

Green Economy Empowers New Quality Productive Forces: Mechanisms, Challenges, and Pathways

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Abstract: The introduction of "New Quality Productive Forces" delineates the direction for China's high-quality economic development. the green economy, as a sustainable development model, is a key driving force empowering these New Quality Productive Forces. This paper aims to explore the intrinsic mechanisms, major challenges, and feasible pathways for the green economy to empower New Quality Productive Forces. the research posits that the green economy provides core impetus and foundational support for the formation and development of New Quality Productive Forces through innovation-driven mechanisms, structural optimization mechanisms, and factor upgrading mechanisms. However, this empowerment process still faces multiple challenges, including technological bottlenecks and cost constraints, institutional obstacles and market failures, and the pains of structural transformation alongside regional imbalances. To effectively overcome these challenges and promote the deep integration of the green economy and New Quality Productive Forces, it is imperative to start by strengthening policy guidance and institutional guarantees, driving technological innovation and industrial upgrading, and improving market mechanisms and factor allocation. This involves constructing systematic development pathways to inject new momentum into China's sustainable, high-quality economic development.

Keywords: Green Economy; New Quality Productive Forces; Empowerment Mechanisms; Development Challenges; Implementation Pathways

1. Intrinsic Mechanisms of Green Economy Empowering New Quality Productive Forces

Currently, a new round of technological revolution and industrial transformation is

deepening, and sustainable development has become a universal consensus in the international community. Against this backdrop, China has clearly proposed the "dual carbon" goals (carbon peaking and carbon neutrality) and has placed the development of New Quality Productive Forces at the core of its national development strategy. New Quality Productive Forces are advanced productive forces led by scientific and technological innovation, characterized by high technology, high efficiency, and high quality, and aligned with the new development philosophy. the green economy is a new economic form oriented by the market, based on the traditional industrial economy, and aimed at achieving harmony between the economy and the environment. Its core lies in realizing synergistic benefits between economic development and ecological environmental protection. Developing a green economy is not only an inevitable choice for addressing global climate change and achieving sustainable development but also an inherent requirement for cultivating and strengthening New Quality Productive Forces.

However, the process of the green economy empowering New Quality Productive Forces is not without its hurdles; it presents both opportunities and challenges. How to deeply understand the intrinsic connections between the two, accurately identify obstacles in the empowerment process, and explore effective implementation pathways are currently urgent theoretical and practical issues requiring research.

The empowering effect of the green economy on New Quality Productive Forces is primarily realized through the following three-level mechanisms, which interact and work in concert to propel productive forces towards a more advanced and sustainable form.

1.1 Innovation-Driven Mechanism: Green Technology Leading Industrial

Transformation

The core of New Quality Productive Forces lies in technological innovation. the development of the green economy itself is highly dependent on breakthroughs and applications in green technology. From clean energy technologies (such as solar, wind, and hydrogen energy), energy-saving and environmental protection technologies, and Carbon Capture, Utilization, and Storage (CCUS) technologies, to green intelligent manufacturing and bio-based materials, the R&D and application of these green technologies directly give rise to strategic emerging industries, such as new energy vehicles, energy-saving and environmental protection equipment, and green buildings. These industries not only represent the development direction of New Quality Productive Forces themselves, but their technological spillover effects can also permeate traditional industries, promoting their green and intelligent transformation. For instance, the integration of digital technologies such as big data and artificial intelligence with green and low-carbon technologies can precisely enhance energy utilization efficiency, optimize production processes, and reduce pollutant emissions, thereby fundamentally improving total factor productivity—a testament to the high-efficiency characteristic of New Quality Productive Forces. Green technological innovation breaks the dependence of traditional production methods on high-carbon factors, providing a core engine for industries to move towards the higher end of the value chain.

1.2 Structural Optimization Mechanism: Green Transformation Reshaping The Industrial Landscape

The development of a green economy requires a shift from high-energy-consuming, high-pollution traditional industrial structures to a low-carbon, circular, and efficient green industrial system. This process itself is a profound adjustment and optimization of the productive forces' structure. On one hand, through policy guidance, market regulation, and other means, the green economy restricts and eliminates outdated production capacity, creating development space for emerging green industries and achieving industrial "metabolism. " For example, mechanisms like carbon emission trading and environmental taxes increase the production costs of high-carbon industries,

compelling them to transform and upgrade or gradually exit. On the other hand, the green economy vigorously cultivates and develops green industries, such as renewable energy, ecological agriculture, green finance, and environmental services. These industries not only create new economic growth points but also absorb more high-quality labor, optimizing labor factor allocation. This optimization of industrial structure simultaneously enhances the "green content" and "value content" of economic growth, shifting economic development from being factor-driven and investment-driven to innovation-driven and green-driven, aligning with the high-quality essence of New Quality Productive Forces.

1.3 Factor Upgrading Mechanism: Green Factors Enhancing Production Efficiency

The formation of New Quality Productive Forces is inseparable from the innovative allocation and efficiency improvement of production factors. the green economy promotes the upgrading of traditional production factors by introducing and strengthening "green factors. " Firstly, concerning capital factors, the development of green finance (such as green credit, green bonds, and green funds) directs more social capital towards green industries and projects, optimizing capital allocation efficiency and reducing the financing costs of green transformation. Green finance guides capital flows into green, low-carbon, environmental protection, and energy-saving sectors, thereby promoting the sustainable development of the real economy.^[1] Secondly, regarding labor factors, the development of the green economy has created a demand for professionals mastering green skills and possessing environmental awareness, promoting the upgrading of human capital structure. Thirdly, in terms of technological factors, as previously mentioned, green technology itself is a core production factor. More importantly, the green development philosophy also regards the ecological environment itself as an important production factor—ecological capital. Through mechanisms for realizing the value of ecological products, "lucid waters and lush mountains" are transformed into "invaluable assets, " enabling high-quality ecological environments to directly or indirectly enhance economic output and people's well-being. Data, as a new type of production factor, also plays a key role in the

green economy, for example, by optimizing resource allocation through environmental monitoring data and improving energy efficiency through energy consumption data. the integration and upgrading of these green factors fundamentally change the production function, improving resource allocation efficiency and output efficiency.

2. Challenges Faced By Green Economy Empowering New Quality Productive Forces

Although the green economy has a tremendous empowering effect on New Quality Productive Forces, in practice, it still faces numerous real-world challenges that require high attention and must be overcome.

2.1 Technological Bottlenecks and Cost Constraints

The R&D and application of green technologies are core to empowering New Quality Productive Forces, but many key green technologies currently face bottlenecks. For example, the cost and efficiency of energy storage technology, the production and storage/transportation of hydrogen energy, and the large-scale application of CCUS technology all face issues of low technological maturity and insufficient economic viability. Some core technologies and key equipment still rely on imports, posing "chokepoint" risks. Concurrently, the initial phase of green transformation often involves high cost inputs. Enterprises require substantial financial support for green retrofitting, adopting clean energy, and developing green products. This cost pressure is particularly prominent for small and medium-sized enterprises (SMEs), potentially leading to insufficient motivation for transformation. High initial investments and long payback periods may also dampen the enthusiasm of social capital for participating in green projects.

2.2 Institutional Obstacles and Market Failures

Although China has introduced a series of policies to support green development, the existing institutional system still needs improvement. Firstly, there is a lack of policy coordination across departments and regions, which may lead to diluted policy effectiveness or even mutual constraints. Secondly, the green standards system is not yet sound, with some industries lacking clear green certification and

evaluation standards, affecting the market promotion of green products and services. Thirdly, the construction of green factor markets, such as carbon markets and green electricity markets, is still in its nascent stages, and market mechanisms have not yet fully played their role. For example, carbon prices do not fully reflect environmental externalities, and green electricity trading mechanisms are immature, making it difficult to effectively incentivize enterprises to make green investments and engage in green consumption. Market failure issues, such as information asymmetry and insufficient internalization of environmental externalities, also constrain the healthy development of the green economy.

2.3 Pains of Structural Transformation and Regional Imbalances

Green economic transformation implies profound adjustments in industrial structure, which inevitably brings certain "transitional pains." the hindering effect of traditional industries on New Quality Productive Forces manifests, on the one hand, in the inability of traditional industrial products to meet the reprocessing needs of other green industries, thereby impeding green industry development. On the other hand, traditional industries, relying on traditional productive forces, block the intervention of green productive forces, which is unfavorable to the formation and development of New Quality Productive Forces.^[2] Some regions and industries dependent on traditional high-carbon sectors may face pressures such as enterprise closures, worker unemployment, and reduced fiscal revenue during the transition. How to properly resettle laid-off workers, cultivate new economic growth points, and achieve a smooth transition are severe tests for local governments. Furthermore, China's regional economic development is unbalanced, with significant disparities between eastern, central, and western regions in terms of green technology levels, industrial foundations, and financial strength. Eastern regions may be the first to achieve green transformation and develop New Quality Productive Forces, while underdeveloped central and western regions may face greater transitional pressures and higher costs, easily leading to a "green divide" and exacerbating regional development imbalances. How to promote green development while considering regional coordination and common

prosperity is an issue requiring comprehensive consideration.

3. Implementation Pathways For Green Economy Empowering New Quality Productive Forces

To effectively address the aforementioned challenges and fully leverage the empowering role of the green economy on New Quality Productive Forces, it is necessary to coordinate efforts at multiple levels, including top-level design, technological innovation, industrial development, and market mechanisms, to construct systematic implementation pathways.

3.1 Strengthening Policy Guidance and Institutional Guarantees

Firstly, it is crucial to strengthen top-level design and strategic planning, deeply integrating the green development philosophy into the entire process of cultivating New Quality Productive Forces. Formulate clear roadmaps and timetables for green economic development, specifying phased goals and tasks. Secondly, improve the legal and regulatory system to provide a legal basis for green transformation, such as revising the Environmental Protection Law and Energy Law to strengthen corporate environmental responsibility. Thirdly, enhance cross-departmental policy coordination, establishing and improving coordination mechanisms between central and local governments, and among government departments, to form policy synergy. Promote the effective linkage of fiscal, financial, industrial, and environmental policies. For example, increase fiscal subsidies and tax incentives for green technology R&D and green industries, and improve government green procurement systems. Finally, establish and improve a scientific green development evaluation and assessment system, incorporating indicators such as resource consumption, environmental damage, and ecological benefits into the socio-economic development evaluation system, to guide local governments and enterprises in adopting correct views on performance and development. Establishing a comprehensive policy effect monitoring and evaluation system, and periodically reviewing and adjusting green economy policies to ensure their adaptability and effectiveness, is key to achieving sustainable development goals.^[3]

3.2 Driving Technological Innovation and

Industrial Upgrading

Technological innovation is the core engine for the green economy to empower New Quality Productive Forces. Firstly, increase R&D investment in key core technologies in the green and low-carbon fields, establish national major science and technology projects, and concentrate efforts on overcoming technological bottlenecks in areas such as energy storage, hydrogen energy, CCUS, biomanufacturing, and negative carbon technologies. Secondly, build a green technology innovation system with enterprises as the main body, market-oriented, and deeply integrating industry, academia, and research. Encourage enterprises to establish R&D centers and support universities and research institutes in jointly building innovation consortia with enterprises to accelerate the transformation and industrialization of scientific and technological achievements. Thirdly, promote the deep integration of digital and green technologies, develop new business formats such as smart energy, smart grids, and smart environmental protection, and use digital means to improve energy and resource utilization efficiency and environmental governance levels. Fourthly, accelerate the green and intelligent transformation of traditional industries. Industrial transformation and upgrading, as a core strategy for enhancing New Quality Productive Forces, guides the economic system towards green, low-carbon, and sustainable development.^[4] Through technological upgrades, equipment renewal, and process optimization, promote energy conservation and carbon reduction in high-energy-consuming industries such as steel, chemicals, and building materials, guiding them towards high-end, intelligent, and green development. Simultaneously, vigorously develop strategic emerging green industries and create internationally competitive green industrial clusters.

3.3 Improving Market Mechanisms and Factor Allocation

Giving full play to the decisive role of the market in resource allocation and better leveraging the role of government is crucial for the green economy to empower new quality productive forces. First, improve the carbon emissions trading market by gradually expanding its coverage, enriching trading products and methods, and forming a carbon price that genuinely reflects the cost of carbon

reduction, thereby incentivizing enterprises to proactively reduce emissions. Second, strengthen the green finance system by vigorously developing financial products and services such as green credit, green bonds, green insurance, and green funds, to guide more social capital towards green and low-carbon sectors. Explore the establishment of climate investment and financing mechanisms. Third, establish a unified and standardized system for green product standards, certification, and labeling to guide and encourage green consumption, and to provide a fair market competition environment for green products. Fourth, deepen the reform of market-based allocation of factors of production, unblocking the flow channels for elements such as green technology, green capital, and green talent, and improving the efficiency of their allocation. Explore the establishment of mechanisms for realizing the value of ecological products, enabling the concept that "lucid waters and lush mountains" genuinely generate economic benefits. Fifth, create a fair competitive market environment by breaking down local protectionism and industry monopolies, and by stimulating the green innovation vitality of various market entities.

4. Conclusion

The green economy and New Quality Productive Forces are dialectically unified and mutually reinforcing. the green economy is not only an important component of New Quality Productive Forces but also a key enabling means for their formation and development. Through the three major mechanisms of innovation drive, structural optimization, and factor upgrading, the

green economy provides an inexhaustible impetus for the cultivation and growth of New Quality Productive Forces. Although currently facing multifaceted challenges in technology, institutions, and structure, as long as we adhere to a systemic perspective, strengthen top-level design, take technological innovation as the lead, industrial upgrading as the focus, and market mechanisms as the support, we will certainly be able to overcome obstacles and forge a path of high-quality development characterized by the synergistic advancement of the green economy and New Quality Productive Forces, laying a solid foundation for the construction of Chinese-style modernization.

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