality. This article outlines the importance of reforming enterprise HR management in the context of big data, scrutinizes the prevailing challenges in this domain, explores strategies for transforming HR management within enterprises in the era of big data, and provides illustrative examples to summarize valuable managerial insights, thereby offer enterprise leaders a valuable source of reference information.

Keywords: Big data; Business management; Human resource

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1. Introduction

In recent years, China has witnessed rapid advancements in science and technology. Big data technology, in particular, has seen significant growth and refinement, yielding positive outcomes across various sectors. In light of these developments, it is imperative for enterprises to proactively align with the evolving societal landscape. This entails conducting thorough research into the intricacies of big data technology, integrating it into the realm of human resource (HR) management, and ultimately enhancing the quality and efficiency of management. These measures contribute to bolstering internal workforce cohesion, thus fostering the sustained and robust development of the enterprise.

2. The role of enterprise human resource management reformation in the context of big data

HR management stands as a pivotal facet of enterprise management, wielding substantial influence over an enterprise's development trajectory. In the era of big data, conventional models for enterprise HR management prove inadequate, necessitating active innovation in management approaches to facilitate the stable and

prosperous growth of enterprises. This paper outlines the impact of HR management reforms within enterprises in the context of big data as follows: First, it elevates enterprises' market competitiveness. In the landscape of big data, talent competition takes center stage in enterprise competition. Enterprises, by embracing altered management concepts and models, can enhance the overall competency of their workforce, thereby augmenting operational efficiency and, in turn, bolstering market competitiveness [1]. Second, it fortifies internal cohesion within the enterprise. Against the backdrop of big data, the adaptation of HR management models enables enterprises to promptly discern employee needs, rationalize compensation structures, and streamline internal organizational dynamics, thus cultivating stronger internal unity within the enterprise.

3. Challenges in enterprise human resource management

3.1. Outdated and ineffective human resource management concepts

At present, some companies continue to adhere to conventional HR management models. These models are rigid and lack flexibility. Managers struggle to promptly grasp employees' work-related issues and changing perspectives, resulting in decreased employee enthusiasm, reduced work efficiency, and a decline in internal cohesion. Consequently, this leads to a diminished market competitiveness of the enterprises, posing a substantial obstacle to their stable and sustainable development [2].

3.2. Issues in project time management

Work projects within enterprises are subject to time constraints, necessitating managers to effectively prioritize based on project importance and complexity. However, some companies face difficulties in managing project timelines. This often stems from inadequate understanding of the projects, ineffective communication with employees, unclear allocation of responsibilities, and poorly defined work tasks, all of which impede the timely completion of projects [3].

3.3. Inadequate analysis of employee needs

In the realm of HR management, it is imperative for enterprises to accurately assess the genuine needs of their employees and formulate management strategies to optimize overall results. Unfortunately, some corporate leaders erroneously believe that employee satisfaction has little impact on the company's progress. Consequently, they fail to conduct an accurate analysis of employee needs, leading to diminished enthusiasm and hindering the company's stable and robust development.

3.4. Challenges in performance appraisal

Performance appraisal plays a role in enterprise HR management, aiming to gauge employee performance and provide appropriate incentives to enhance overall workforce cohesion. Nonetheless, certain companies have yet to establish comprehensive performance appraisal systems. Their incentive structures fail to align with employee needs, salary systems lack rationality, and the integration between performance appraisal and salary management needs substantial improvement. These issues, in turn, adversely affect the stable and healthy development of the enterprise [4].

4. Strategies for reforming enterprise human resource management in the era of big data

4.1. Revamping human resource management concepts leveraging big data

In the context of the big data era, the transformation of enterprise HR management is a necessity. To achieve

this, corporate leaders must delve into the nuances of big data technology and refine HR management concepts to enhance the overall standard of HR management. First, enterprises should depart from traditional recruitment models by incorporating big data into their hiring processes, employing intermediary agencies, the Internet, and job fairs to recruit talent. This should include offering competitive compensation and establishing a strong employer brand to attract top talent. Simultaneously, enterprises should harness big data technology to construct a talent resource database, enabling them to identify and match talent with corporate positions efficiently, thereby bolstering the overall competence of the workforce [5]. Second, enterprises should prioritize employee training, shifting their approach to align with big data models. This entails utilizing big data technology to identify issues within employee work and tailoring training content accordingly. An online training platform should be established to facilitate independent learning. Post-training, big data analysis should be employed to gauge the effectiveness of training and adapt the training plan as necessary to optimize outcomes [6].

4.2. Utilizing big data technology for enhanced project time management

The progress of an enterprise is intricately linked to effective project management, where timely completion relies on efficient workforce and time management. Corporate leaders must employ big data technology to support project time management. This involves the precise prediction of project timelines through data analysis, in-depth assessment of prediction results, and the formulation of a final time management and allocation plan [7]. Meanwhile, big data technology should be harnessed to refine and adapt the project time management system. Accurate analysis of employee work data and project progress data should drive necessary adjustments to staffing and scheduling, ensuring projects are completed with both high quality and within designated timeframes.

4.3. Gaining insight into employee needs through big data

Within the sphere of HR management, effective communication with employees is essential. This includes conveying the enterprise's requirements, gaining profound insight into employee work conditions and actual needs through big data technology, and optimizing the management system with an employee-centric approach. The aim is to stimulate employee work enthusiasm and elevate overall market competitiveness [8]. In this process, questionnaires can be employed to gather employee feedback. These questionnaires should be methodically organized and analyzed through big data technology to derive significant insights into employee needs. Based on these insights, enterprises can formulate development plans that guide employee needs, foster job satisfaction, strengthen the sense of belonging to the company, promote internal cohesion, and ultimately drive the enterprise's stable and healthy development [9].

4.4. Instituting a performance management model in the age of big data

Performance management is a cornerstone of enterprise HR management, with the potential to enhance employee motivation, skills, and efficiency. In the era of big data, enterprises should make strategic use of this technology to analyze and address existing performance management issues, adapt management models, enhance performance-related aspects, and amplify the impact of performance incentives. Simultaneously, a comprehensive performance management supervision system should be established, along with a performance management feedback platform. This enables the dynamic analysis of employee performance data and the flexible adjustment of performance management models to improve their effectiveness [10]. Furthermore, fairness and sustainability should be guiding principles in performance management. Ensuring transparency in the salary system and involving employees in performance management system formulation can build trust and promote effective communication between enterprise management and employees, thus yielding the best

performance management results.

5. A case analysis

The company was founded in 2008 as a business-to-consumer (B2C) e-commerce firm, encompassing operations in food production, e-commerce sales channels, and cold chain logistics. At present, the company boasts approximately 1,400 employees, consisting of 8% in senior management positions, 22% in mid-level roles, and the remaining staff as junior employees. As the company evolved, it became evident that there was a need for great emphasis on economic performance and HR management. The organization faced challenges related to talent acquisition, salary structures, and benefits. Consequently, it was imperative to optimize and adjust the HR management model to facilitate stable and healthy company development.

In the era of big data, it is recommended that the company embrace the following HR management model. Firstly, elevate the level of attention to HR management. In the backdrop of big data, company management should intensify their focus on HR management. They should utilize big data technology to scrutinize prevailing issues in HR management and fine-tune the management model accordingly. Secondly, increase capital investment. With the influence of big data, the company should allocate greater resources to HR management, actively integrating software and hardware solutions in line with big data technology. This should lead to the continual enhancement of HR management informatization, thus advancing the overall standard of HR management. Thirdly, establish a robust organizational structure system. In the age of big data, the company should create a dedicated HR management informatization project department and recruit specialized technical personnel to engage in the development of HR management informatization. Concurrently, the company should leverage big data to analyze current issues within the organizational structure and optimize HR management plans to achieve optimal management outcomes.

6. Conclusion

In the era of big data, the conventional enterprise HR management model falls short of meeting societal requirements. Consequently, there is a need to refine and adapt the management model, introduce innovation into the HR management system, modernize management principles, and bolster both performance management and project time management to enhance enterprise HR management.

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Exploring the 2023 Reformation of Financial Systems in Higher Education Institutions and Examining the Practical Aspects of its Execution

Chang Tian*

Faculty Development and Teaching Evaluation Office, The First Affiliated Hospital of Xi'an Medical University, Xi'an 710000, Shaanxi Province, China

***Corresponding author:** Chang Tian, 18629552035@163.com

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Abstract: As China's economy has experienced rapid growth, the economic landscape for higher education institutions' financial systems has become increasingly intricate. Consequently, there has been a heightened demand for enhanced financial management in these institutions. Notably, in 2012, the country's Ministry of Finance and Ministry of Education introduced a new financial system for higher education institutions, and in 2022, the Ministry of Finance publicly revised this system to further standardize financial practices within higher education institutions, align with financial management requirements, and foster the development of these institutions. This paper offers an extensive examination of the updated financial system for higher education institutions compared to the previous version, delving into aspects such as the financial management framework, professionalization criteria for financial directors, enhancements in managing the proceeds from technology and research achievements, and the incorporation of management accounting reports. Additionally, it provides a comprehensive analysis of the challenges faced by financial management in higher education institutions and outlines strategies for addressing these issues.

Keywords: Higher education financial system; Reformation; Financial management

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1. Introduction

The necessity for financial system reform in higher education institutions (HEIs) arises from the imperative to align institution finances with the demands of the contemporary era. The rapid advancements in China's information technology have significantly impacted conventional institution financial systems, thereby instigating innovation and change within institution accounting practices. The development and reform of financial operations bear relevance not only to institution management but also to the financial sector itself, underscoring its profound importance [1]. The adoption of information technology office procedures serves a dual purpose: it reduces the consumption of physical office supplies while enhancing working methods and overall efficiency. Simultaneously, information technology elevates the transparency and precision of financial work, facilitating the execution and oversight of an institution's financial tasks, thereby playing a pivotal role in

enhancing the quality and efficiency of financial operations [2].

The reform of the HEI financial system aligns with the intrinsic needs of financial operations. Given the inherently critical attributes of financial work, necessitating a high degree of accuracy and timeliness, the previous modus operandi relied heavily on manual data compilation. With the advent of modernization, accounting systems have continuously evolved, propelling the financial sector toward digitalization [3]. Information technology significantly enhances the precision and timeliness of financial operations while ensuring data completeness. In the former financial processes within institutions, managing extensive data was a formidable challenge, with limited capacity for instant analysis and data retrieval. The utilization of information technology effectively addresses these issues, enabling instant access to pertinent data, thereby reducing data extraction time and facilitating more precise analysis and informed decision-making [4]. In recent years, HEIs have been striving to leverage their strengths, necessitating ongoing enhancement and refinement of the financial system to accommodate the evolving needs of these institutions.

The restructuring of HEI financial systems is an essential requirement for management endeavors. Information technology integration enables financial data to be linked with various resources, providing comprehensive and accurate information for HEIs. This empowers managers to gain profound insights into the financial status and related information based on the real-time information system, thus enhancing the accuracy and efficiency of management operations. Furthermore, it aids HEIs in establishing seamless data connections, enabling the timely extraction of relevant data from higher authorities, and ensuring the precision and fluidity of information transmission [5]. As institutions progressively seek to intertwine their financial information with other organizations, such as banks, information technology fosters smoother and more convenient communication between institutions and these external entities. In line with the demands of the new era and the need to strengthen connections and interactions with the external world, institutions must expedite the development of their information technology systems.

2. Five key aspects of financial system reform in higher education institutions

2.1. Strengthening Chinese government leadership in higher education

Article 5 of the "Financial Rules for Institutions" states that "financial activities within institutions shall be centrally managed by the institution's financial department, under the leadership of the institution's head." The "Financial System of Higher Education Institutions" further elaborates on this concept in Chapter 2, "Financial Management System" [6].

Within this framework, Article 7 of the new system revises the original Article 6, with significant changes that include: (1) Emphasizing the execution of financial tasks within HEIs "under the leadership of the Party Committee" of the institution's head, thereby reinforcing the overall leadership of the government within institutions; (2) Under the new system, HEIs are no longer obligated to establish the role of a chief accountant, instead, they have the flexibility to decide whether or not to appoint a chief accountant. They can also assign deputy institution-level administrative leaders to assist the head of the institution or faculty in managing financial operations; (3) Whether or not the position of a chief accountant is created, the new system places great emphasis on equipping the administrative leadership team of HEIs with individuals possessing financial professionalism to support the institution's financial management under the head's guidance; (4) The new system also removes the provision stating that "any higher education institution with a chief accountant shall not have a deputy head of institution whose authority overlaps with that of the chief accountant."

2.2. Raising financial professionalism in higher education institutions

Article 38 of the "Accounting Law of the People's Republic of China" specifies that "accounting personnel must possess the necessary professional skills to engage in accounting work. The individual responsible for the accounting department of an entity (accounting personnel) must qualify as an accountant or possess more than three years of experience in accounting." To bolster the professional management of finance matters in HEIs, Article 8 of the new "Financial System of Higher Education Institutions" emphasizes the professional qualifications of primary financial management staff, thereby raising the standard of financial management and promoting the standardization of financial operations [7].

2.3. Optimizing the management of tech achievements and driving scientific progress

In recent years, there has been a notable emphasis from the Party Central Committee and the State Council on the transformation of scientific and technological accomplishments. To expedite the implementation of the innovation-driven development strategy, facilitate the transfer and transformation of scientific and technological achievements, and elevate economic quality, efficiency, and advancement, the National People's Congress amended the Law on the Promotion of the Transformation of Scientific and Technological Achievements in August 2015. A significant aspect of this amendment is the encouragement and incentivization of scientific research institutions to actively engage in the conversion of scientific and technological achievements, along with the refinement of the management and revenue distribution system for these achievements [8]. In alignment with these developments, the "Financial System of Higher Education Institutions" introduces a new provision in Article 49, subsection 3, which states that "higher education institutions may independently decide to transfer, license, or invest in scientific and technological achievements, and the income generated from the transformation of these achievements is to be retained by the unit in its entirety." Additionally, the category of "income from the transformation of scientific and technological achievements" is removed from the definition of "income from scientific research undertakings" in Article 22 of the new system.

It is worth emphasizing that the "other" segment of income generated from the use of state-owned assets in HEIs should be governed in accordance with the specific management protocols outlined by local financial departments [9]. This is due to the "Administrative and Public Utility State-owned Assets Management Regulations" in 2021 (State Council Decree No. 738), Article 35, subsection 3, specifies that "revenue resulting from the use of state-owned assets in public institutions are subject to specific management guidelines set by the financial department of the local government."

2.4. Shifting higher education finance from management to accounting with clear guidelines

The implementation of government cost accounting constitutes a pivotal element in China's government accounting reform [10]. In December 2019, the Ministry of Finance issued "Basic Guidelines for Cost Accounting in Public Institutions" (Caikuai [2019] No. 25) to establish fundamental principles. Subsequently, in November 2021, the Ministry of Finance issued "Specific Guidelines for Cost Accounting in Public Institutions – Public Hospitals" (Caikuai [2021] No. 26). In May 2022, the Ministry of Finance also released a draft of specific guidelines for higher education and scientific institutions for public review. Cost accounting has evolved into a critical component of institutional financial management [11]. Historically, China's HEIs have placed significant emphasis on cost management, dedicating an entire chapter (Chapter 10, "Cost Management") to it.

However, the new system omits the previous Chapter 10 "Cost Management." Instead, the new Article 30 states that "higher education institutions should strengthen their economic accounting and may perform cost accounting in alignment with the actual requirements of teaching, research, and other activities. Specific cost

accounting methods should adhere to the relevant regulations of the State Council's financial department." Under the "Financial Rules for Institutions", cost accounting in HEIs and other institutions is mainly regulated by the unified basic guidelines and specific guidelines outlined by the Ministry of Finance, no longer specified within the financial system [12].

It is essential to highlight the shift from the original "cost management" in the previous system to the "cost accounting" emphasis in the new system, the basic guidelines, and the specific guidelines. Notably, cost accounting and cost management represent two dimensions of cost accounting, with cost accounting serving as the foundation for effective cost management [13]. Therefore, the government's approach to cost accounting reform is pragmatically reinstating the fundamentals of cost accounting.

2.5. Strengthening reform requirements for higher education institutions within the *Financial Rules for Institutions*

As previously mentioned, the reform of the "Financial Rules for Institutions" encompasses twenty significant innovations in the context of the three major financial budget management reforms. The reform of the "Financial System for Higher Education Institutions" strengthens some of these important reform requirements.

Firstly, as part of China's budget management integration reform, an important innovative mechanism revolves around the budget item as the foundational unit, establishing a comprehensive mechanism for managing budget items throughout their entire lifecycle [14]. Article 22 of the new system reiterates the need for the expenditure budget to adhere to the "integrated budget" concept, where "all expenditures are included in the unit budget, and establish a robust expenditure management system," adding "implement project pool management." Furthermore, Article 27 in the new system introduces a provision, "no budget shall be allocated for projects not included in the budget project pool," to fortify these requirements.

Secondly, the foundational position of the new rules regarding the borrowing practices of institutions remains unaltered. Article 51 adds the directive to "truthfully reflect the borrowing situation in accordance with the law," underscoring the importance of transparency and openness in institutional borrowing, which serves as the fundamental condition for averting financial risks. Additionally, Article 57 of the new system reinforces that "no direct or indirect financing or guarantee shall be provided on behalf of local governments and their departments in any way, and new hidden debts of local governments shall be strictly prohibited."

Thirdly, in line with China's government accounting reform's principle of "dual reporting - dual basis - dual function," the new rules revise the previous chapter titled "Financial Reporting and Financial Analysis" to "Financial Reporting and Accounts Reporting," involving structural adjustments. This revision represents the most extensive part of the "Financial Rules for Institutions" reform. Articles 57 and 59 outline the composition of the financial report and final accounts report, encompassing financial/final statements and financial/final analyses, stipulating specific components for financial and final statements, as well as the content of financial and final analyses, respectively. Additionally, the new system, through Articles 63 and 65, elaborates on the essential aspects that should be addressed in the indicators presented in the financial/accounts analysis by adding a second paragraph to each.

The evolving government accounting system imposes higher standards on the financial management of higher education institutions. To successfully implement the reform of HEI financial systems, the focus must start with financial management, addressing the existing deficiencies to align with the demands of the new accounting system [15].

3. Problems and remedial measures in financial management for higher education institutions

3.1. Problems in financial management for higher education institutions

3.1.1. Weaknesses in internal control.

Financial management mandates stringent control measures, necessitating mutual supervision among financial personnel, well-defined roles, and advertence of impropriety, among other prerequisites [16]. However, in some HEIs, individuals hold multiple positions, such as cashier and accountant concurrently or simultaneously managing auditing, provident fund oversight, payroll, and more. Additionally, many institutions have adopted computerized accounting methods, but the authority settings often do not align with requirements, leading to individuals exceeding their designated limits. This fosters a conducive environment for malpractice and errors in financial record processing [17]. The causes stem from both internal and external factors. Internally, financial staff may lack the necessary competence and fail to recognize the issue. Externally, the shortage of financial personnel in HEIs necessitates multitasking out of necessity.

3.1.2. Limited quality and expertise in financial personnel

Previously, HEIs adhered to a straightforward "cash system" bookkeeping, which was a relatively simple accounting process. Consequently, some financial personnel in HEIs have remained focused on basic bookkeeping, overlooking the need for more advanced financial reporting, analysis, and management [18]. This can be attributed to the suboptimal quality of financial personnel and a lack of recognition regarding the elevated demands of financial management in HEIs.

3.2. Remedial measures in financial management for higher education institutions

3.2.1. Elevate the expertise and competence of financial personnel

Enhancing the quality and expertise of financial personnel is fundamental. Financial and accounting professionals must evolve their skills and adapt their thinking to address the complex demands of modern financial management. HEIs should intensify professional training, create platforms for knowledge exchange among financial personnel, and offer opportunities for external learning and training. The focus should be on enhancing financial skills, analysis, and reconciliation abilities. Proficiency in document interpretation is crucial for understanding higher-level directives and ensuring sensible financial practice [19]. To keep pace with modernization, financial computerization must be embraced, enhancing computer application proficiency to boost efficiency and enable data visualization, retrieval, and improved financial management.

3.2.2. Enhance budget accuracy and implementation

Budgets shape a HEI's financial landscape, and the commitment to accurate, reasonable, and stringent budgeting is essential. Unit leaders and relevant managers must prioritize budgeting, ensuring that budgets are both accurate and realistic. An early warning account processing system must be established, promoting regular supervision and control. Only then can effective fund utilization be guaranteed, fostering the HEI's healthy and sustainable growth [20]. In the revised accounting system, both financial and non-financial funds contribute to the expenditure section, requiring a meticulous distinction of fund sources during the budgeting process.

4. Conclusion

In summary, the implementation of the new financial system for HEIs poses fresh challenges but also promises opportunities for positive transformation. The ongoing innovation and reform in financial systems aim to align

with new accounting norms. Thus, financial reporting will be more comprehensive and accurate, and financial management will evolve to embrace modernization, standardization, and enhancement.

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Examining the Effects and Operational Mechanisms of Green Credit on Carbon Emissions in Chinese Regions

Qin Liu*

School of Digital Economy, Sichuan University Jinjiang College, Meishan 620860, Sichuan Province, China

***Corresponding author:** Qin Liu, liuqin_jinjiang@163.com

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Abstract: The utilization of a green financial system, particularly through the implementation of green credit, plays a pivotal role in fostering environmentally sustainable, low-carbon economic growth and facilitating the transition toward a more ecologically responsible economy. This paper employs a two-way fixed-effects model, utilizing provincial panel data spanning from 2012 to 2020, to investigate the influence of green credit on regional carbon emissions within different regions of China. The results reveal a significant reduction in carbon emissions as a consequence of the green credit program's implementation. The analysis of the pathway indicates that green credit is instrumental in mitigating carbon emissions by instigating shifts in the energy mix, with evidence suggesting a partial mediating effect. Furthermore, a heterogeneity analysis discovered that the suppressive impact of green credit on carbon emissions is more pronounced in the eastern and western regions of China, while it is less significant in the central and northeastern areas. The implications of this study provide robust evidence in support of the role of green credit in reducing carbon emissions and can serve as a valuable resource for policymakers aiming to promote the expansion of green credit programs and, in turn, contribute to substantial reductions in carbon emissions.

Keywords: Carbon emission; Green credit; Intermediary effect

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1. Introduction

China's remarkable economic growth following its reform and opening-up policies stands as a global economic growth milestone. Nevertheless, the conventional concept of economic growth, characterized by excessive resource consumption, high pollution levels, and heavy environmental degradation, has given rise to profound environmental and pollution issues. China has long held the inevitable position of being the world's foremost contributor to total carbon emissions. As a result, there is a pressing and substantial need to curtail emissions. China's role as a major player in global emission reduction efforts is evident in its adoption of the "dual carbon" target.

The implementation of green credit exerts credit controls over industries characterized by "high energy

consumption and high pollution," curtailing their expansion through mechanisms such as project access restrictions, elevated interest rates, and quota limitations, all aimed at compelling a shift away from their high energy consumption and high pollution business models. Meanwhile, through the provision of preferential credit policies and credit products, it fosters the growth of low-carbon, recycling, energy-saving, and environmentally friendly sectors, leading to significant ecological gains and ultimately realizing a symbiotic relationship between ecology and finance. The interplay between green credit, energy conservation, emission reduction, and the support of local low-carbon economic transformation has emerged as a key challenge in the pursuit of sustainable green development.

2. Literature review

2.1. Exploration of carbon emissions

The study of carbon emissions is a multifaceted field influenced by numerous factors, with a primary focus on environmental regulation, technological advancements, and industrial structure. Substantial research efforts have been devoted to strategies for reducing carbon emissions. Lin and Liu (2010) advocated the reduction of carbon emissions by maintaining GDP growth while controlling the urbanization rate and diminishing energy consumption intensity [1]. Sun *et al.* (2016) highlighted the optimization of industrial and energy structures to enhance carbon emissions efficiency, with government intervention playing a pivotal role in achieving energy target constraints [2]. Wang *et al*. (2018) revealed a significant inverted U-shaped curve relationship between economic growth and carbon emissions, while population agglomeration, technological advancements, openness to global markets, and intensified highway transportation together inhibit the increase in the level of urban carbon emissions [3]. Liu *et al*. (2019) unveiled the impact of technological innovation, foreign trade, and industrial concentration on both the carbon intensity of local high-energy-consuming industries and neighboring areas through the spatial spillover effect, while energy and industrial structures, as well as enterprise-scale primarily affect the carbon intensity of the local high-energy-consuming industries [4]. It is important to note that the factors influencing carbon emissions can differ greatly across industries and regions, necessitating the development of region-specific policies [5-8].

2.2. Exploration of green credit mechanisms

Scholarly investigations support the notion of a financing penalty and investment inhibition effect on high-energy and high-pollution firms as a result of green credit policies. Zhou and Luo (2017) observed that, following the implementation of green financial policies, non-heavily polluting enterprises gradually matched or even exceeded heavily polluting counterparts in obtaining new and long-term borrowings. Companies with a stronger green reputation were more successful in securing new borrowings and long-term financial support in their analysis of heavily polluting A-share listed enterprises [9]. Su and Lian (2018) employed a double difference method to conclude that green credit policies hinder interest-bearing debt financing and long-term liabilities for heavy polluters, with new investments exhibiting a declining trend [10]. Ding and Hu (2020) ascertained that green credit policies effectively curtail the credit financing of heavy polluters, with a stronger impact on long-term credit financing [11]. Wang *et al.* (2021) researched Chinese listed firms and determined that green financing policies enhance the investment effectiveness of high-polluting companies [12].

Moreover, studies confirm the role of green credit in promoting the development of environmental protection industries. Ding *et al*. (2020) utilized the data envelopment analysis (DEA) model to analyze the efficiency of green credit in supporting ecological economic development in Zhejiang Province and found a gradual improvement in the overall efficiency of green credit support for ecological economic development.

Specifically, they observed that energy-saving, environmental protection, medicine, and health industries attract substantial green credit inputs with high output efficiency [13]. Song *et al*. (2022) highlighted the significant impact of green finance on the dissemination of environmental protection technologies at the national level, with cleaner production technologies outweighing end-of-pipe technologies [14]. Shu *et al*. (2023) discovered that green credit policies play a substantial role in stimulating green innovation in enterprises [15].

2.3. Investigation of green credit's impact on carbon emissions

Research on the impact of green credit on carbon emissions is divided. He *et al*. (2023) discovered that green credit effectively contributes to carbon emissions reduction, with a more pronounced impact in the eastern region compared to the central and western regions [16]. Yin *et al*. (2019) contended that green credit lowers carbon emission intensity through the transmission chain of research and development expenditures in high-tech enterprises [17].

Conversely, some researchers assert that the influence of green credit is conditional. Huang *et al*. (2023) conducted a threshold effect analysis and revealed that the progress of environmental technology needs to surpass a certain threshold for green credit to significantly promote the manufacturing industry. Within a reasonable range of green credit intensity, it can notably enhance the efficiency of carbon emissions [18]. According to Wang and Huang's analysis in 2022, the impact of green credits on carbon emissions is dependent on environmental regulation. Green credit can greatly reduce carbon emissions when environmental regulations are stringent [19].

Based on this classification, this study employs two-way fixed-effects panel models, mediation effect analysis, and regional heterogeneity analysis to investigate the effects and impact pathways of green credit on carbon emissions in China, encompassing the eastern, central, western, and northeastern regions. The findings from this study hold valuable insights for the development and implementation of policies.

3. Research hypotheses

The green credit policy increases the loan difficulty and interest rates for enterprises with high pollution and high energy consumption, while incentivizing industries to transition towards energy conservation, environmental protection, low energy consumption, and reduced pollution. This shift contributes to the reduction in carbon emission intensity. Additionally, the concurrent development of low-carbon recycling industries enhances support for energy efficiency and environmental protection, resulting in greater ecological benefits. Under the regulatory guidance of green credit, social capital is more likely to flow into green sectors, expediting industrial transformation and carbon emission reduction. Therefore, the initial hypothesis of this study is as follows:

Hypothesis 1: Green credit facilitates a reduction in carbon emission intensity.

Green credit fosters the decarbonization of the energy consumption structure through expansion, technological advancement, and feedback effects [20]. Conventional energy sources like coal pose significant environmental threats, and enterprises heavily reliant on coal often generate substantial carbon emissions. Such businesses may encounter challenges in obtaining financial support within the green credit framework. Conversely, green credit promotes investments in new energy sources, accelerates their technological progress, reduces the cost of adopting new energy sources, and enables enterprises to utilize these sources cost-effectively. This ensures profitability while achieving low-carbon development and fostering a virtuous cycle. As a result, the following hypothesis is proposed:

Hypothesis 2: Green credit affects carbon emissions by reshaping the energy mix.

Given the substantial variation in carbon emissions, energy structures, the degree of green credit system maturity, and environmental objectives across China's provinces and regions, the effectiveness of green credit implementation exhibits regional disparities. Thus, the third hypothesis is formulated:

Hypothesis 3: Regional variability exists in the impact of green credit on carbon emissions, as well as in the transmission pathways from green credit to carbon emission reduction through the energy structure.

4. Selection of variables and modeling

4.1. Selection of variables

Explained variable: carbon intensity (CO_2gdp). Carbon intensity is the number of carbon emissions per unit of GDP. The measurement of carbon emissions used is based on the total amount of eight major energy sources consumed when converted to standard coal, together with the coefficient of carbon produced during the complete combustion of standard coal. Coal, crude oil, coke, gasoline, kerosene, diesel, fuel oil, and natural gas are the eight main energy sources. The specific formulas are:

$$CO_{2it} = \sum_{j=1}^{8} E_{itj} \times m_j \times n_j \tag{1}$$

$$CO_2gdp_{it} = \frac{CO_{2it}}{GDP_{it}} \tag{2}$$

Here, E_{itj} denotes the consumption of j types of fossil energy in province i in year t, whereas m_j and n_j represent the conversion factor of the jth type of fossil energy standard coal and the carbon emission factor of energy, respectively, and GDP_{it} denotes the real gross domestic product in province i in year t.

Core explanatory variable: green credit level (GC). According to Zhang and Zhao (2019) [21], the interest expense ratio of the six high-energy-consuming industries is used as the inverse indicator to ensure the continuity and completeness of the data at the provincial level. Therefore, the green credit level was measured using "1 - the interest expense ratio of 6 high-energy-consuming industries."

Mediating variable: energy structure (ES). The traditional energy source on which China currently relies most is coal, and the inefficient use of coal has caused great pressure on the environment; one of the most important goals of energy structure transformation is to reduce the reliance on coal and develop new types of energy. This paper adopts the method of Zhang and Li (2022) to measure the degree of energy structure transformation by using the proportion of coal consumption to total energy consumption [22].

Control variables: urbanization rate (URL), expressed as the ratio of urban population to total population; foreign direct investment (FDI), expressed as the ratio of FDI to total investment in fixed assets; degree of technological advancement (TI), expressed as the total amount of technological contract turnover; industrial structure (IND), expressed as the ratio of tertiary to secondary industries; level of economic development (PGDP), using regional GDP per capita.

4.2. Data sources

Carbon emission intensity is computed based on data encompassing eight energy consumption categories derived from the "China Energy Statistics Yearbook." "Gross Regional Product" data are sourced from the statistical yearbook of respective regions, and the nominal GDP is adjusted to real GDP using the GDP deflator with the year 2000 serving as the base period. Data pertaining to interest expenses are extracted from the "China Industrial Statistical Yearbook" and "China Economic Census Yearbook." The turnover of technology contracts

is drawn from the "China Science and Technology Statistics Yearbook." Information on urban population, total population, foreign direct investment, investment in fixed assets, and output value of secondary and tertiary industries is obtained from the "China Statistical Yearbook."

To address heteroscedasticity, this paper employs a logarithmic transformation for variables such as carbon intensity, green credit level, urbanization rate, foreign direct investment, GDP per capita, and technological progress. The sample for this research encompasses panel data from 30 provinces, autonomous regions, and municipalities across China, excluding Hong Kong, Macao, Taiwan, and Tibet. The data covers the period from 2012 to 2020. A comprehensive overview of variable definitions and descriptive statistics can be found in **Table 1**.

Table 1. Variable definitions and descriptive statistics

Variable	Meaning	N	Mean	Std	Min	Max
$lnCO_2$ gdp	The logarithm of carbon intensity	270	0.947	0.732	-1.068	2.852
lnGC	Logarithm of (1 - Percentage of Interest Expenditures in the Six Major Energy-Consuming Industries)	270	3.805	0.405	2.240	4.392
ES	Share of coal consumption in total energy consumption	270	4.401	0.645	0.691	6.145
lnFDI	Logarithm of the ratio of foreign direct investment to total fixed investment	270	3.614	1.177	1.588	8.556
lnURL	Logarithm of the ratio of urban population to the total population	270	4.055	0.192	3.595	4.495
lnTI	Logarithm of total technology contract turnover	270	4.825	1.798	-0.568	8.751
lnPGDP	Logarithm of GDP per capita	270	1.258	0.464	0.087	2.405
IND	The ratio of tertiary to secondary output	270	1.257	0.703	0.549	5.310

4.3. Modeling

This research uses carbon emission intensity as an explanatory variable, green credit level as a core explanatory variable, and other variables impacting energy consumption intensity as control variables to investigate the effect of green credit on carbon emission intensity. In the end, a panel model (3) is established:

$$\ln CO_2gdp_{it} = \alpha_0 + \alpha_1 \ln GC_{it} + \alpha_2 Control_{it} + \delta_i + \varepsilon_{it} \quad (3)$$

Here, the explanatory variable $\ln CO_2gdp_{it}$ is the carbon emission intensity, the core explanatory variable $\ln GC_{it}$ is the level of green credit in each region, $Control_{it}$ is the control variable, δ_{it} is the regional effect, and ε_{it} is the random error term.

The mediating effect refers to the explanatory factor's indirect impact on the explained variables via the intermediary variables. Models (4) and (5) are created as stepwise regression is typically used to examine the intermediate effect, and both equations examine the impact of green credit on energy structure, the intensity of carbon emissions, and the direct impact of green credit on carbon emission intensity. ES_{it} stands for the energy structure. If both β_1 and γ_2 are significant, the product of the two reflects the indirect effect of green credit on carbon emission through energy structure.

$$ES_{it} = \beta_0 + \beta_1 \ln GC_{it} + \beta_2 Control_{it} + \varphi_i + \varepsilon_{it} \quad (4)$$

$$\ln CO_2gdp_{it} = \gamma_0 + \gamma_1 \ln GC_{it} + \gamma_2 ES_{it} + \gamma_3 Control_{itt} + \varphi_i + \varepsilon_{it} \quad (5)$$

5. Analysis of regression results

5.1. Baseline regression results

It is important to decide beforehand whether to use a fixed effects model or a random effects model. The article

additionally controls the temporal effect and establishes a two-way fixed effect model after the Hausman test demonstrating that the data in this research are better suited for the fixed effect model.

The regression outcomes for model (3) are displayed in **Table 2**. **Table 2**'s column (1) displays the results when no controls are added, columns (2) through (5) display the results when control variables are gradually added, and column (6) displays the regression results when all control variables have been included. As can be observed, the calculated coefficients of green credit are all significantly negative, meaning that green credit has a considerable positive impact on reducing carbon emissions. Hypothesis 1 of the article is verified.

Using the estimation results in **Table 2**'s column (6) as the baseline for analysis, the coefficients of the degree of technological progress, industrial structure, and level of economic development are significantly negative, indicating that improving the level of technology, optimizing the industrial structure, and promoting the green development of the economy can help to reduce carbon emissions, which is in line with expectations. Foreign direct investment and the rise of urbanization level will bring about an increase in carbon emission intensity, which may be related to the impacts of laxity in the gatekeeping of foreign investment and the transfer of the rural population brought about by urbanization.

Table 2. Benchmark regression results

	(1)	(2)	(3)	(4)	(5)	(6)
	lnCO$_2$ gdp	**lnCO$_2$ gdp**	**lnCO$_2$ gdp**	**lnCO$_2$ gdp**	**lnCO$_2$ gdp**	**lnCO$_2$ gdp**
lnGC	-0.321*** (-5.443)	-0.265*** (-4.549)	-0.263*** (-4.499)	-0.297*** (-5.037)	-0.233*** (-4.352)	-0.203*** (-4.000)
lnFDI		0.0739*** (4.379)	0.0746*** (4.387)	0.0750*** (4.469)	0.0286* (1.764)	0.0457*** (2.919)
lnURL			0.0816 (0.396)	0.174 (0.847)	0.968*** (4.555)	0.555** (2.584)
lnTI				-0.0338*** (-2.752)	-0.0373*** (-3.387)	-0.0361*** (-3.469)
lnPGDP					-1.695*** (-7.544)	-1.683*** (-7.929)
IND						-0.195*** (-5.339)
Constant	2.454*** (11.021)	1.994*** (8.347)	1.661* (1.899)	1.555* (1.801)	-0.0194 (-0.024)	1.610** (1.973)
Province fixed effects	YES	YES	YES	YES	YES	YES
Time fixed effect	YES	YES	YES	YES	YES	YES
Adjust R^2	0.753	0.771	0.770	0.776	0.820	0.840

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.2. Robustness analysis

To ensure that the relationship between the explained variables and explanatory variables in the empirical results of the model is accurate and reliable, it is necessary to do the robustness test of the model. In this paper, the model empirical results are tested for robustness in two ways. The first is to replace the explanatory variables. To eliminate the possible influence of introducing real GDP, total carbon emissions are selected as the explanatory variable to do the robustness test. Secondly, considering the possible endogeneity of the variables, the difference GMM method is used to re-estimate the benchmark regression.

After utilizing total carbon emissions as an explanatory variable, (1) in **Table 3** displays the regression

findings. The final regression results reveal that the amount of green credits has a negative impact on overall carbon emissions. It is consistent with the benchmark regression's findings and demonstrates the benchmark regression's robustness.

The output of building a dynamic panel model for differential GMM estimation is shown in **Table 3** at (2). The first-order autocorrelation *p*-value is 0.01 and the second-order autocorrelation *p*-value is 0.20, which supports the notion that there is just a first-order autocorrelation and no second-order autocorrelation. Hansen's test yields a value of 0.294, which shows that the model's instrumental variables were reasonably well chosen and that the differential GMM estimate results are trustworthy. According to the estimation results, the coefficient of green credit is significantly negative at the national level, and the significance of the other variables is similar. This suggests that even after accounting for the model's potential endogeneity issue, our main conclusions are still valid.

Table 3. Robustness analysis

	(1)	(2)
	$lnCO_2$	**$lnCO_2$ gdp_GMM**
$lnCO_2$ gdp		0.381^{***} (9.290)
lnGC	-0.225^{***} (-4.515)	-0.128^{***} (-5.744)
lnFDI	0.0367^{**} (2.398)	0.0484^{***} (4.058)
lnURL	0.735^{***} (3.496)	-0.169 (-1.553)
lnTI	-0.0327^{***} (-3.215)	-0.0131^{**} (-2.648)
lnPGDP	-0.971^{***} (-4.679)	-0.186^{**} (-2.401)
IND	-0.227^{***} (-6.361)	-0.220^{***} (-9.461)
Constant	9.493^{***} (11.897)	
Province fixed effects	YES	YES
Time fixed effect	YES	YES
AR(1)		0.010
AR(2)		0.200
Hansen		0.294

$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

5.3. Analysis of intermediation effects

Table 4 (1) shows the overall impact without taking into account energy structure, and the result is markedly negative, with a coefficient of -0.203. (2) shows, with 99% certainty, that green credit has a detrimental impact on energy structure. Green credits can enhance the energy structure and lower the percentage of coal use. Given that energy structure is a reverse indication, the coefficient of energy structure in (3) is noticeably positive, demonstrating that the change of energy structure contributes to a decrease in carbon emissions. Additionally, the coefficient in (3) is -0.133, with a substantially lower absolute value than in the total effect model (1) and a lessened negative impact on carbon emissions. This suggests that there is a partial mediating effect of energy structure in the effect of green credit on carbon emissions, and the partial mediating effect is -0.7, indicating that hypothesis 2 is validated. Green credit's carbon emission reduction effect helps to optimize the energy structure by forcing high-polluting enterprises to use more environmentally friendly and clean energy for production, replacing the original crude production mode dominated by coal resources, which reduces carbon emissions.

Table 4. Analysis of intermediation effects

	(1)	(2)	(3)
	$lnCO_2$ gdp	**ES**	**$lnCO_2$ gdp**
lnGC	-0.203*** (-4.000)	-0.505*** (-3.248)	-0.133*** (-2.823)
ES			0.139*** (7.036)
Control variable	YES	YES	YES
Province fixed effects	YES	YES	YES
Time fixed effect	YES	YES	YES
Adjust R^2	0.840	0.156	0.868

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.4. Analysis of regional heterogeneity

It is necessary to further investigate the different performance of the relationship between green credit and carbon emission intensity in different geographic regions. According to the National Bureau of Statistics, China is divided into four regions: eastern, western, central, and northeastern. Group regression is carried out on the four subsamples to determine the heterogeneity. The regression findings from the heterogeneity analysis are displayed in **Table 5**. The estimation findings in **Table 5** show that there are quite obvious discrepancies between the coefficients of green credit. While the central and northeastern regions are not significant, the eastern region experiences the greatest reduction in carbon emissions via green credits, followed by the western region.

Table 5. Analysis of regional heterogeneity

	(1)	(2)	(3)	(4)
	Eastern	**Central**	**Western**	**Northeastern**
lnGC	-0.268*** (-4.676)	0.227 (1.239)	-0.202** (-2.266)	-0.0620 (-0.481)
Control variable	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES
Time fixed effect	YES	YES	YES	YES
Adjust R^2	0.929	0.872	0.865	0.976

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The eastern region of China stands as the forefront of economic and cultural development, with the highest population density and environmental pressures. It faces an urgent need for economic transformation and development. In this region, financial institutions, enterprises, environmental awareness, and investments in emission reduction are relatively high. These favorable conditions contribute to the substantial inhibitory impact of green credit on carbon emissions in the eastern region.

The western region, on the other hand, has seen a more pronounced influence from national policies in recent years. It receives relatively greater support in terms of national policies and financial aid. The region's industrial development is largely centered around resource-based economies. Consequently, much of the green credit in this region is directed toward clean energy and sustainable development industries. However, due to a delayed initiation of green credit activities in the western region compared to the eastern region, its overall

effectiveness in carbon emission reduction is somewhat lower.

The central and northeastern regions of China find themselves in an intermediate position regarding national policies and development. These regions receive comparatively less policy and financial support, possess relatively underdeveloped industrial research, and apply technology to a limited extent. Their industrial structures tend to be more homogeneous, resulting in a less significant impact on green credit on carbon emissions reduction.

Since the green credit policy significantly reduces carbon emission intensity in both the eastern and western regions, the next step is to delve into an analysis of the mediating role of energy structure in these regions. As shown in **Table 6**, all coefficients in the eastern region are statistically significant, indicating that energy structure plays a partial mediating role. This implies that green credit has not only improved the energy structure in the eastern region but has also spurred the growth of cleaner energy sources, ultimately leading to a reduction in carbon emissions. Conversely, in the western region, there is no significant correlation between green credit and energy structure, thereby negating any mediating effect. Thus, hypothesis 3 is validated.

Table 6. Analysis of regional mediating effects

	(1)	(2)	(3)	(4)
	ES_East	**lnCO$_2$ gdp_east**	**ES_West**	**lnCO$_2$ gdp_west**
lnGC	-0.883*** (-3.054)	-0.213*** (-3.631)	-0.0987 (-0.666)	-0.169** (-2.258)
ES		0.0630*** (2.698)		0.334*** (5.708)
Control variable	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES
Time fixed effect	YES	YES	YES	YES
Adjust R^2	0.497	0.935	0.268	0.906

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

6. Conclusions and recommendations

This study draws upon data from 30 Chinese provinces, autonomous regions, and municipalities spanning the years 2012 to 2020. It conducts a comprehensive analysis, encompassing basic regression, robustness testing, mediation effect analysis, and regional heterogeneity analysis, using a two-way fixed effect model. The study yields the following key findings.

First, the implementation of the green credit policy significantly reduces carbon emission intensity. This reduction is also influenced, to some extent, by technological progress, improvements in industrial structure, and economic development. In contrast, foreign investment and urbanization contribute to increased carbon emissions. Second, there is a partial mediating effect attributed to the energy structure. Third, the impact of the mediating role of the energy structure is particularly pronounced in the eastern region, while it is less significant in other regions. The suppression effect of green credit is more prominent in the eastern and western regions compared to the central and northeastern regions.

As a conclusion, this paper underscores the substantial role of scaling up green credit in reducing carbon emissions. To harness this potential, relevant state authorities should actively work on reinforcing the legal framework and the depth of green credit legislation to facilitate the seamless execution of green credit policies. This includes providing commercial banks with more flexibility within predefined standards, promoting transparency in green credit operations, streamlining the application process, and assisting in the establishment

of regional green credit systems.

Based on the insights garnered from the mediation analysis, it is evident that green credit's capacity to reduce carbon emissions is largely attributed to improvements in the energy structure. Therefore, increasing the share of clean and low-carbon energy in energy consumption and optimizing the energy mix are crucial steps in mitigating carbon emissions. To encourage the development of new energy sources, green credit financing should be channeled effectively through investments in talent, technology, and capital. Gradually diminishing the role of "two highs and one leftover" industries in China's energy consumption and transitioning towards a high-quality energy system rooted in renewable sources such as hydropower, wind power, and natural gas is imperative.

Nonetheless, it is worth noting that the regional disparities in economic development, geographic location, resource endowment, and other factors result in variations in the implementation and impact of green credit across regions. Local governments should tailor green credit policies to align with their unique economic development, ecological environment, and industrial structure characteristics. By leveraging regional strengths, they can bolster the environmental protection industry and stimulate the coordinated development of the local ecological and economic environments.

This paper primarily focuses on the relationship between green credit and carbon emission intensity, laying the foundation for policy recommendations. Nevertheless, it has two main limitations. First, due to data constraints, the direct measurement of green credit across different provinces is challenging. Thus, the interest share of high-energy-consuming industries is employed as a proxy. Second, additional intermediary effects and influence mechanisms warrant further exploration and research.

Disclosure statement

The author declares no conflict of interest.

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Public Transportation Management Strategies in a Low-Carbon Economy

Can Chen*

Chongqing Energy College, Chongqing 402260, China

***Corresponding author:** Can Chen, nychencan@163.com

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Abstract: The importance of public transportation in social and economic development is undeniable. With the rising concerns of environmental pollution and resource depletion in recent times, China has made significant efforts to transition towards a low-carbon economy. To advance this transition, it is imperative to confront the obstacles faced by public transportation and enact effective management strategies that promote both economic and environmental sustainability. In this regard, the author has evaluated the existing status of public transit within the context of a low-carbon economy and put forth targeted management approaches. This research is expected to make a valuable contribution towards enhancing the quality of public transportation management.

Keywords: Low-carbon economy; Public transportation; Transportation management

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1. Introduction

In the context of a low-carbon economy, it is crucial to conduct a comprehensive examination of the shortcomings in public transportation and, grounded in real-world conditions, offer pragmatic management strategies. By aligning with the low-carbon economic trend, this endeavor aims to advance the growth of public transportation in China. Embracing sustainable development for optimizing public transit not only enhances the comfort and safety of transportation for the public but also mitigates carbon emissions and conserves energy, thereby propelling China's public transportation sector toward an eco-friendly and low-carbon trajectory.

2. Low-carbon economy

A low-carbon economy represents a model grounded in environmental preservation and energy conservation. Within this framework, every enterprise is mandated to reduce energy consumption and minimize environmental pollutants during their operations and growth. In the context of striving for China's sustainable development objectives, the low-carbon economy fundamentally embodies the principles of environmental protection. While the continuous expansion of the public transportation industry has yielded favorable conditions and convenience for the public's mobility, the operational process of vehicles consumes more energy and generates

emissions, contributing to heightened environmental pollution. Consequently, in a low-carbon economy, it becomes imperative to prioritize the enhancement of public transportation management to foster the evolution of the public transportation sector.

The low-carbon economic model can be mainly segmented into three components. The initial aspect entails achieving zero-carbon development, necessitating the complete elimination of carbon emissions during the development of the public transportation industry. The second aspect is centered on carbon usage reduction, aiming to minimize carbon consumption in line with past public transportation advancements. The third aspect targets carbon emissions reduction, distinguishing itself from decarbonization by striving to reduce carbon emissions intensity below the level of carbon production. Realizing the objectives of low-carbon economic development is a gradual, long-term process. Transitioning from decarbonization to carbon reduction and ultimately attaining zero carbon is the overarching goal, which cannot be accomplished overnight.

3. Challenges in public transportation within a low-carbon economy

3.1. Inadequate urban road planning

In the current state of urban road planning, government departments are energetically fostering the development of the public transportation industry to meet the daily commuting needs of the public. However, constraints stemming from existing road infrastructure and systems hinder the formulation of comprehensive public transportation routes. Typically, road planning is limited to land use considerations, without a comprehensive analysis of population distribution. This results in an inadequately scientific and rational approach to public transportation road planning. Hence, road congestion frequently occurs in some segments, while others remain underutilized, leading to an inefficient use of public transportation resources and impeding progress toward sustainable development goals.

3.2. Limited public awareness of low-carbon initiatives

As the general public's living standards continue to rise, there is an increasing trend towards owning private vehicles, which are perceived as convenient and swift modes of travel. While public transportation is more environmentally friendly and energy-efficient, the public's awareness of low-carbon options remains relatively weak. Public transportation is not the primary choice for travel. Strengthening public awareness of low-carbon environmental protection is essential when implementing public transportation management in a low-carbon economy. Encouraging people to actively opt for public transportation and participate in energy conservation and emission reduction is key to advancing low-carbon economic development and achieving the "double carbon" goal.

3.3. Deficient information management in public transportation

Resource constraints in terms of talent, technology, and funding have resulted in a lack of informatization and intelligence in public transportation management in China. The general public faces challenges in accessing basic information about public transport through mobile phone applications or software programs. This includes accurate details about transport operations, such as arrival times, departure schedules, intervals, and final departure times, which are essential for flexible travel planning. While some regions have introduced apps and software programs, the information they provide regarding public transportation is often outdated, lacking real-time updates on traffic conditions and accidents. Consequently, passengers may experience delays and disruptions when using public transportation, leading many to prioritize driving their own vehicles.

4. Effective strategies for public transportation management in a low-carbon economy

4.1. Rationalization of public transportation routes

In the current phase, urbanization and industrialization are on the fast track. The robust expansion of the public transportation sector has enhanced the daily lives of the public and spurred local economic growth. However, it is undeniable that the rapid growth of this sector has led to substantial damage to the surrounding ecological environment, resulting in the wastage of natural resources. Therefore, in a low-carbon economy, there is a need for the judicious planning of public transportation routes to further the goals of low-carbon economic development [1]. On one hand, relevant government bodies and grassroots industrial organizations should prioritize the principle of "facilitating mass travel" and, when designing urban public transportation routes, consider controlling vehicle emissions while mitigating road congestion. On the other hand, to prevent the wastage of public transportation resources, authorities must enhance their strategic planning capabilities. This includes ensuring seamless intermodal connections between buses, subways, and other modes of transport, along with implementing road usage restrictions to maintain public transit efficiency while reducing carbon emissions, thus contributing to the achievement of sustainable development objectives.

4.2. Enhanced promotion of low-carbon awareness

In a low-carbon economy, the key to the rapid expansion of urban public transportation is securing public support and recognition. Given the currently weak awareness of low-carbon practices among the general population, there is a pressing need to intensify efforts to advocate low-carbon concepts and vigorously promote low-carbon economic, transportation, and travel models. Public enthusiasm should be mobilized to participate actively in low-carbon development to realize green and sustainable growth [2]. Strategies for increasing public awareness include: formulating preferential policies to encourage public transportation use by reducing fares; utilizing various communication channels, including official public transit website, WeChat official accounts, and popular media platforms such as TikTok and Weibo to communicate the advantages of using public transportation and the importance of low-carbon concepts. Traditional media such as radio and television stations, city newspapers, or through banners, pasting slogans, or social activities, community education, can also be utilized; engaging public figures, such as government members, social representatives, celebrities, and authoritative scholars, to experience public transportation and convey its convenience and efficiency, fostering broader public acceptance of the low-carbon economy and public transportation as a preferred travel option.

4.3. Augmentation of public transportation services' intelligence

As society advances, the demand for personalized and customized mass transit services becomes more prominent. With China's rapid technological progress, advanced information technologies are increasingly mature and available. In a low-carbon economy, it is crucial to actively incorporate these technologies into public transportation management to enhance the qualities and capabilities of urban transportation services. This should include the reduction of travel time, and closing the gap between public transportation and self-driving options. The adoption of information technologies can promote the informatization and intelligence of public transportation services [3]. For instance, it can introduce "one-stop" low-carbon and green travel services, dispelling misperceptions about long wait times and poor transfer efficiency, thus allowing passengers to experience the comfort and convenience of public transportation in the modern era. High-quality services can encourage the public to choose public transportation as their first option for travel, reducing vehicle emissions and reinforcing the low-carbon concept. To address shortcomings in urban public transportation information

management, collaboration with local universities and research institutes can be strengthened to cultivate a skilled workforce and improve the development of intelligent public transportation. Regular optimization and improvement of urban public transportation management information systems are essential to further the development of the urban low-carbon economy [4].

4.4. Promotion of new energy vehicles

In a low-carbon economy, the active promotion and utilization of new energy vehicles within public transportation management is vital for reducing carbon emissions. This plays a crucial role in China's sustainable economic and societal development. To achieve this, relevant government departments and industries should work diligently to establish centralized charging and fuel cell hydrogenation stations to facilitate the widespread adoption of new energy vehicles [5]. In addition, the replacement and upgrading of old public vehicles should be accelerated, supporting the development of the low-carbon economy and the achievement of sustainable development goals [6].

4.5. Reinforcement of public transportation management systems

To ensure that transportation management practices are standardized and effective, relevant government departments should establish comprehensive transportation management systems in accordance with China's current laws and regulations. Furthermore, the implementation of these systems should be rigorously enforced to enhance compliance among public vehicle operators [7]. These detailed systems should delineate responsibilities for managers and set precise standards for the conduct of public transportation drivers. Regular performance appraisals for both managers and drivers, coupled with corresponding reward and penalty measures, can be implemented to motivate adherence to the established systems [8]. To alleviate road congestion and ensure the smooth flow of traffic, relevant departments should make scientifically-based adjustments to public transportation plans. This includes the rational division of main roads, secondary roads, motor vehicle lanes, and pedestrian lanes, as well as the allocation of parking spaces to prevent unauthorized parking or obstructions of pedestrian walkways.

4.6. Increased involvement of government departments

To encourage businesses to actively participate in low-carbon economic development and effectively reduce carbon emissions, relevant government departments in China should increase their involvement [9]. For instance, companies that produce low-carbon, environmentally friendly public transportation can receive financial subsidies or preferential tax exemptions. Clear standards for carbon emissions for companies across various sectors should be established, with all companies mandated to engage in low-carbon and environmentally friendly practices. Special funds can be used to support companies developing clean energy, while government subsidies can incentivize public transportation companies to replace older, more polluting vehicles with new energy alternatives. Travel subsidies can be offered to passengers who choose public transportation, reducing the number of private vehicles on the road [10]. To enhance public satisfaction and acceptance of public transportation services and increase their willingness to utilize these services, relevant government departments should invest in supporting infrastructure based on the local context, aiming to create a more comprehensive public transportation services system that fosters the development of the low-carbon economy more effectively.

5. Conclusion

In summary, within a low-carbon economy, it is essential to intensify promotional activities during the

implementation of public transportation management. These efforts should aim to enhance public awareness of the low-carbon economy and encourage active participation in low-carbon travel. Simultaneously, through the development of relevant policies, the encouragement of new energy vehicle production companies, and the incorporation of diverse information technology solutions, public transportation service quality can be consistently elevated, motivating the public to make public transportation their preferred mode of travel. This multifaceted approach is vital for the advancement of the low-carbon economy.

Disclosure statement

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Examining the Impact Factors and Strategies to Mitigate Economic Fluctuation in the Real Estate Sector

Yadong Xiao*

Anhui Open University, Hefei 230022, Anhui Province, China

Corresponding author: Yadong Xiao, 174375337@qq.com

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Abstract: With the continuous growth of the economy and the rapid pace of urbanization, the real estate sector has assumed an increasingly substantial role within the national economy. Ensuring the stable and sustainable development of the real estate sector to maximize its societal and economic contributions has become a pressing issue. China, presently engaged in an extensive urbanization drive, places real estate development and sales as pivotal components in the broader real estate industry, significantly impacting the overall functionality of the real estate market. Real estate, being a comprehensive system encompassing land, housing, infrastructure, and other key elements, exerts a profound influence on people's basic needs such as shelter, sustenance, and daily living. Its evolution directly shapes the trajectory of the national economy and social stability. Therefore, to foster the consistent and robust growth of China's real estate economy, it is necessary to implement effective measures that entail a systematic and thorough analysis of the factors responsible for the fluctuations in China's real estate economy.

Keywords: Real estate; Economic fluctuations; Influencing factors; Countermeasures

Online publication: October 20, 2023

1. Introduction

Since the initiation of economic reforms and opening up, China's real estate sector has achieved remarkable progress, significantly contributing to the national economic development. However, the rapid economic growth has given rise to several challenges, including persistent housing price increases, the imbalance between real estate market supply and demand, and the growing fiscal revenues of local governments, which have, in turn, triggered a series of economic fluctuations. In response to these fluctuations in the new era, both the central and local governments have devised relevant policies and measures aimed at addressing this issue. This paper mainly examines the underlying causes of real estate economic fluctuations and outlines the key strategies for mitigating these fluctuations, intending to resolve real estate economic fluctuations in China in this new era.

2. Factors influencing fluctuations in the real estate economy

2.1. Housing prices

Housing prices play an important role in affecting the fluctuations within the real estate economy. The level of housing prices directly reflects the market's demand for real estate. Generally, higher housing prices lead to reduced buyer willingness, resulting in greater price fluctuation, while lower housing prices boost buyer enthusiasm and minimize price fluctuation [1]. Simultaneously, as China continues its urbanization process, the demand for housing among its citizens is continually on the rise. However, a scarcity of available residential land and irregular land supply practices in China have led to substantial land underutilization. Consequently, numerous individuals engage in various degrees of speculation to secure additional land resources, further exacerbating the supply-demand imbalance in the real estate market and consequent housing price fluctuations. Therefore, government authorities need to adopt effective measures to encourage the rational formation and stable development of housing prices. In addition, reinforcing macro-level control of the housing market is essential to ensure the steady and healthy development of the real estate economy.

2.2. Resident income

Resident income encompasses the monetary income acquired by individuals through diverse means, including wages, interest, rent, property income, and more. There exists a certain connection between the real estate economy and the residents' income, with fluctuations in the real estate economy being greatly affected by changes in resident income [2]. On one hand, higher income levels among residents correspond to increased demand for home purchases. On the other hand, individuals with higher incomes tend to invest surplus funds in the real estate market, thereby driving up housing prices. It is evident that an improvement in residents' income levels significantly propels the development of the real estate economy. However, China's real estate economic market currently exhibits certain anomalies, including high housing prices, inadequate supply of affordable housing, excessive currency issuance, and more. These irregularities somewhat constrain the populace's demand for the real estate market [3]. Thus, rectifying these discrepancies is vital to promoting the stable and healthy advancement of China's real estate economy.

2.3. Interest rates and deposit reserve requirements

Interest rates represent a crucial factor affecting fluctuations within the real estate economy. Given the intricate connection between interest rates and real estate investments, an increase in interest rates directly reduces real estate investments, thereby impacting the development of the real estate economy. Interest rate fluctuations also reverberate within household consumption patterns and consequently exert a substantial influence on the real estate market [4].

In essence, as interest rates rise, consumers' purchasing ability for commercial housing diminishes, thereby negatively affecting real estate investment. On the contrary, a decrease in interest rates bolsters consumers' purchasing ability for commercial housing, favorably enhancing commercial housing sales. In light of these dynamics, it is essential, during the process of macroeconomic regulation, to thoroughly assess the implications of interest rates and deposit reserve ratios on real estate economic fluctuations. However, due to the relatively nascent state of China's financial market, limited investment avenues, and the high bank reserve ratio, further enhancements are warranted. Hence, future development should prioritize financial innovation, broaden investment opportunities, improve the deposit reserve system, and standardize the bank's financial product market to foster the stable and healthy growth of China's real estate economy [5].

3. Strategies to mitigate the influencing factors on real estate economic fluctuations

3.1. Uphold the principle of "housing for dwelling, not speculative investment"

In the face of considerable economic pressures, it is imperative to maintain the stance that housing should serve as a means of residence, not speculative investment. Real estate must not be utilized as a short-term stimulus for the economy but rather foster a healthy and stable development of the real estate market. Adherence to the "no speculation on housing" principle is essential to prevent abrupt surges or declines in housing prices, thus restoring rationality to the real estate market [6].

(1) Enhance regulation of the land market: Simultaneously with the "no speculation" principle, bolstering land market regulations stands as an important measure to stabilize the real estate market in the contemporary era. As various policies and measures are introduced, the Chinese government should exercise prudent land price management to stabilize land and housing prices, and curb excessive expectations. This can be accomplished by adjusting land auction prices, increasing land transfer fees, and regulating land supply quantities. Additionally, the government can mitigate rapid land price increases by elevating the approval threshold for real estate projects and augmenting the supply of residential land [7].

(2) Establish and refine real estate market supervision mechanisms: To ensure the sustained development of the real estate market, the Chinese government must institute and refine supervision mechanisms for the real estate sector, accompanied by the formulation of relevant laws and regulations. This approach entails robust supervision and management of real estate projects, stringent control of illicit activities, and continuous enhancement of the legal and regulatory framework within the real estate market. In parallel, overseeing local governments and regulatory departments is crucial to assess and supervise their activities.

(3) Develop rational tax policies: Taxation policies serve as an important instrument for mitigating fluctuations within the real estate economy. The Chinese government can strategically adjust the tax policy by increasing the proportion of residential and commercial real estate land in the tax policy. This helps stabilize the supply-demand dynamics within the real estate market and prevents abrupt surges in housing prices.

3.2. Optimize the land supply structure and advance housing system reforms

Land plays a pivotal role in real estate economic fluctuations, necessitating the strategic planning of land supply to meet the current market demands. The government has already implemented multiple policies and measures to enhance land supply, aligning land regulation and control, and increasing housing land supply. For instance, the central government issued the "Notice on Issues Related to Strengthening Land Regulation and Control" in 2017, increasing the supply of housing land from 400 hectares a year previously to 1,200 hectares a year; In 2019, the central government issued the "Guidelines on Further Promoting the Economical and Intensive Use of Land," stated that all localities are required to increase the economical and intensive use of land for urban industrial and mining construction, rural collective land for commercial construction and unused land, and incorporate it into the overall urban planning; In 2020, the central government issued the "Guidelines on Deepening the Reform of State-owned Enterprises," where local governments are required to adopt various ways to increase the use of urban construction land; In 2021, the central government issued the "Notice on Further Standardizing the Management of Income and Income of Land Transfer," stated that all localities are required to strengthen the management of land transfer revenues and expenditures.

The above policies and measures were implemented to mitigate the current real estate economic

fluctuations. However, certain issues remain, such as the imbalance in land supply structures and incomplete housing system reforms, which contribute to structural imbalances in China's real estate economic fluctuations. Therefore, policy adjustments and continuous optimization of the land supply structure are required to effectively control real estate economic fluctuations [7].

At present, housing system reform stands as one of the most fundamental strategies to mitigate real estate economic fluctuations. By increasing the price of commercial housing and accelerating the construction of affordable housing, the government can effectively moderate economic fluctuations in the real estate sector. The authorities must augment their support for indemnificatory housing construction while expediting the transformation from affordable housing to commercial housing, thus minimizing the impact on real estate economic fluctuations [8].

3.3. Enhance the regulation mechanism of the real estate market

As the market mechanism evolves, the government should actively exercise its macroeconomic control function. When the housing market experiences fluctuate, corresponding measures should be deployed for regulation. While regulating, the government should continually refine the market mechanism to avoid ineffective or excessive intervention. This entails the enhancement of land policies to determine land prices systematically, vigilance in overseeing housing credit policies to prevent real estate credit bubbles, and the effective utilization of tax policies to strictly curb speculative purchases and prevent market overheating [9].

4. Conclusion

To sum up, numerous factors impact the fluctuations in China's real estate economy, necessitating a thorough analysis and summation of these influencing factors. To ensure the stable progression of the real estate economy, it is imperative to consistently refine pertinent policies, optimize the operational environment for the real estate sector, and devise well-informed macroeconomics control policies that align with the industry's evolution and dynamics. As China's market economic system continually evolves, the real estate industry undergoes continuous development. The challenge at hand is to craft macroeconomic control policies that are harmonized with the current state and trajectory of China's real estate industry. This represents a collective endeavor for all relevant departments, and success in this regard is essential to drive the healthy and stable development of China's real estate sector, thereby contributing to the high-quality growth of the national economy.

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Research on the Development of Green Hotels in the Context of Low Carbon Tourism

Ze Hui Fan[1]*, Fang Huang[1], Jiang Tao Li[2]

[1]Guangdong Eco-Engineering Polytechnic, Guangzhou 510520, Guangdong Province, China
[2]Shenzhen No.7 Senior High School, Shenzhen 518104, Guangdong Province, China

Corresponding author: Ze Hui Fan, 995421087@qq.com

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Abstract: With the continuous implementation of national measures related to carbon neutrality strategy, the concept of a low-carbon economy has been deeply rooted in people's hearts. Low-carbon tourism has gradually become an inevitable trend, and the tourism industry is also undergoing orderly transformation and upgrading. To promote the sustainable development of the tourism industry, the tourism and hotel industry should also shift towards a low-carbon and green model. Hotel activities can easily bring related environmental issues, such as energy consumption, garbage generation, ecological pollution, etc. Therefore, building a green hotel will bring huge social and economic benefits to the low-carbon tourism industry. This article will address the above issues and take a low-carbon economy as the starting point, proposing sustainable development strategies and suggestions for green hotels from both the internal and external environment of the hotel, creating a low-carbon management atmosphere, and promoting the low-carbon operation of the green hotel industry.

Keywords: Low carbon tourism; Green hotels; Sustainable development

Online publication: October 20, 2023

1. Introduction

In the history of human development, the industrial revolution has driven the development of the world, gradually increasing the size of the economy, but also causing great damage to the ecological environment. A series of issues such as glacier melting, sea level rise, and temperature increase have attracted widespread attention worldwide. In 1988, the Intergovernmental Panel on Climate Change (IPCC) was officially established. In 2003, the UK first proposed the concept of low-carbon, and in 2009, Denmark held the United Nations Climate Change Conference in Copenhagen. In 2015, 195 country representatives reached the Paris Agreement, promising to work towards net zero emissions. China deeply understands the significant impact of carbon emissions on the ecological environment, and therefore the Chinese government is taking multiple measures to reduce carbon emissions.

The tourism industry was once considered a "green industry," but now it also faces the problem of how to deal with high carbon emissions. As an important pillar of the tourism industry, the hotel industry accounts for about 19% of the total carbon emissions of the tourism industry, becoming the second largest carbon-

emitting energy source. Therefore, the concept of green hotels has emerged. Green hotels will be committed to developing low-carbon and environmentally friendly models, promoting energy conservation and emission reduction, and promoting sustainable development of hotels [1].

2. Explanation of relevant concepts

2.1. Sustainable development

In the 1980s, the concept of "sustainable development" was first proposed in the World Nature Conservation Outline, and the emergence of this concept allowed society to realize the importance of sustainable development. Sustainable development encompasses a multifaceted approach, requiring not only stable economic development but also environmental protection and long-term development, while also meeting the current self-development needs. Sustainable development is a fundamental requirement of scientific development and a forward-looking concept. The development of the economy and society should be based on the premise of safeguarding natural resources and the environment. It is imperative to steadfastly reject the exclusive pursuit of short-term gains while neglecting long-term consequences. Economic development and environmental protection ought to be seen as complementary and interdependent [2].

2.2. Low carbon tourism

Low carbon refers to lower carbon dioxide emissions in social production processes. Researchers have applied low-carbon technology to various fields, such as low-carbon communities, low-carbon culture, low-carbon art, low-carbon tourism, low-carbon economy, etc. Among them, low-carbon tourism is an important content [3]. Low-carbon tourism is not only a form of tourism but also an important way to promote the development of green industries. Economic prosperity and technological development have brought certain negative impacts to the ecological environment, so it is very necessary to promote the awakening of low-carbon concepts among all tourists, residents, and staff.

2.3. Green hotels

2.3.1. Definition of green hotels

At present, there is no universally accepted definition of "green hotels." However, green hotels can be associated with the concepts of sustainable development. For example, in the operation process of green hotels, they will adhere to a responsible attitude towards the environment, make reasonable use of resources, protect the ecological environment, and pursue economic benefits while also pursuing ecological benefits. Green hotels should not only conform to the regional economic development status, but also utilize natural resources reasonably, save electricity, water, and energy, and slow down resource depletion based on the ecological environment's affordability.

2.3.2. Concepts of green hotels

Green hotels adhere to the three core concepts of "safety, health, and environmental protection." The principle of "safety" places a strong emphasis on public safety, fire safety, and food safety throughout the hotel's production and operation processes. Additionally, hotels are expected to have facilities in place to ensure public safety and implement food safety assurance systems. Health concerns are centered on maintaining hygiene in operations and providing eco-friendly dining options, ensuring that guests enjoy a healthy diet during their stay and have access to products that promote both physical and mental well-being. Environmental protection refers to the reduction of energy consumption and the treatment of pollution sources, as well as energy conservation

and emission reduction.

2.3.3. Standards for green hotels

The industry standard "Regulations on the Rating of Green Hotels" (SB/T 10356-2002) proposed by the China Hotel Association and formulated by the State Economic and Trade Commission stipulates that in international practice, green hotels are divided into five levels, namely A, AA, AAA, AAAA, and AAAAA, with AAAAA being the highest level (Table 1).

Table 1. Classification of green hotels

Level	Environmental impact
A	The hotel complies with national laws and regulations on environmental protection, health, and safety, and has begun to implement some measures to improve the environment.
AA	The hotel has achieved preliminary results in providing green services to consumers.
AAA	The hotel has made effective progress in achieving ecological benefits through continuous efforts and is in a leading position in the hotel industry in the region.
AAAA	The hotel's services and facilities are in a leading position in improving ecological efficiency in China and are highly recognized by society.
AAAAA	The hotel's services and facilities are in a highly leading position in improving ecological efficiency, and various measures have been widely adopted and imitated by hotels both domestically and internationally

3. Analysis of the current green hotel development status in China

3.1. Key challenges

3.1.1. Ambiguity in grasping the green hotel concepts

Certain hotels lack a comprehensive understanding of green development. While they may promote themselves as green hotels, their actual operations often do not significantly differ from those of ordinary hotels. It is vital to recognize that being a green hotel extends beyond mere cost-cutting; it also involves the incorporation of advanced energy-saving technologies and green architectural design. The concept of green hotels goes beyond just adding more plants to lobbies and guest rooms; it encompasses an integral approach that encompasses hotel design, management, technical implementation, guidance, and promotion [4,5].

3.1.2. Insufficient emphasis on green awareness

When hotel operators lack a strong commitment to green practices and prioritize efficiency over green ideals, they often fail to instill green principles or cultivate employees' environmental consciousness in their hotel management work. Even when some efforts are made in this regard, they tend to be superficial. Employees without proper green guidance and a weak sense of environmental awareness cannot fully grasp the importance of green initiatives, let alone effectively guide customers and consumers to support the hotel's green measures.

3.1.3. Suboptimal utilization of energy-saving technology

Although some hotels have introduced energy-saving technology and related equipment into their green development strategies, many still struggle to maximize the utilization rate of these technologies. This may be due to the immaturity of the technology, hindering the seamless integration of energy-saving equipment. Additionally, the cost of acquiring and operating this equipment can be prohibitively high, and the equipment's efficiency may be subpar, resulting in less-than-optimal outcomes [6].

3.1.4. Limited scalability

Green hotels represent only a small fraction of the overall hotel industry, primarily due to issues such as inadequate funding, insufficient awareness of green practices, and other factors. Many hotels continue to adhere to traditional concepts that do not align with modern green business models. Their management goals often prioritize economic gains as the sole goal, rather than embracing green management principles.

3.2. Key factors contributing to these challenges

3.2.1. Lack of guidance for green awareness

The hotel industry has traditionally held a passive stance on green management, with inadequate understanding of green hotel concepts. The implementation of green management practices in hotels often lacks vigor. Many senior hotel leaders prioritize the hotel's economic gains as their sole goal, viewing green management as excessively resource-intensive, leading to heightened financial costs and diminished economic returns. Moreover, a substantial number of consumers fail to grasp the significance of green hotels, resulting in significant dissatisfaction with hotels' green management measures, sparking a series of complaints. These consumer attitudes and behaviors also act as obstacles to the widespread adoption and implementation of green management practices in hotels.

3.2.2. Environmental pollution increases green costs and reduces service quality

The tourism industry is rife with pollutants and pollution sources, including wastewater from laundry, domestic sewage, noxious gases, plastic bags, disposable consumables, and more [7]. A typical hotel of a significant size can discharge at least 100,000 tons of harmful sewage per year, about 30 tons of sulfur dioxide, about 50 kilograms of smoke and dust, and about 3,100 tons of carbon dioxide into the air, which all these detrimentally affect the ecological environment. Therefore, the prevention and treatment of various pollution forms and waste in green hotels incur significant costs, leading to the indirect transfer of these expenses to customers. This can result in diminished customer loyalty and hotel occupancy rates. As a result, hotel operators may have a certain ambivalent attitude towards green management measures.

3.2.3. Insufficient investment in equipment and technology

Green facilities and equipment within hotels are often outdated, with low technological sophistication, impacting production efficiency, especially when financial resources are limited. Outdated technology and inadequate equipment can also contribute to significant environmental damage. The physical structures of green hotels demand more sophisticated architectural design to minimize energy consumption, covering lighting, cooling, heating, and energy consumption in kitchens and bathrooms. Poor architectural design can lead to increased energy consumption and have an adverse environmental impact.

3.2.4. Lack of government policies

In a society where the government takes a leading role, proactive government guidance and comprehensive promotion are pivotal for the advancement of green hotels. Government support holds an important place in this context. However, existing laws and regulations related to environmental protection are not yet comprehensive, lacking details, stringency, and effective enforcement. Legal support and policy guidance are unclear, and detailed regulations governing incentives and penalties are absent. This has resulted in low enthusiasm among hotel operators for the implementation of green management measures.

4. Strategies and recommendations for advancing the sustainable development of green hotels

While many green hotels have made significant strides in their development, they still grapple with various challenges. In response to these issues, pertinent strategies are proposed in this paper to foster the sustainable development of green hotels [8].

4.1. Hotel interior

4.1.1. Enhance monitoring and management of green hotels

Hotels should institute a more comprehensive green energy management system, execute efficient energy conservation management, collect data from various departments, and meticulously analyze it to improve energy auditing. This, in turn, will facilitate a more in-depth analysis of green operating systems, encompassing aspects such as the fresh air system, indoor temperature control system, and low-carbon development management system. Hotels must implement refined management practices, including double-sided use of office paper, turning off lights and air conditioning when unoccupied, reducing standby time for fax machines and computers, and promptly shutting down office equipment. In the realm of green development, the goal should be to accumulate incremental changes and engage in meticulous operational management.

4.1.2. Energy allocation and utilization

The rational use of energy plays a crucial role in hotel operations, and green hotels should increase the proportion of renewable resources used to reduce carbon emissions. The type of energy used plays an important role in carbon emissions. For instance, green hotels can harness renewable energy sources such as solar energy to store heat in the underground water layers for winter heating. Rainwater can be collected and reused, wind energy can be harnessed, all contributing to substantial reductions in carbon emissions.

4.1.3. Training for green hotel professionals

Professionals are indispensable to the development of green hotels. While energy-saving equipment and materials form the foundation, individuals possessing expertise in green hotel management are the backbone. Professionals in the realm of green hotels should embody the concept of green hotel design, possess an understanding of relevant low-carbon equipment, and be adept at guiding customers to comprehend and support green hotel management initiatives.

4.1.4. Strengthen green design

At the outset of a green hotel's design, the importance of incorporating eco-friendly design should be underscored. Rational green hotel design is crucial for long-term interests. Committed adherence to green energy-saving standards in technical applications, along with explicit planning for the proportion of renewable energy utilization, is essential. Furthermore, environmentally friendly and energy-efficient equipment should be employed, and efforts should be made to recycle waste heat wherever feasible [9].

4.2. Hotel exterior

4.2.1. Cultivate green awareness among customers

Integrating green management principles into the hotel's corporate culture is essential. Energy-saving guidelines and green promotion should be included in promotional materials. Regular training in low-carbon and environmental preservation should be provided to hotel staff. Encouraging consumer engagement in the hotel's green initiatives is crucial to helping customers gain a tangible understanding of green practices and

their significance. Special activities can be organized to encourage customer participation in low-carbon and green consumption.

4.2.2. Enhance promotion of green hotels

The use of modern and traditional media can be harnessed to create documentaries promoting green hotels. Social media platforms such as WeChat official accounts, TikTok, and other apps can be utilized to disseminate information about green hotels and low-carbon environmental protection. Inviting online influencers to endorse green hotels can boost their popularity. Through comprehensive publicity, green hotels can increase their visibility, which is beneficial for sustainable development.

4.2.3. Establish a green hotel communication platform

Creating a network of green hotel associations can serve as a bridge between hotels and governmental bodies. These associations can provide a communication platform for green hotels, facilitating inter-hotel communication, dismantling information barriers, advocating for green technology in the hotel industry, and helping governments devise supportive policies for green hotels [10].

5. Conclusion

This article takes the background of low-carbon tourism as the entry point, comprehensively reviews the relevant concepts and development status of green hotels, and elaborates on the level of standards and problems faced by green hotels. Furthermore, it offers a range of strategies and suggestions aimed at advancing the sustainable progression of green hotels. This encompasses enhancing the oversight and administration of green hotels, optimizing energy allocation and consumption, nurturing skilled personnel with expertise in green hotel management, and fortifying green design principles. It also emphasizes the importance of instilling eco-friendly principles among customers beyond the hotel's premises, intensifying the promotion of green hotels, and constructing a communication platform for green hotel stakeholders. In the context of low-carbon tourism, it is extremely important to improve the quality and development of green hotels. Green hotels should actively propagate low-carbon concepts to achieve an elevation in the quality of their eco-friendly services.

Disclosure statement

The authors declare no conflict of interest.

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Research on the Relationship Between Human Resource Management and Corporate Environmental Responsibility

Zhenbing Yu*

Nanjing Tech University Pujiang Institute, Nanjing 211200, Jiangsu Province, China

***Corresponding author:** Zhenbing Yu, 85610438@qq.com

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Abstract: The significance of human resource management in enterprise management is steadily growing, especially as businesses today are expected to shoulder their share of social responsibility. Among these responsibilities, corporate environmental responsibility assumes a pivotal role. This paper aims to investigate the interplay between human resource management practices and corporate environmental responsibility. The study employs various factors of human resource management practices as independent variables, using the current environmental status quo and environmental innovation capacity as intermediary variables, and adopts multiple regression analysis to scrutinize the influencing factors of corporate environmental responsibility. The findings underscore that when the working environment is favorable, enterprise human resource management practices can effectively enhance corporate environmental responsibility. Furthermore, when supported by environmentally responsible behavior, these human resources practices exhibit a positive influence on a company's environmental responsibility. Consequently, this study provides practical recommendations for enhancing corporate environmental responsibility.

Keywords: Human resource management; Corporate environmental responsibility; Employee

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1. Introduction

In today's world, global consensus is primarily achieved when addressing environmental issues, with a particular emphasis on the double carbon economy. The pervasive impact of these issues on all aspects of human activity has made them a top concern for everyone. This section aims to provide a theoretical framework for environmental strategy, encompassing its development and the incorporation of environmentally friendly elements into human resource management (HRM) operations and economic considerations [1]. Consequently, HR procedures play a crucial role in the development of sustainable businesses. Sustainable growth introduces a framework that combines environmental regulations and development plans, with the dual objectives of promoting economic advancement while preserving environmental quality, as recognized by the United Nations General Assembly.

1.1. Literature review

According to Shafaei et al. (2020), business enterprises have frequently been at the center of sustainability discussions and are considered a major contributor to ecological challenges on local, regional, and global scales [2]. Consequently, corporations are expected to play a vital role in addressing environmental issues. Beyond merely obtaining social approval to operate, stakeholders are increasingly pressuring corporations to take a proactive stance on ecological concerns and acknowledge their responsibility for their ecological footprint, ensuring the needs and aspirations of future generations are met. Achieving environmental sustainability requires companies to go beyond mere compliance and embrace a more strategic approach [2].

China and Malaysia, both typical developing countries experiencing rapid industrialization, are also grappling with environmental concerns [3]. Drawing from the theory and empirical research of green HRM in China, this paper delves into the development of green human resource theory in China. Zhang (2022) discussed the concept of HR and its application in crucial areas such as recruitment, staff training, and performance management. The paper presented recommendations aimed at facilitating the sustainable development of businesses and fostering harmonious coexistence with ecosystems, offering valuable insights [4].

1.2. Theories

This section elucidates the fundamental theories underpinning HRM systems and practices within organizations. Numerous scholars have sought to define the principles of HRM, and achieving sustainable HR practices is a complex process reliant on managing external organizational constraints, the efficiency of sustainable resources, empowering individuals, and shaping employee behavior towards environmental conservation. Therefore, it is crucial to explore the theoretical foundations of HRM, which include key HR theories, prior to devising an HRM model for the organizations. Prominent HR theories that have been employed to formulate HRM models in various sectors encompass theories such as organizational behavior, resource-based, institutional theory, ability, motivation, opportunity, and others.

Emphasizing organizational behavior helps elucidate how specific behaviors influence employee productivity and motivation, in addition to understanding how different policies impact HRM. Rehman *et al.* (2021) investigated the connections underlying knowledge-oriented administration [5], whereas Gim *et al.* (2021) explored the interplay between HRM, leadership-members exchange (LME), core evaluations of self (CES), workplace engagement, and HRM performance inferences. They focused on theories of attribution and the preservation of resources to uncover these relationships [6].

2. Variables and models related to the study

2.1. Variables

Yusoff (2018) discussed a set of HR practices that prioritize productivity through green approaches, including recruitment, training, engagement, and green performance management and compensation [7]. Joyce and Vijai (2020) reported that green HRM practices involve enhancing employees' eco-friendly skills through training, encouraging the use of green performance management, and offering environmentally conscious opportunities through employee participation [8]. Malaysia's hotel industry demonstrates better environmental performance through the application of green HRM practices, such as green recruitment and selection, training and development, performance evaluation, and compensation. This enhances the environmental performance of the company as a response to competitive pressures and the need for environmental compliance [2,8]. Aboramadan (2020) empirically examined the effects of HRM on environmental performance in postsecondary education, treating HRM practices as an independent variable and environmental performance as a dependent

variable. The study revealed strong associations between independent and dependent variables based on data from 208 individuals working in higher education institutions in Palestine [9]. Ojo *et al*. (2020) empirically investigated the contribution of HRM tasks and processes to environmental performance in the information technology sector, using environmental performance as the dependent variable and HRM practices as an independent variable. The study involved 333 IT professionals working for Malaysian companies. It employed the resource-based view (RBV) and partial least squares structural equation modeling (PLS-SEM) approaches to show how HRM practices serve as organizational resources that promote environmentally conscious IT attitudes and achievements [10]. Kar and Praharaj (2020) discussed various green human resources practices and a few initiatives, as well as suggested a few prolific HR initiatives for green organizations [11]. On the other hand, Duric and Topler (2021) offered an insight into, and analysis of, performance and indicators of the environmental sustainability of hotels through relevant literature [12].

2.2. Models

Various hypotheses can be formulated based on the examination of mediation factors and the relationships between variables, as seen in **Figure 1.**

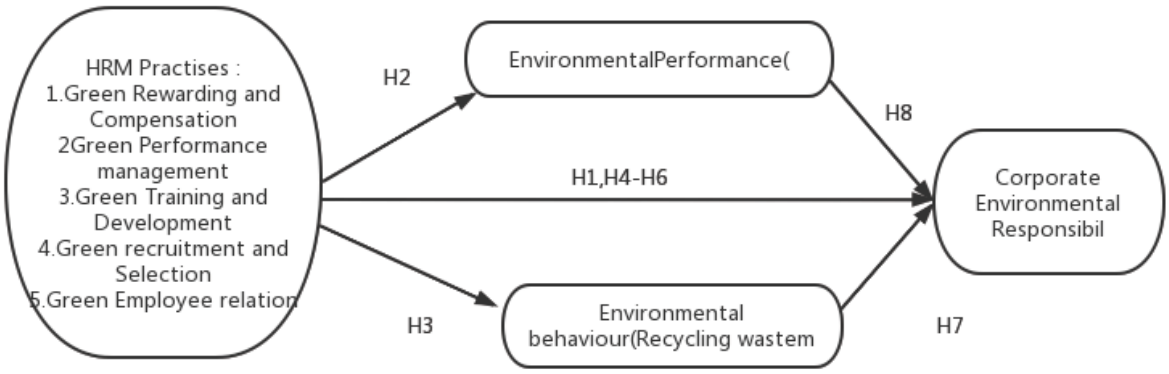

Figure 1. Research models

(1) Hypothesis 1 (H1): The relationship between HRM and sustainable performance can be mediated through environmental performance.
(2) Hypothesis 2 (H2): Green behavior among employees acts as a mediator between HRM procedures and sustainable performance.
(3) Hypothesis 3 (H3): Environmental performance and green HRM practices are related through the mediation of green innovation.
(4) Hypothesis 4 (H4): Green recruitment and selection practices are positively associated with environmental performance.
(5) Hypothesis 5 (H5): Green training and development and environmental performance have a positive relationship.
(6) Hypothesis 6 (H6): Green rewards and compensation are positively associated with environmental performance.
(7) Hypothesis 7 (H7): Environmental performance and green performance evaluation are positively associated.
(8) Hypothesis 8 (H8): Environmental performance and green innovation are closely related.

2.3. Multiple regression

In multiple regression analysis (MRM), each independent variable is examined separately, allowing each to have a unique coefficient that represents its relationship with the dependent variable. Using coefficients such as the coefficient of determination and the significance level, MRM helps explain the direction and magnitude of the associations observed between the study variables.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e \quad (1)$$

Here, Y is the environmental sustainability, $\{\beta_i, i=1,2,3,4\}$ is the coefficients for independent variables, X_1 is the green recruitment, X_2 is the green training and development, X_3 is the green reward and compensation, X_4 is the green performance, and e is the error term. The coefficients β_1, β_2, β_3 and β_4 indicate the degree of influence of independent variables on the variation in the dependent variable (Y). The intercept β_0 represents the minimal effect on the dependent variable when assuming all other variables have no effect. The independent variables X_1, X_2, X_3 and X_4 contribute to the error term e in the model, which accounts for any inexplicable changes.

3. Data sources

3.1. Data survey

A comprehensive research instrument consisting of 54 statements and 5 demographic variables was meticulously designed to gauge employees' perceptions of environmentally sustainable HRM practices. The questionnaire was developed following an extensive review of relevant literature and is structured into three sections, along with an introductory preface. The preface served to acknowledge the respondents and provided a brief overview of the study and instrument used.

The survey section of this study delineates the sampling design, the population, the sample frame, and the sampling techniques employed to determine the sample size of respondents. The survey encompassed several sectors, including Automobile, Electronics, Plastic, and Food.

3.2. Reliability tes

Before employing the research instrument in the actual study, a test-retest procedure was applied to assess its validity (**Table 1**).

Table 1. Reliability test

	Human resource management (HRM) practices	Enterprise environmental responsibility
Cronbach's α	0.98	0.92
Number of items	4	44

The Cronbach's α coefficient for HRM practices was found to be 0.98, indicating a high degree of internal consistency. This scale includes four items. The Cronbach's α coefficient for enterprise environmental responsibility was 0.92, suggesting a robust level of internal consistency. Reliability coefficients between 0.6 and 0.7 are considered acceptable, while values of 0.8 or higher indicate very good reliability. In this case, both HRM and enterprise environmental responsibility exhibit reliability well above 0.90.

3.3. Data analysis

3.3.1. Demographic statistical analysis

The demographic data analysis includes an examination of the age distribution of the population working in

the four industries. The data is summarized in **Table 2**, which displays the percentages and frequencies for five different age groups.

Table 2. Frequency table of age

	Frequency	Percent
18 to 25	46	17.0
26 to 35	87	32.1
36 to 45	71	26.2
46 to 55	39	14.4
56 to 70	28	10.3
Total	271	100.0

Among the 271 participants in the study, the majority of the participants fall within the "26 to 35" age group, representing 32.1% of the total population, followed by 71 aged 36–45 (26.2%), 46 aged 18–25 (17%), 39 aged 46–55 (14.4%), and 28 aged 56–70 (10.3%).

Moreover, the demographic data also reveals the gender distribution among the participants. Of the 271 total participants, 170 are male, while 101 are female, accounting for 62.7% and 37.3%, respectively, as indicated in **Table 3**.

Table 3. Frequency table of gender

	Frequency	Percent
Male	170	62.7
Female	101	37.3
Total	271	100.0

3.3.2. Descriptive analysis

In **Table 4**, the analysis of the relationship between HRM and corporate environmental responsibility reveals several statistics. A scatter plot in **Figure 2** indicates a strong positive relationship between HRM and corporate environmental responsibility.

Table 4. Descriptive statistics of HRM and corporate environmental responsibility

	HRM	Corporate environmental responsibility
Min	3	3.10
Max	5	4.64
Range	2	1.55
Mean	3.93	3.97
Variance	0.49	0.17
Standard deviation	0.69	0.41
Skewness	0.06	-0.36
Kurtosis	-1.06	-1.07

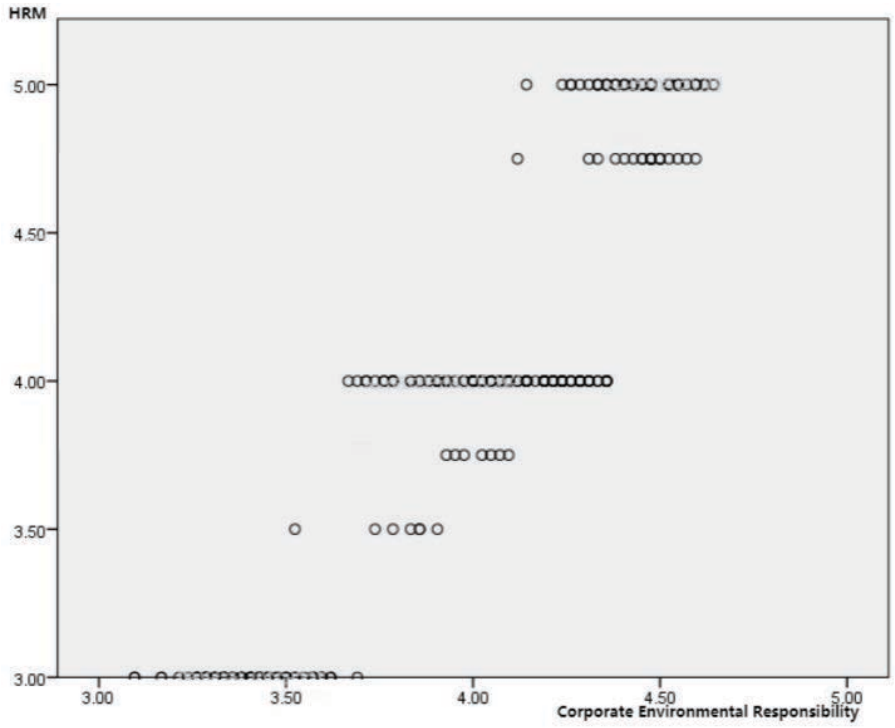

Figure 2. Scatter plot between HRM and corporate environmental responsibility

3.4. Regression analysis

Multiple regression analysis of the data is presented in **Table 5**. In this analysis, corporate environmental responsibility is the dependent variable, while HRM serves as the predictor or explanatory variable. The regression model is employed to investigate the relationship between corporate environmental responsibility and HRM and to assess how corporate environmental responsibility is affected by HRM. **Table 5** includes a regression summary, which reports the strength of the correlation between the model and the predictor variable.

Table 5. Regression summary

R^2	Standard error of the estimate
0.863	0.16454

Variable coefficient analysis is detailed in **Table 6**. This table provides information about the regression coefficients, which statistically quantify the overall operational relationship between variables. Notably, the constant coefficient is 1.86, and its significance level indicates that the constant is a significant predictor of corporate environmental responsibility. The HRM coefficient is 0.541 with a standard error of 0.01, signifying that HRM significantly predicts corporate environmental responsibility. Additionally, the positive HRM coefficient suggests a positive relationship between HRM and corporate environmental responsibility, indicating that an increase in HRM corresponds to an increase in corporate environmental responsibility. In specific terms, a one-unit increase in HRM is associated with a 0.54-unit increase in corporate environmental responsibility.

Table 6. Coefficients

	Unstandardized coefficients		Standardized coefficients	*t*	*p*-value
	B	Standard error	β		
Constant	1.864	0.055		33.546	0.000
HRM	0.531	0.012	0.929	37.927	0.000

4. Discussion

4.1. Government-level initiatives

To promote the adoption of green human resource management, governments must improve environmental protection laws and regulations, bolster monitoring and subsidies for environmental pollution control, and serve as a catalyst for companies to implement green HR practices. For instance, companies should bear the responsibility and costs of pollution control and management of their pollution sources. In cases where pollution leads to damage, compensation for losses should be provided, along with the obligation to rectify the pollution's consequences. The introduction of mechanisms such as sewage charges and tax incentives can be leveraged to tighten the oversight and penalties for entities contributing to pollution. This, in turn, can encourage enterprises to upgrade their technology and intensify their focus on green HR management, fostering environmental awareness among all employees. Furthermore, financial incentives and tax benefits can be extended to enterprises exhibiting exemplary performance in environmental protection and green initiatives.

4.2. Prioritizing environmental awareness in recruitment

In the practice of HRM, it is crucial to assess the environmental responsibility of individuals during the recruitment process. Emphasizing green recruitment not only allows for the identification and retention of candidates well-versed in environmental conservation but also facilitates the integration of environmental responsibility within the enterprise. Moreover, candidates with heightened environmental consciousness often exhibit higher overall qualities. Research has indicated that individuals with higher education backgrounds tend to display greater social responsibility during their tenure with a company. Additionally, an improved working environment has been observed to enhance an employee's sense of social and environmental responsibility. To bolster corporate social and environmental responsibility, it is necessary to improve the working conditions of employees.

4.3. Non-financial incentives for employees

Previous studies have highlighted the effectiveness of organizations in enhancing environmental performance through the provision of various non-financial rewards, such as commendations, promotions, career advancement, cash bonuses, gifts, and a diverse range of incentives. Diversified welfare policies can be developed to motivate environmentally responsible behavior among employees. For example, offering incentives for green commuting can encourage employees to reduce their carbon footprint and elevate their environmental awareness. Recognizing green patents, eco-friendly improvement proposals, or outstanding project teams and employees during annual meetings can foster a positive organizational culture and reinforce a sense of pride and mission. Acknowledging employees for their exceptional green performance in company publications leads to a sense of accomplishment among colleagues and serves as a more effective influencing factor for ecological initiatives.

4.4. Facilitating employee green engagement

Green participation entails providing employees with the opportunity to actively engage in environmental management. This extensive green engagement encompasses engagement, support culture, and tacit knowledge and is designed to instill commitments to the organization's environmental initiatives. Companies can increase the involvement of employees in environmental decision-making processes, granting them more opportunities to contribute to environmental protection efforts.

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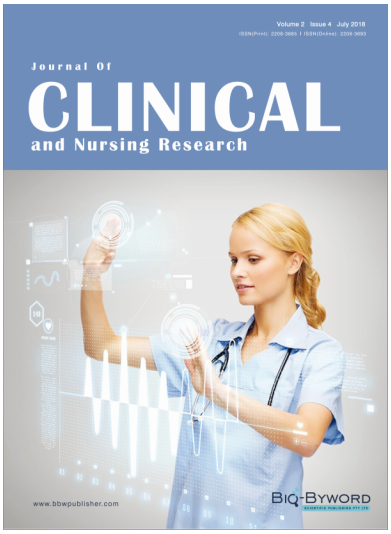

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