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Framework and Elemental Analysis for Constructing a Real-Time New Quality Productivity Monitoring System

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Abstract: New quality productivity represents the core force driving global economic transformation and high-quality development. It signifies a shift in the economic system from being driven by traditional factors to a focus on innovation, technology intensiveness, and green, sustainable transformation. In this context, establishing an effective quality productivity monitoring system is of critical importance. This paper aims to construct a theoretical framework for the new quality productivity monitoring system and analyze its key elements. The goal is to provide a robust data foundation and scientific guidance for policy planning, platform development, talent cultivation, and introduction. The ultimate aim is to achieve real-time monitoring and precise evaluation of new quality productivity, ensuring its alignment with the long-term development of the social economy.

Keywords: New quality productivity; Monitoring system; Policy support; Innovation-driven; Technological progress

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1. Introduction

Compared with traditional productivity, new quality productivity emphasizes not only innovation and technological progress but also the efficient use of resources and green, sustainable development. Consequently, formulating economic policies requires countries to address the significant challenge of accurately evaluating and monitoring the development of new quality productivity. Currently, the integration of technological change and globalization has accelerated the rapid evolution of new quality productivity, rendering traditional monitoring methods inadequate [1]. Therefore, it is essential to establish a scientific, dynamic, flexible, and highly operable monitoring system for new quality productivity.

2. Overview of new quality productivity

New quality productivity refers to a modern form of productivity driven by scientific and technological innovation, green development, and information technology in the new era. Unlike traditional productivity, it places greater emphasis on innovation, technological advancement, and the efficient utilization of resources, rather than relying primarily on labor and capital [2]. In the context of global economic transformation, the emergence of new quality productivity signifies a significant shift in production modes from being factor-driven to innovation-driven [3].

Its core characteristics are as follows:

(1) Innovation-driven foundation: Innovation, led by science and technology, serves as the cornerstone of economic development, driving the transformation of production and business models.

(2) Technology-intensive industries: Sectors such as artificial intelligence and big data contribute to increased intelligence and automation in production processes.

(3) Green and sustainable practices: The entire production process integrates green concepts, with low-carbon and environmentally friendly methods increasingly becoming mainstream.

3. Construction of theoretical framework of new quality productivity monitoring system

3.1. Monitoring goal setting

The primary task in constructing a new quality productivity monitoring system is to establish clear goals and guidance to ensure practicality and strategic relevance. In the new era, new quality productivity has emerged as a key engine of economic growth, making it essential to monitor its development level and trends to facilitate smooth economic transformation and sustainable development [4].

The specific monitoring objectives include three aspects:

(1) Comprehensively evaluate the current state of new quality productivity, using data collection and analysis to objectively assess its performance and determine whether it meets expected goals.

(2) Tracking the development of new quality productivity in real time, enabling a review of historical trends and predictions for the future. This includes early detection of factors impeding progress to enable risk early warning.

(3) Identifying potential risks, particularly in the context of globalization and technological innovation. The monitoring system must be forward-looking, addressing constraints such as technical barriers and talent shortages, and providing robust support for policy formulation.

3.2. Monitoring principles

To ensure the monitoring system is scientific, comprehensive, and effective, several key principles must be adhered to during its construction:

(1) Scientific principle: The design of the monitoring system must rest on a solid theoretical and practical foundation to ensure each indicator accurately reflects the core elements of new quality productivity and its dynamic evolution. Monitoring tools and data analysis methods must be robust and precise to avoid errors that could distort results.

(2) Systematic principle: The system must comprehensively cover multiple dimensions of new quality productivity, including core elements such as scientific and technological innovation, industrial

structure, talent supply, policy environment, and market demand. This holistic approach provides a well-rounded perspective for improvement [5].

(3) Dynamic principle: Emphasizing flexibility and foresight, the system must adapt to rapid changes in new quality productivity by updating indicators in line with market and technological shifts. This ensures the timeliness and relevance of monitoring outcomes.

(4) Operational principle: The system must remain concise and easy to implement, avoiding overly complex frameworks or cumbersome data collection methods that could increase operational costs and hinder adoption. This ensures its applicability across diverse regions and industries.

3.3. Monitoring index design

The core of constructing a new quality productivity monitoring system lies in the scientific design of monitoring indices. To accurately reflect the development of new quality productivity, the selection of indicators must align with its core elements:

(1) Total indicators: These measure the overall scale and contribution of new quality productivity, including technological R&D investment, innovation outputs, and scientific and technological achievements, thereby demonstrating its economic weight.

(2) Structural indicators: These evaluate the distribution of new quality productivity across industries and differences in innovation capacity, such as the proportion of technological innovation in various industries and the output value of the digital and green economies. This allows for an in-depth analysis of its impact on both traditional and emerging industries [6].

(3) Efficiency indicators: These assess resource allocation and transformation efficiency, such as innovation output per unit of resource and the market conversion rate of technological innovation. These metrics help identify inefficiencies in resource utilization or innovation transformation, providing a strong basis for policy formulation.

(4) Temporal considerations: Indicators must balance long-term macro trends with short-term dynamics to ensure the monitoring system is forward-looking yet practical.

3.4. Monitoring methods and techniques

In the era of big data, modern technologies are indispensable for effective monitoring:

(1) Data collection: Technologies such as data mining and web scraping enable real-time capture of new quality productivity dynamics from sources such as social media, e-commerce platforms, and enterprise databases.

(2) Data processing: Advanced statistical techniques, including regression and factor analysis, extract key information, while machine learning and deep learning facilitate large-scale data mining and trend prediction. These techniques are particularly useful for identifying potential trends in innovative environments [7].

(3) Digital and intelligent platforms: The future lies in building digital and intelligent monitoring platforms based on cloud computing and big data. These platforms can automate data collection, provide dynamic updates, and conduct real-time analysis, offering precise decision support for governments and enterprises.

4. New quality productivity monitoring system: Element analysis requirements

4.1. Definition of monitoring objects

To ensure the pertinence and effectiveness of the monitoring system, the monitoring objects of new quality productivity must be clearly defined and categorized based on different levels and application scenarios.

At the macro level, enterprises, as the direct creators and implementers of new quality productivity, are central to monitoring. Their innovation initiatives, technological research and development (R&D) investments, and progress in digital transformation are key aspects of the monitoring focus. Additionally, given the variations in innovation capacity and developmental stages across industries, defining monitoring objects at the industry level is equally important. Technology-intensive and knowledge-intensive industries, in particular, are critical as they serve as the core drivers of new quality productivity [8].

At the regional level, disparities in economic development, industrial structures, and policy environments lead to varying performances in new quality productivity. Therefore, monitoring must also encompass regional economies, especially those prioritizing innovation-driven development. Once the monitoring objects are identified, they should be further classified by enterprise scale, industry characteristics, and regional attributes to enable precise and differentiated monitoring and evaluation.

4.2. Analysis of monitoring content

The comprehensiveness and depth of monitoring content are crucial for ensuring accurate results within the new quality productivity monitoring system.

The foremost focus is on scientific and technological innovation. The innovation capacity of enterprises and industries should be evaluated through measures such as R&D investment, innovation output, and patent applications. Additionally, resource use efficiency is a critical area, particularly given global resource constraints. Indicators such as resource output per unit and energy utilization efficiency are essential to assess technical and managerial improvements in resource efficiency.

Environmental impact is another indispensable component. As green development becomes a global consensus, assessing production activities' ecological effects has become a vital standard for evaluating sustainable development [9]. Environmental indicators, such as carbon emissions, waste management, and energy consumption, must be included to comprehensively evaluate the positive and negative environmental impacts of new quality productivity.

Finally, with rapid technological advancements and increasing industrial digitization, monitoring content should also address digital economy penetration and intelligent application levels. These indicators are crucial for reflecting the modernization and technological sophistication of new quality productivity.

4.3. Monitoring means and tools

The rapid progress of information technology has positioned digital platforms, big data analysis, and artificial intelligence (AI) as core components of modern monitoring systems.

(1) Digital monitoring platforms: Using the Internet of Things (IoT) and sensing technologies, these platforms automate the collection and processing of data from production activities, ensuring real-time and efficient monitoring.

(2) Big data analysis: This significantly enhances the data-processing capabilities of monitoring systems, providing insights into trends and risks in new quality productivity. Advanced data mining algorithms

are particularly effective in identifying key influencing factors, especially when dealing with complex nonlinear correlations [10].

(3) Artificial intelligence: AI technologies, including machine learning and deep learning, allow the system to self-learn and predict future development trends of monitored objects.

(4) Hardware infrastructure: Alongside software tools, hardware such as sensor networks and monitoring terminals ensures stable data flows for real-time monitoring, enhancing the accuracy and timeliness of the system.

4.4. Data sources and management

Data sources must be diverse to ensure comprehensiveness and representativeness.

(1) Government statistics: Industry statistical yearbooks and economic census data provide a macroeconomic context.

(2) Corporate reports: Annual financial and R&D investment reports reflect enterprise-level innovation and resource utilization [11].

(3) Social surveys: Data on consumer behavior and market demand can effectively supplement internal data gaps.

Effective data management is essential to maintain data quality:

(1) Data cleansing: Anomalies and missing values must be addressed to ensure data integrity and consistency.

(2) Data verification: Accuracy should be validated through multi-channel comparisons.

(3) Data security: Legal compliance is vital for data storage and confidentiality. Privacy protection, particularly for corporate and personal data, is key to enhancing the monitoring system's legitimacy and credibility.

4. Practical application countermeasures of the new quality productivity monitoring system

4.1. Providing data support and recommendations for policy-making

Data centers should prioritize the comprehensive collection and integration of statistical data related to new quality productivity, covering key areas such as innovation input, technological output, resource efficiency, and ecological impacts. Leveraging big data and intelligent analysis technologies allows for in-depth analysis of productivity trends and potential, providing a robust foundation for policy-making. A stable data collection mechanism must be established to ensure the timeliness and accuracy of the data [12].

Beyond assessing the current situation, predictive models should be employed to forecast the development trajectory of new quality productivity, offering forward-looking policy recommendations for decision-makers. To better serve government departments, data centers should publish regular monitoring reports that provide a comprehensive overview of industry innovation, resource utilization, and green development dynamics. These reports must be based on rigorous analysis, enriched with actionable insights, and clearly outline recommendations to support policy optimization.

In addition, based on monitoring outcomes, data centers should proactively deliver policy advisory services, offering tailored recommendations for specific industries or regions. This approach enhances the precision and effectiveness of decision-making processes.

4.2. Platform construction and optimization

An efficient monitoring platform is essential for the effective operation of the new quality productivity monitoring system. Upgrading existing platforms using information and digital technologies is necessary to facilitate real-time and accurate data collection, processing, and analysis. Creating an intelligent data platform can broaden monitoring capabilities, deepen data interactions and mining, and help relevant departments swiftly identify trends in new quality productivity.

The platform must integrate data from enterprises, industries, governments, and other stakeholders, establishing robust information-sharing and collaboration mechanisms [13]. Data sources should include both traditional statistics and real-time data from modern channels such as the Internet and IoT, leveraging big data technologies to enhance accuracy and comprehensiveness.

To ensure smooth platform operation, interdepartmental information-sharing and collaboration must be strengthened. A unified platform can foster communication and data exchange among government agencies, enterprises, research institutions, and other societal sectors, promoting an open and transparent cooperative environment.

The platform should also feature intelligent data analysis and forecasting capabilities, employing artificial intelligence to extract insights from big data. Moreover, optimizing the user experience is essential; simplifying operations related to data entry, processing, querying, and analysis ensures that policymakers and industry stakeholders can access information efficiently, enhancing decision-making accuracy.

4.3. Talent training and recruitment

Effective talent development emphasizes innovative, interdisciplinary education and fostering strong collaboration between higher education institutions and enterprises. Joint efforts should focus on cultivating high-caliber talents with practical skills and innovative mindsets. Educational institutions must design curricula and research projects aligned with the demands of new quality productivity and encourage student participation in technology R&D and innovation activities.

For postgraduate education, investments should prioritize cutting-edge fields such as green technology, intelligent manufacturing, and the digital economy. Leveraging the production-university-research model can significantly enhance students' abilities to address real-world challenges [14]. Government support is crucial for facilitating school-enterprise collaborations, promoting technology transfer, and accelerating industrial applications.

Talent recruitment also plays a pivotal role. Governments should actively attract top domestic and international talents to bolster the development of new quality productivity, particularly in frontier sciences and emerging industries. Recruiting professionals with advanced technical expertise and global perspectives strengthen the innovation capacities of local enterprises.

4.4. Continuous monitoring and evaluation

Modern technologies, combined with real-time data collection and processing, underpin the establishment of a continuous monitoring mechanism that ensures comprehensive and dynamic monitoring of new quality productivity across various industries, regions, and timeframes.

This mechanism must balance stability and flexibility, enabling sensitivity to changes in productivity across sectors and regions. Automated systems should facilitate instant updates on innovation inputs, technology applications, and green development performance [15]. Regular evaluations, supported by statistical analyses, predictive models, and policy simulations, are necessary to provide detailed feedback and insights derived from monitoring data.

Evaluations should not only capture overarching trends in new quality productivity but also analyze differences among industries and regions in areas such as innovation capacity, resource efficiency, and green development. This granular focus lays the groundwork for precise policy interventions.

The speed of evaluation feedback is critical for timely policy adjustments. Monitoring agencies must submit evaluation reports and policy optimization recommendations promptly, ensuring that policies remain aligned with the evolving direction of new quality productivity.

5. Conclusion

To ensure the efficient promotion of new quality productivity, constructing a scientific monitoring system is of critical importance. This paper elaborates on the monitoring framework and implementation strategy for such a system. By utilizing scientific and intelligent monitoring tools, the system enhances real-time tracking and risk warning capabilities for new quality productivity. Furthermore, through robust data support and in-depth analysis, the monitoring system can provide valuable data insights to facilitate policy adjustments, thereby ensuring that the growth of new quality productivity remains sustainable and robust. In the future, as technological advancements and applications continue to deepen, the monitoring system must maintain flexibility and foresight to contribute significantly to the sustained prosperity of the global economy.

Disclosure statement

The author declares no conflict of interest.

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