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Green Collaborative Innovation, Transformation of Old and New Driving Forces, and Economic Growth

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Abstract: In the current era of globalization and information technology, economic growth is no longer the result of a single industry or technological advancement but rather the interplay of multiple factors. Among these, "green collaborative innovation" and the "transformation of old and new growth drivers" have emerged as critical engines for sustaining healthy and high-quality economic development. This paper seeks to explore how these two concepts interact to foster economic growth and proposes corresponding strategies.

Keywords: Green collaborative innovation; Replacement of old and new growth drivers; Economic growth

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1. Introduction

Greening represents not only an innovation in traditional development models but also a forward-looking strategy for shaping the future trajectory of economic development. As a vital approach to achieving greening objectives, collaborative innovation facilitates the integration of key innovation elements such as technology, capital, and talent, thereby generating new drivers for economic progress. With the advancement of global economic integration, traditional industries characterized by high energy consumption and pollution levels have become inadequate in addressing evolving market demands and environmental standards. This necessitates the cultivation and growth of emerging industries through the transformation of old and new growth drivers, creating new economic growth points.

An essential challenge in this process involves effectively managing the phase-out of outdated growth drivers while nurturing new ones. Addressing this challenge is one of the core objectives of this paper [1]. The ultimate goal of both green collaborative innovation and the transformation of old and new growth drivers is to achieve sustained, stable, and healthy economic growth [2]. This paper examines the synergy between these two concepts in driving economic growth and offers targeted and actionable policy recommendations to support this process.

2. Green collaborative innovation: A new paradigm for driving economic growth

In the context of global climate change and increasingly severe resource and environmental constraints, the traditional economic growth model characterized by high energy consumption, high emissions, and low efficiency is no longer sustainable. Green collaborative innovation, as a new development paradigm, is increasingly becoming a key driver of economic transformation, upgrading, and sustainable development.

2.1. Technological innovation leadership: Research and development and application of green technology

The rapid advancement of science and technology has positioned green technology as a cornerstone for driving the green transformation of the economy [3]. Green technologies encompass fields such as clean energy, energy conservation and emission reduction, and resource recycling. Their research, development, and application can significantly reduce energy consumption during production processes, improve resource utilization efficiency, and achieve a synergy between economic and environmental benefits [4].

In clean energy, the continuous innovation of renewable energy technologies—such as solar and wind energy—has progressively lowered costs and enhanced the efficiency of these sources, enabling the transition away from traditional fossil fuels [5]. In energy conservation and emission reduction, technologies such as smart grids, energy-efficient equipment, and new energy vehicles have effectively minimized energy consumption and carbon emissions. Simultaneously, breakthroughs in resource recycling technologies, including waste resource utilization and wastewater treatment and reuse, not only mitigate environmental pollution but also advance resource conservation and efficiency.

In addition to steering green development, technological innovation has spurred the emergence of green industries, fostering broad market prospects and stimulating related industrial chains, thereby injecting vitality into economic growth [6]. For example, the rapid development of the new energy vehicle industry has not only advanced core technologies such as batteries, motors, and electronic control systems but has also propelled associated industries such as charging infrastructure and connected car technologies.

2.2. Guarantee of institutional innovation: Establishing and improving the policy system and market mechanism for green development

Institutional innovation provides the structural foundation for green collaborative innovation. To promote the development and application of green technology, it is essential to create a robust policy system and market mechanism.

From a policy perspective, governments should implement measures to encourage green technological innovation, including research and development funding support, tax incentives, and government procurement programs. Concurrently, strict environmental regulations and standards should be established to phase out high-pollution, high-energy consumption industries, thus facilitating the adoption and application of green technologies [7].

On the market side, a green financial market system should be developed to support green technology research and application. Issuing green bonds and establishing green funds can channel private capital into green industries. Moreover, a green product certification and labeling system can enhance consumer awareness and acceptance of green products, fostering the development of a green consumer market.

2.3. Collaborative innovation platforms: Building enterprise collaborative communication and innovation platforms

Collaborative innovation platforms serve as crucial enablers of green collaborative innovation. To accelerate the research and application of green technology, platforms that integrate industry, academia, and research should be established [8].

In these platforms, enterprises, universities, and research institutions must leverage their unique strengths to form collaborative innovation networks. Enterprises should act as the principal agents of technological innovation and application, directing efforts toward green technology development based on market demands. Universities and research institutions should provide theoretical and intellectual support through scientific research and talent development. Furthermore, enhanced collaboration between upstream and downstream enterprises within industrial chains can expedite the industrialization of green technologies.

Efficient management and operation of these platforms are essential for maximizing their impact. Efforts should also focus on fostering openness and sharing, including the development of shared technology research, testing, and verification platforms. These platforms can offer accessible technical services and resources to various stakeholders. Additionally, the transformation and application of platform-generated outcomes should be prioritized to accelerate the industrialization and commercialization of green technologies.

3. Replacing old growth drivers with new ones: A key path to promote economic transformation

Amid significant shifts in the global economic landscape, the transformation of old growth drivers into new ones has become an essential pathway to achieving economic transformation and high-quality development. This process encompasses industrial restructuring, technological innovation, model transformation, and green development.

3.1. Transformation and upgrading of traditional industries: Revitalizing with new potential

As the foundation of the national economy, traditional industries play a pivotal role in the transformation of growth drivers. However, they face challenges from growing resource and environmental constraints and intensifying market competition. To address these issues, traditional industries must accelerate technological advancements and model innovations to improve production efficiency and environmental sustainability.

Technological transformation is fundamental to the modernization of traditional industries. Enterprises are encouraged to adopt advanced production equipment and technologies, such as automated production lines and intelligent management systems, to enhance efficiency, reduce costs, and minimize resource consumption and environmental impacts. Additionally, a focus on research and development is crucial to advancing products toward higher-end, intelligent, and green specifications to align with the evolving demands of modern consumers.

Model innovation is another critical avenue for upgrading traditional industries. Enterprises should explore new business models and operational strategies, such as platform-based operations, customized services, and the sharing economy. These approaches enhance adaptability to market fluctuations and consumer demands, increase responsiveness, and strengthen market competitiveness.

In facilitating the transformation and upgrading of traditional industries, the government plays an instrumental role. Policy initiatives, financial support, and technical guidance are necessary to assist enterprises

in overcoming the challenges of transformation. Simultaneously, enterprises must strengthen internal management, improve workforce quality, and actively cooperate with governmental directives to ensure a seamless transition and sustainable development.

3.2. Cultivating and strengthening emerging industries: Green and low-carbon development as new growth engines

Emerging industries are crucial for replacing outdated growth drivers and fostering new economic growth points. With rapid technological advancements and expanding markets, sectors such as the digital economy, intelligent manufacturing, and biomedicine are emerging as powerful engines driving economic development.

The digital economy, as a key representative of emerging industries, is revolutionizing lifestyles and production methods at an unprecedented pace. The integration of advanced technologies, including big data, cloud computing, and artificial intelligence, has not only enhanced production efficiency and service quality but also spawned numerous new business models. To sustain growth, deeper integration of digital technologies across various sectors and closer alignment between the digital and real economies should be prioritized to invigorate economic development.

Intelligent manufacturing, as the future direction of advanced manufacturing, is spearheading the shift toward high-end, intelligent, and green production. By integrating cutting-edge technologies such as intelligent robotics, the Internet of Things, and 5G communication, intelligent manufacturing significantly improves efficiency, quality, and resource utilization while reducing production costs. Moreover, it fosters collaborative innovation across upstream and downstream industrial chains, enhancing the competitiveness of the entire ecosystem.

The biomedical industry, as a vital component of emerging sectors, is poised for remarkable growth. Driven by an aging population and heightened health awareness, demand for biomedical products and services is projected to increase substantially. To capitalize on this potential, investments in research and innovation must be intensified, with a focus on breakthroughs in key areas such as drug development and medical device manufacturing. These efforts will contribute to safer, more effective, and accessible healthcare solutions.

3.3. Integrated development of service and manufacturing industries: Advancing synergy and enhancing the industrial chain

The integrated development of the service and manufacturing industries serves as a critical approach to replacing old growth drivers with new ones. With the global industrial division of labor deepening and market competition intensifying, the boundaries between these sectors are becoming increasingly blurred, and the trend toward integration is accelerating.

As a foundational support for the manufacturing sector, producer services are playing an increasingly significant role. These services, which include research and development, logistics and distribution, and marketing, provide comprehensive assistance to manufacturing enterprises. They help reduce production costs, enhance efficiency, and improve market competitiveness. Moreover, the expansion of producer services fosters the transformation of manufacturing toward high-end, intelligent, and environmentally friendly operations.

During the process of integration, the government should emphasize collaborative innovation between upstream and downstream enterprises in the industrial chain. Strengthening cooperation in areas such as technological research and development, personnel training, and market expansion is crucial for creating a

tightly connected network of enterprises with shared interests. Such efforts will enhance the competitiveness of the entire industrial chain and contribute to the coordinated development of regional economies.

Additionally, policy guidance and support play pivotal roles in achieving this integration. The government must enact policies to encourage the collaborative development of the service and manufacturing sectors while bolstering infrastructure and service systems to provide a robust foundation for this integration.

3.4. Building an open cooperation mechanism

In the era of globalization, no nation can afford to remain isolated. The transformation from old to new growth drivers necessitates actively building an open cooperation mechanism and enhancing exchanges with the global community. Such initiatives will help introduce advanced foreign technologies and management practices while fostering international collaboration in green technologies and industries to address shared global challenges such as climate change.

The government should prioritize the establishment of open cooperation mechanisms and broaden the scope of international partnerships. Beyond traditional economic and trade relations, collaboration in areas such as technological innovation, green development, and environmental protection must be emphasized. Encouraging enterprises to participate in international research projects and to co-develop research platforms will facilitate the adoption of advanced green technologies and environmental protection methodologies, accelerating the development of domestic green industries.

Additionally, enterprises should actively engage in the formulation and revision of international standards to amplify their influence in the creation of global rules. Encouraging domestic enterprises to participate in global markets will enhance the visibility and competitiveness of Chinese brands on the international stage.

International technology transfer is a vital method for facilitating this transformation. Establishing and improving systems for such transfers, along with strengthening cooperation with foreign institutions, will help acquire advanced scientific achievements and patents from abroad. Simultaneously, domestic enterprises should be encouraged to invest in independent research and innovation to elevate technical capabilities and core competitiveness.

Furthermore, international cooperation in green technology and industries represents a key direction for this transformation. Active participation in international green technology projects and collaboration with global green industry organizations will promote the development and application of sustainable technologies. Such efforts will align green technology with industrial growth, injecting fresh momentum into economic transformation while addressing environmental concerns.

3.5. Strengthening personnel training and recruitment

Talent is the foremost resource. In the process of transitioning from old to new growth drivers, the cultivation and recruitment of talent must be prioritized. By enhancing training and recruitment efforts in the field of green technology, a multi-level and wide-ranging talent pool can be established, providing robust intellectual support for green collaborative innovation and the transformation of economic momentum.

Relevant institutions should focus on strengthening talent development in green technology, including the introduction of related majors and courses in higher education. This effort will foster a new generation of high-quality professionals equipped with expertise in green technology and environmental protection principles. Additionally, vocational training and continuing education programs should be expanded to enhance the

proficiency and professional quality of active personnel in green technology fields.

In addition to developing local talent, the recruitment of high-end professionals in green technology should be actively pursued. The government should establish talent recruitment funds and offer attractive benefits and working environments to entice top-tier green technology experts from both domestic and international markets to contribute to China's development. Strengthening connections with international talent markets and diversifying recruitment channels will further bolster this initiative.

Enterprises should work to form comprehensive talent teams encompassing diverse levels and fields. This includes experts ranging from basic research to application development, theoretical research to practical operations, and local to international talent pools. By cultivating a high-quality workforce with innovative capabilities and practical skills, enterprises can better align with the demands of economic transformation.

To stimulate the innovation potential of professionals, enterprises should refine their talent incentive mechanisms. This may include establishing technological innovation reward funds, offering equity incentives, and implementing benefit-sharing models for the conversion of scientific achievements. Such measures ensure that innovative contributions are appropriately recognized and rewarded. Furthermore, robust intellectual property protections should be enforced to safeguard the rights and achievements of talents.

Promoting the coordinated development of talent and industries is equally crucial. Enterprises should foster partnerships with universities and research institutions to create platforms that enable synergy between talent development and industrial growth. Additionally, governments should implement and refine talent policies to offer stronger support and assurances for professionals engaged in transformative economic activities.

4. Summary and suggestions

The transformation of growth drivers from traditional models, characterized by high energy consumption, high pollution, and low added value, to innovative, green, low-carbon, and high-efficiency models represents both an optimization of the industrial structure and a fundamental shift in economic development paradigms. This transition is critical for achieving sustainable and high-quality economic progress.

Green collaborative innovation and the replacement of old and new growth drivers serve as vital pathways to promote high-quality development. Continued emphasis on the synergy between these strategies is essential for effectively addressing global environmental challenges and achieving sustainable economic and social advancement.

Disclosure statement

The author declares no conflict of interest.

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