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Research on the Construction of a Resilient Governance Mechanism for the Human Resources System in Liaoning Province in the Context of the Digital Economy

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Abstract: Against the backdrop of the digital economy profoundly reshaping the operational logic of regional human resource systems, the resilience of human resource systems has become a core indicator for measuring a region's risk-resistance capabilities and sustainable development potential. This paper focuses on Liaoning Province, aiming to establish a resilience governance mechanism for the human resources system that aligns with the characteristics of the digital economy. By integrating system resilience theory with a human resources management perspective, the paper defines core concepts and analyzes the underlying mechanisms linking the digital economy to human resources system resilience. It then identifies key challenges in resilience-building, such as insufficient digital skill supply and unclear responsibilities among governance entities, based on the current state of Liaoning Province's human resources system and the impact of the digital economy. Based on this, the paper proposes a "multi-stakeholder collaboration + dynamic response" governance mechanism, including core mechanisms such as digitally enabled dynamic monitoring and early warning, and multi-stakeholder collaborative governance, and provides targeted policy recommendations. The research offers theoretical and practical references for enhancing the resilience of Liaoning Province's human resources system and formulating precise human resources strategies.

1. Introduction

The rapid development of the digital economy is profoundly reshaping the operational logic of regional human resource systems. The impacts of technological substitution, employment structure transformation, and upgrading of skill requirements have significantly increased the uncertainty facing regional development [1]. Against this backdrop, the resilience of human resource systems, as a core indicator for measuring regional risk resistance and sustainable development potential, is of strategic significance for Liaoning Province in breaking through industrial transformation bottlenecks and achieving high-quality economic development. While existing research has already examined the

interactive relationship between the digital economy and human resources, there remain shortcomings in the systematic construction of resilience evaluation indicators and the collaborative design of governance mechanisms, particularly lacking empirical exploration tailored to the specific conditions of Liaoning Province.

This paper integrates system resilience theory with the perspective of human resources management to construct an analytical framework for assessing the resilience of regional human resources systems under the digital economy, thereby enriching the theoretical framework of the field. It also designs operational evaluation tools and governance schemes to provide decision-making references for Liaoning Province in formulating precise human resources strategies.

Current research both domestically and internationally indicates that studies on the impact of the digital economy on the labor market have formed an analytical framework of "technology-driven—structural transformation—policy response". Methods for evaluating system resilience have evolved from single-dimensional vulnerability assessments to multi-dimensional dynamic measurements [2], and regional human resource governance models are also showing a trend toward a transition from "government-led—multi-stakeholder collaboration" [3]. However, research specifically targeting the unique characteristics of the northeastern region's old industrial bases remains insufficient.

Based on this, this paper adopts a research approach of "theoretical construction—evaluation system design—governance mechanism optimization," comprehensively employing literature review, Delphi method, analytic hierarchy process, and case analysis methods, aiming to produce research outcomes that combine theoretical depth with practical value. The core innovations of this paper include: first, the construction of a four-dimensional evaluation indicator system integrating the characteristics of the digital economy, namely "resilience—recovery—adaptability—transformation"; second, the proposal of a governance mechanism suitable for Liaoning Province, namely "multi-stakeholder collaboration + dynamic response."

2. Theoretical Basis and Conceptual Definition

2.1. Definition of Core Concepts

The digital economy is a new economic model that uses data resources as a key production factor, modern information networks as its primary medium, and the integration and application of information and communication technologies and the digital transformation of all elements as important driving forces to promote greater unity between fairness and efficiency. It is characterized by strong penetrability, high integration, and rapid innovation. By driving transformations in production methods, lifestyles, and governance models, it exerts a profound influence on regional economies, enhancing production efficiency and optimizing resource allocation while fostering new industries, business models, and operational paradigms, thereby reshaping the competitive landscape of regional economies.

The human resources system is an organic whole composed of elements such as the supply, demand, allocation, and development of labor within a region. Its constituent elements include the quantity, quality, structure (age, education level, skills, etc.), employment status of the labor force, as well as the efficiency of human resources allocation, mobility, and development mechanisms. This system is open, constantly exchanging personnel, information, and resources with the external environment; it is dynamic, evolving with socio-economic development; it is interconnected, with various elements within the system influencing and interacting with one another to maintain its stable operation.

System resilience, in the context of the human resources system, refers to the system's ability to withstand internal and external shocks (such as technological changes, economic fluctuations, and sudden events), maintain its basic functions without interruption, quickly return to a stable state after

a shock, and adapt to new environments by adjusting its structure and functions, or even achieve transformation and upgrading [4]. From the perspective of the four stages of "resistance - recovery - adaptation - transformation," resistance refers to the system's ability to withstand shocks; recovery refers to the system's ability to return to its original state after suffering a shock; adaptation refers to the system's ability to adjust itself to adapt to the new environment brought about by the shock; and transformation refers to the system's ability to achieve structural and functional upgrades under sustained shocks and move toward a higher-level state.

2.2. The Mechanism Linking the Digital Economy and the Resilience of Human Resource Systems

Digital technology has a dual impact on the resilience of human resource systems. On the one hand, digital technology can improve the efficiency of skill matching by using big data, artificial intelligence, and other technologies to accurately analyze and match supply and demand information in the labor market, reducing information asymmetry and enabling workers to find suitable jobs more quickly, thereby enhancing the system's adaptability and resilience [5]. On the other hand, the development of digital technology also brings structural unemployment risks. Some traditional jobs are disappearing due to technological substitution, leading to unemployment among some laborers. If laborers cannot promptly upgrade their skills to adapt to new job requirements, it will weaken the system's resistance and resilience.

The resilience of the human resources system plays a crucial supporting role in the development of the digital economy. A supply of highly skilled labor is the core driving force behind the development of the digital economy. Talent with digital skills and innovative capabilities can drive the research, development, and application of digital technologies, thereby promoting the growth of the digital industry. Additionally, a human resources system with strong resilience can swiftly adapt to changes brought by the digital economy, providing a stable talent pool to support continuous innovation in the digital economy and thereby driving its sustained growth and expansion.

2.3. Theoretical Framework for Evaluating and Governing the Resilience of Human Resource Systems

The evaluation dimensions are based on a four-dimensional evaluation logic of "resistance - resilience - adaptability - transform ability." Resistance evaluation focuses on the system's ability to defend itself against shocks, including the skill level of the workforce and the completeness of the social security system. Resilience evaluation emphasizes the system's recovery speed and effectiveness after an impact, such as the efficiency of re-employment training and the implementation effectiveness of employment assistance policies; Adaptability evaluation assesses the system's ability to adapt to new environments, such as the transfer of labor to emerging industries and enterprises' capacity to adjust human resources; Transformation capability evaluation focuses on the system's long-term development potential, such as the education system's ability to cultivate digital skills talent and the enhancement of talent innovation capabilities through industry-academia-research collaboration.

The governance logic follows a closed-loop governance approach of "risk identification - stakeholder collaboration - resource allocation - dynamic adjustment." Risk identification involves monitoring and analyzing internal and external risks faced by the human resources system to promptly identify factors that may affect the system's resilience; Stakeholder collaboration refers to the clarification of responsibilities and coordination among diverse stakeholders such as governments, enterprises, universities, and social organizations to jointly participate in the governance of human resources system resilience; Resource allocation involves reasonably distributing human, material,

and financial resources based on governance needs to ensure the effective implementation of governance measures; Dynamic adjustment involves promptly adjusting governance strategies and measures based on governance outcomes and environmental changes to form a continuous improvement governance closed-loop.

3. Analysis of the Current State of Resilience in Liaoning Province's Human Resources System and the Impact of the Digital Economy

3.1. Basic Characteristics of the Human Resources System in Liaoning Province

In terms of labor force size and structure, Liaoning Province, as an old industrial base, has relatively abundant labor resources. However, in recent years, it has faced the problem of an aging population, resulting in an older labor force age structure. In terms of educational attainment, while the proportion of highly educated labor has increased with rising education levels, it still lags behind that of more developed regions in eastern China. In terms of skill distribution, there is a relatively large number of traditional industrial skilled workers, while there is a shortage of digital skills and high-end R&D skilled workers.

In terms of human resources allocation efficiency, Liaoning Province's employment structure still has certain unreasonable aspects. The proportion of the population employed in the primary sector is relatively high, the proportion of employment in traditional manufacturing in the secondary sector is significant, and the proportion of employment in the tertiary sector, especially modern services, needs to be improved. Talent mobility is relatively low, with some talent flowing to eastern coastal regions due to regional economic development disparities, affecting the optimal allocation of human resources. The level of collaboration between industry, academia, and research is not sufficiently deep, with low rates of research from universities and research institutions, failing to fully leverage their role in promoting human resource development and economic growth.

From the perspective of historical resilience, Liaoning Province has achieved a certain degree of re-employment and transformation of the labor force through measures such as industrial upgrading and enterprise restructuring during the process of industrial transformation. However, the process has been challenging, and some workers in traditional industries face employment difficulties. In response to the impact of the pandemic, Liaoning Province has implemented a series of employment stabilization policies, such as distributing job retention subsidies and conducting online vocational training, which have helped the employment market gradually recover. However, the recovery speed and effectiveness lag behind those of economically developed regions.

3.2. The Current Status of Digital Economy Development in Liaoning Province and Its Impact on the Human Resources System

The scale of the digital economy in Liaoning Province continues to expand, and its penetration into various industries is gradually increasing. In the manufacturing sector, some large enterprises have achieved digital transformation and adopted technologies such as smart manufacturing and industrial internet to improve production efficiency. In the service sector, platform economy and e-commerce are developing rapidly, injecting new momentum into economic growth. However, compared to digitally advanced regions like the Yangtze River Delta and Pearl River Delta, Liaoning Province still has significant room for improvement in terms of the overall scale and industrial penetration depth of its digital economy.

The digital economy has had a positive impact on Liaoning Province's human resources system. On one hand, it has created new professions such as data analysts, artificial intelligence trainers, and e-commerce operations specialists, providing more employment opportunities for the workforce; on

the other hand, it has increased skill premiums, enabling workers with digital skills to secure higher salaries, thereby incentivizing workers to enhance their skill levels; simultaneously, digital technologies have optimized the efficiency of human resource allocation, enabling more precise matching between labor supply and demand.

However, the digital economy has also brought some negative impacts. Skill mismatches have intensified, as the market has a strong demand for digital skill talent, while the existing workforce lacks sufficient personnel with relevant skills, leading to a coexistence of job vacancies and labor unemployment. The replacement of traditional jobs is evident, with repetitive and low-skill positions being replaced by machines and algorithms, causing some workers to lose their jobs. Additionally, the regional talent drain effect is significant, with digital skill talent in Liaoning Province being attracted by higher salaries and better career prospects in economically developed regions, further exacerbating the talent shortage issue.

3.3. Core Challenges Facing the Resilience of Liaoning Province's Human Resources System

Based on an in-depth analysis of phased results, the resilience of Liaoning Province's human resources system faces numerous core challenges. There is a shortage of digital skills supply, with the digital-related majors offered by universities and vocational colleges not closely aligned with market demand, resulting in a shortage of talent to meet the needs of digital economic development. Additionally, the coverage and quality of digital skills training for employed personnel require improvement. The responsibilities and authorities of governance entities are unclear, with insufficiently defined roles for governments, enterprises, universities, and social organizations in the construction of human resources system resilience, and a lack of effective coordination mechanisms, leading to suboptimal governance outcomes. Dynamic response mechanisms are absent, with insufficiently timely monitoring of changes and shocks in the human resources market, and delays in the formulation and implementation of response measures, making it difficult to swiftly and effectively address various risks and challenges.

4. Designing a Resilience Governance Mechanism for the Human Resources System in Liaoning Province in the Context of the Digital Economy

4.1. Governance Objectives and Principles

The governance objective is to enhance the dynamic adaptability of Liaoning Province's human resources system and achieve a virtuous cycle of "resilience, innovation, and development." By establishing effective governance mechanisms, the human resources system will be better equipped to respond to the shocks and challenges brought about by the digital economy. While maintaining stable operations, it will continuously enhance its innovation capabilities to provide strong support for regional economic development.

The governance principles include multi-stakeholder collaboration, digital empowerment, targeted policies, and sustainability. Multi-stakeholder collaboration requires governments, businesses, universities, social organizations, and other entities to leverage their respective strengths, work closely together, and form a collective governance effort. Digital empowerment emphasizes the use of digital technology to enhance the efficiency and precision of governance, such as through big data for risk monitoring and talent matching. Targeted policies require the development of differentiated governance measures based on the actual circumstances of different regions and groups. Sustainability requires governance mechanisms to be long-term and adaptable to the long-term development needs of society and the economy.

4.2. Governance Entities and Responsibility Allocation

The government is responsible for policy formulation, public service provision, and cross-regional coordination in governance. It formulates laws, regulations, and policies that promote the resilience of the human resources system, such as talent cultivation policies and employment support policies; provides public services such as public employment services, vocational training, and social security; and strengthens cooperation and coordination with other regions to promote cross-regional talent mobility and resource sharing.

As market entities, enterprises are responsible for skill training, job matching, and data sharing. Based on their own development needs and the trends of digital economic development, they conduct targeted skill training for employees to enhance their digital skills and professional competence; adjust job settings to align job requirements with labor force skills; and actively participate in data sharing to provide data support for human resources market analysis and policy formulation.

Higher education institutions and research institutions primarily undertake tasks such as talent cultivation, technological research and development, and think tank support. They optimize their academic programs based on the needs of digital economic development to cultivate digital skill talent that meets market demand; conduct digital technology research and application studies to provide technical support to enterprises; and offer think tank services such as human resources policy consulting and market analysis to governments and enterprises.

Social organizations play a role in employment services, rights protection, and feedback on labor market needs. They provide employment information consulting, career guidance, and entrepreneurship services to the labor force; protect the legitimate rights and interests of workers and mediate labor-management relations; and collect and feedback on labor market needs and opinions to provide reference for policy-making by governing bodies.

4.3. Building a core governance mechanism

A dynamic monitoring and alert system, digitally empowered through big data analytics, shall be deployed to maintain real-time tracking of the workforce resilience index across Liaoning Province. By collecting and analyzing data on labor market supply and demand, skill levels, employment status, and digital economic development, we can monitor the real-time status of the human resource system, spot potential risks and issues early, and send out early warning signals to give timely and accurate info support for governance decisions.

A multi-stakeholder collaborative governance mechanism will be established through a tripartite government-enterprise-university linkage platform. Through this platform, communication and coordination among stakeholders will be enhanced, with clearly defined responsibilities in talent cultivation, skills training, and employment promotion to achieve resource sharing and complementary advantages. Regular coordination meetings will be convened to address operational challenges, institutionalizing a sustainable collaborative governance model.

The skills supply-demand matching mechanism shall be enhanced through university-enterprise cooperative customized training programs. Training curricula shall be jointly developed by higher education institutions and enterprises based on actual industry needs, implementing demand-driven cultivation to improve job matching efficiency. A standardized digital skills certification system shall be established with unified competency assessment criteria, providing verifiable benchmarks for workforce upskilling and employment qualification.

The risk response and resource allocation mechanism shall be strengthened through the establishment of an employment stabilization fund. This fund shall provide displaced workers affected by economic shocks with transitional support measures including but not limited to temporary living allowances and vocational training subsidies. A cross-regional talent redeployment

mechanism shall concurrently be instituted to facilitate evidence-based workforce mobility aligned with regional demand differentials, thereby alleviating localized talent shortages and optimizing human capital allocation.

5. Conclusions and Policy Recommendations

5.1. Research conclusions

The resilience of Liaoning Province's human resources system is at an intermediate level, demonstrating a certain degree of risk-bearing capacity and recovery capability. However, it exhibits significant shortcomings in adaptability and transformative capacity. Its current characteristics include an aging labor force, shortages of highly educated and digitally skilled talent, an unreasonable employment structure, low talent mobility rates, and insufficient collaboration between industry, academia, and research. Core weaknesses primarily include insufficient supply of digital skills, unclear responsibilities among governance entities, and the absence of dynamic response mechanisms.

The four-dimensional evaluation indicator system constructed in this paper, which integrates the characteristics of the digital economy—resistance, resilience, adaptability, and transformative capacity—has certain applicability and can comprehensively and objectively reflect the resilience level of Liaoning Province's human resources system. The proposed "multi-stakeholder collaboration + dynamic response" governance mechanism is feasible and provides effective pathways and methods for enhancing the resilience of Liaoning Province's human resources system.

5.2. Policy Recommendations

To address shortcomings in evaluation and enhance transformative capacity, expand enrollment in digital economy-related majors, adjust university major offerings based on market demand, align university curricula with industry needs, and improve the quality of talent cultivation. To enhance workforce resilience, a unified provincial reemployment training database shall be established to consolidate training resources, enabling shared access and efficient utilization of training information. The "Internet Plus Vocational Training" model shall be scaled up to expand program coverage and effectiveness, while institutional barriers to cross-sectoral mobility shall be eliminated through streamlined employment procedures and accelerated policy implementation to ensure timely impact delivery.

Relevant government authorities shall implement comprehensive safeguards to operationalize governance mechanisms, encompassing three critical dimensions: First, institutional safeguards will involve refining digital skills certification standards through a robust competency assessment framework while strengthening regulatory oversight to ensure impartiality and authoritative recognition; concurrently, talent mobility incentives—including housing subsidies, educational benefits for dependents, and tax concessions—shall be enacted to attract and retain skilled professionals. Second, resource safeguards will necessitate strategic investments in digitizing human resources services via high-performance information platforms to enhance service efficacy, alongside establishing a Resilience Enhancement Special Fund to finance talent development, skills training, and research collaborations. Third, technical safeguards require deploying Liaoning’s provincial Workforce Resilience Analytics Platform, which integrates cross-sectoral and multi-regional human capital data through unified API gateways to enable secure data interoperability and evidence-based utilization, ultimately strengthening data-driven governance decision-making.

For long-term development recommendations, resilience indicators should be incorporated into the performance evaluation system of local governments, with the establishment of a sound evaluation mechanism to incentivize local governments to actively take measures to enhance the

resilience of the human resources system. A composite talent ecosystem combining "digital literacy + professional skills" should be cultivated, with a focus on developing digital literacy during the basic education stage and strengthening the integration of digital skills and professional skills in vocational and higher education to create a favorable environment for talent development and attract and gather outstanding talents of all kinds.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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