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Dynamic Mechanisms and Institutional Frameworks of China's Green Development: An Analysis from the Perspective of Collaboration

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Abstract: With the intensifying deterioration of the global ecological environment and the continuous depletion of natural resources induced by human activities, the world is standing at a crossroads. As the largest developing country in the world, China has an urgent need to change its development model to a more sustainable one. Green development, the inevitable choice to promote the construction of an ecological civilization, is the only way to achieve a beautiful China. Dynamic mechanisms are the key factors to achieving green development, and the improvement of institutional frameworks is a fundamental guarantee for improving the quality of green development. The purpose of this study is to identify the driving forces that compose the dynamic mechanisms and to propose an institutional framework for green development in China. This paper discusses the various driving forces behind green development, and analyzes the dynamic mechanisms as well as the roles of the various forces in achieving green development. Finally, an institutional framework for pursuing green development in China is provided. It was found that the dynamic mechanism behind green development in China includes four aspects, namely, pressure, a pulling force, a pushing force, and a supporting force. The institutional framework for green development in China can be established from the aspects of education, stakeholder coordination, the legal system, ecological compensation, scientific and technological innovation, regional cooperation, and other system countermeasures.

Keywords: green development; driving forces; dynamic mechanism; institutional framework; multidimensional collaboration



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1. Introduction

China's economy has witnessed remarkable achievements benefiting from the country's reform and opening-up policies since the late 1970s. However, both the natural resources and the ecological environment have faced tremendous pressure, which has led to a series of unsustainable problems. As a consequence, the green transformation of the national economy is urgently needed in China [1]. As a new concept, green development is different from the traditional development model in many ways [2]. Green development emphasizes the correct handling of the relationship between human beings and nature to promote a dynamic balance among the economy, society, resources, and environment; it improves the level of harmonious coexistence between human development and natural resources and organically integrates economic development and ecological environmental protection instead of mainly relying on the increasing consumption of natural resources and the pursuit for quantitative expansion to achieve economic and social development. Therefore, taking the road of green development has become an inescapable choice for China to reduce the pressure on resources and the environment, resolve the conflict between economic development and ecological protection, and promote the construction of an ecological civilization [3]. The Fifth Plenary Session of the 19th Central Committee

of the Communist Party in China (CPC) proposed to promote green development and establish a harmonious relationship between human beings and nature. Obviously, green development has become one of the top priorities among the top decision makers in China.

In order to achieve green development, dynamic mechanisms and the various driving forces are the critical factors that need to be identified and analyzed. In addition, the establishment and improvement of institutional frameworks is the fundamental guarantee for improving the quality of green development. This paper contributes to a comprehensive understanding of green development in China by discussing the dynamic mechanisms of green development from the four aspects of pressure, a pulling force, a pushing force, and a supporting force. It also analyzes the institutional framework such as education, the legal system, stakeholder coordination, ecological compensation, technological innovation, and regional cooperation from the dimensions of conceptual synergy, legal synergy, stakeholder synergy, incentive synergy, scientific and technological synergy, and regional synergy, which can provide some policy implications for achieving green development in China.

The rest of this paper is organized as follows: Section 2 presents the state of the art and evolution of green development around the world and China. Section 3 summarizes the various driving forces of green development in China. Section 4 describes the dynamic mechanism model of green development composed by various driving forces. Section 5 is the institutional framework. The conclusions and discussions are presented in Section 6.

2. State of the Art

Green development is a new development concept proposed concerning the progressively reduced supply of resources and energy as well as the continuous deterioration of the ecological environment. It is not only a development concept but also a development model that protects the natural ecological environment and achieves the sustainable development of the economy, society, and ecology. Moreover, the rational utilization of resources, environmental protection, and the maintenance of ecological balance are the core elements of green development [4]. Green development stems from the emergence of sustainable development, and it is the result of researchers who are constantly questioning the large number of environmental problems caused by the traditional industrialization and urbanization models in developed countries. In 1962, Rachel Carson reflected deeply on the environmental damage caused by traditional industrial civilization for the first time in *Silent Spring* [5], which began to draw widespread attention to environmental issues from all sectors of society. In 1989, the British economist Pearce conducted an in-depth analysis of the concept of green economy in *Blueprint for a Green Economy* and discussed the ways of achieving a green economy [6]. Since then, more theoretical research and practices have concentrated on green economy and green development. After the outbreak of the international financial crisis in 2008, Ban Ki-moon, Secretary of the United Nations, launched the Green New Deal, which mainly included resource conservation, environmental improvement, and the sustainable development of human beings and nature. Subsequently, the United States, Germany, Japan, the United Kingdom, France, and other major economic powers have implemented the Green New Deal and issued appropriate regulations and green plans regarding the development of a green economy as a new engine of economic growth. Many newly industrialized countries and regions have also endorsed green development as an important measure and basic national policy to promote the development of their economies and societies.

Aside from measures issued by countries and governments, the recent literature also widely addresses the topic of green development from different aspects. Firstly, the implementation plans and measures of the Green New Deal have been intensively emphasized. The United Nations Environment Programme, the Green Europe Foundation, and other institutions have elaborated on the global Green New Deal plan and the European Green New Deal plan [7,8]. Barbier believed that the global Green New Deal has played a significant role in the economic recovery of various countries [9]. Secondly, green governance is considered an important part of green development. Pedersen pointed out that green

governance, a new development paradigm, can guide human beings to reconsider the relationship between the ecological environment and human development [10]. Claudia advocated preserving the harmonious beauty between enterprises and the environment through green development [11]. Thereafter, green industrial development also has received wide attention from scholars. Feng and Chen analyzed the relationship between environmental regulation, green innovation, and green industrial development [12]. Some scholars have also discussed the strategic significance and approach of green industrial development [13–15].

In 2012, the Report of the 18th National Congress of the CPC put forward the concept, principles, and policies of ecological civilization construction and proposed to focus on green development, circular development, and low-carbon development. In 2015, the Proposal on Formulating the Thirteenth Five-Year Plan for National Economic and Social Development proposed to adhere to green development, indicating that green development has become the strategic goal and direction of national development as a whole. On 24 March 2015, General Secretary Xi Jinping proposed “greening” for the first time at a meeting of the Political Bureau of the Central Committee of the CPC. In April, the Central Committee of the CPC and the State Council issued the Opinions on Accelerating the Construction of Ecological Civilization, which took green development, circular development, and low-carbon development as the basic means of accelerating the construction of an ecological civilization. In October, the Fifth Plenary Session of the 18th Central Committee of the CPC put forward the concept of green development, indicating that the construction of an ecological civilization has entered a new stage in China. The Report of the 19th National Congress of the CPC also mentioned green development many times, opening a new era of green development both in policy and practice in China.

Presently, with much attention paid to green development, there are many researchers focusing on this topic, and large-scale studies have been conducted to discuss the proposition of green development, which is of great significance for the research of green development. The existing literature mainly focuses on the following aspects.

The connotation, challenges, and pathways of green development are a topic of common interest among scholars and policymakers. For instance, Lorek and Spangenberg believed that the concept of sustainable development has often been weakened and misinterpreted, but it is still a convincing concept [16]. The introduction of green economy and green growth is the evolution of sustainable development in current conditions, so they summarized the challenges of green growth and provided some solutions to achieving a sustainable economy [16]. Liao explained the connotation and significance of green development, as well as the means by which this can be achieved [17]. D’Amato et al. analyzed the diversity within and among the concepts of a green economy, a circular economy, and a bio economy based on bibliometric analysis [18]. Gu et al. analyzed the basic connotation of green development and believed that green development is characterized by humanization, ecology, rationalization, economy, high efficiency, cleanliness, low-carbon outputs, safety, high levels of technology, and low costs, and they also compared the relationship among green development, circular development, and low-carbon development [19]. Loiseau et al. summarized the theories, concepts, approaches, and tools related to the green economy and developed a framework that presents the capacity of a green economy’s concepts, approaches, and tools to support the transition to sustainability [20]. Guo studied the challenges to the realization of green agricultural development in the Yangtze River Basin of China [21].

The measurement and assessment of green development have also attracted wide attention from scholars. The Organization for Economic Co-operation and Development (OECD) proposed indicators for monitoring green growth from four aspects, including environmental and resource productivity, the natural asset base, environmental quality of life, and economic opportunities and policy responses [22]. Based on this, Kim et al. selected 12 indicators to measure green growth performance for OECD countries and Korea [23]. As the largest developing country, China’s green development levels have been

intensely investigated. Wang et al. evaluated the green development level of nine cities within the Pearl River Delta of China based on five dimensions, namely, the enhancement of the living environment, the treatment and utilization of pollutants, improvements to ecological efficiency, the optimization of economic growth, and the development of innovative potential [24]. Chen et al. designed an evaluation framework used to measure the level of industrial green development in 30 Chinese provinces and discussed the corresponding influencing factors using a dynamic panel data model [25]. Long et al. evaluated the green development level of China's coal resource-based cities by considering the economic, social, resource, and environmental aspects [26]. Wu et al. measured China's regional green economic efficiency based on a novel data envelopment analysis model and analyzed its dynamic evolution using time series [27]. By using the stochastic frontier analysis based on the translog production function and panel data, the industrial green total factor productivity in Shanghai was proved to present an overall upward trend between 1994 and 2011 [28]. Huang evaluated the provincial green total factor productivity in China from 2000 to 2018 [29].

The strategy and pathways for achieving green development have also been intensely discussed. Csete and Horváth discussed a framework for action by which to reduce vulnerability and adapt to climate change in the European Union, and presented the main objectives of London's greening program and some possible elements of green developments in the adaptation strategy [30]. Chua and Oh studied the progress and evolution of low-carbon policies in Malaysia to indicate the government's commitment to promoting sustainable development [31]. The Chinese government has also paid great attention to green development and has proposed an ecological civilization by focusing on building a resource-conserving and environment-friendly society as a way to accelerate the transformation of the pattern of economic development [32]. Rio and Firza discussed the influence of China's green development strategy in Asia through the implementation of a green development agenda within the Belt and Road Initiative [33]. Li et al. put forward a theoretical framework to explain the green development system in China and its mechanism of formation [34]. Li et al. explained the coordinated mechanisms revealing the reasons and paths for China's green development by proposing a research framework for synergetic evolution; additionally, the different effects of high-quality development that guide resource and environmental forcing mechanisms were also analyzed based on the Haken model [35]. Liao et al. summarized that the model and path of green development should provide guidance to the culture and the linkage of three cores, namely, green culture should be taken as the value guide, and the green innovation of enterprises, the green governance of the government, and residents' green consumption should be taken as the core driving forces; all stakeholders should work together to form a joint force to promote the green development of China's economy and society [36].

Scholars have also paid great attention to the institutional framework of green development. Lv believed that the key to achieving green development is the creation of an effective institutional mechanism and policy environment; changes to the traditional mode of environmental protection; a combination of legal, administrative, economic, and social governance with science and technology; a combination of development with environmental prevention, protection, and governance; a combination of supervision and incentives; a combination of short-term measures with long-term mechanisms; the promotion of consistency between individual benefits and overall benefits; and the promotion of green development [37]. Xu and Zheng pointed out that agricultural production in Zhejiang Province has gradually developed towards the path of green development and initially formed a set of institutional mechanisms for sustainable agricultural development [38]. From the perspective of the relationship between the government and the market, Li emphasized the role of the institutional system in achieving green development in China, and believed that it is necessary to establish and improve the market's institutional system and the governmental institutional system to promote green development [39]. Liang believed that the institutional innovation of China's green development in the following decades

should adhere to the strategic prospect of more than 10–30 years; the innovation should be guided by the concept of community life; the green development plan should be adjusted to promote innovation with overall planning and high quality; and the accuracy of the contents, provisions, policies, and measures within the institutional framework should be improved [40]. Qin and Hu believed that the focus should be on accelerating the greening of production and lifestyles, as well as building an institutional guarantee system to promote green development [41]. Zhu et al. found that industrial structure adjustments can improve green development efficiency [42]. Li and Ren summarized three pathways for achieving China's green development, namely, enhancing the resource allocation capacity of scientific and technological innovation, promoting the effective connection between supply and demand, and building a new pattern of green ecological internationalization based on the globalization of green development [43].

There are a lot of factors that can affect green development. By using provincial panel data from the period 2005–2017, Zou and Zhang explored the influence of environmental regulatory systems on green development in pollution-intensive industries [44]. Chen et al. found that the degree of openness, urbanization, industrial structure, and technological innovation play active roles in promoting regional green sustainable development, while economic growth, corporate ownership structures, fiscal policies, and foreign investment dependence have hindered the progress of regional green sustainable development to a certain extent [45]. Wu et al. found that environmental decentralization and environmental administrative decentralization were important factors in promoting regional green development, but environmental supervision decentralization and environmental monitoring decentralization have negative impacts on regional green development [46]. Jin et al. believed that macroeconomic uncertainty inhibited the green development of less developed cities, and high-level innovation was good for the green development of less developed cities [47].

In addition, green development also involves a wider range of disciplines, including economics, management, ecology, philosophy, law, political science, and so on. All of these studies have provided a theoretical and practical basis for analyzing the dynamic mechanisms and institutional frameworks of green development in this study. Overall, despite the existing literature on green development being fruitful, there is still an insufficiency due to the lack of discussion on the driving forces and dynamic mechanisms. Additionally, there is little literature that analyzes the institutional path to green development from a collaborative perspective. In other words, dynamic mechanisms are the key factor in achieving green development, and the improvement of institutional frameworks is a fundamental guarantee by which to improve the quality of green development.

3. The Driving Forces of Green Development

The correlation and interaction of dynamic factors, which are multifaceted, constitute the dynamic mechanism of green development. This paper discusses the driving forces of green development from four aspects, i.e., pressure, a pulling force, a pushing force, and a supporting force.

3.1. Pressure

Presently, green development in China is facing various pressures from both external and internal aspects. The external pressure on transitioning to green development comes from global pressure for the reduction of carbon emissions, and international pressure for transitioning to green development mainly comes from the requirements of resource conservation and environmental protection.

3.1.1. International Pressure for the Reduction of Carbon Emissions

Externally, the global ecological crisis is intensifying, and green development has become a common consensus among all the countries in the world. Stepping into the 21st century, the challenges faced by human development extend to the lack of resources,

climate change, ecological damage, and environmental degradation, which have caused the problems facing the living environment to become even more severe [48]. Serious resource and ecological issues have become the focus of the international community, and thus the calls for returning to nature and protecting the earth are becoming stronger [49]. Furthermore, after the outbreak of the global financial crisis in 2008, the United Nations' Environment Programme put forward the initiative of the "Global Green New Deal" and the development of the "Green Economy" [50]. Additionally, the United States, the European Union, the United Kingdom, Germany, Japan, and South Korea have launched green development plans successively, showing that green development has become a global consensus and general trend [51].

China, the largest energy producer, consumer, and carbon emitter in the world, is facing increasingly urgent international pressure to reduce carbon emissions [52,53]. The Paris Agreement was reached at the Paris Climate Conference in December 2015, and China has promised to see carbon dioxide emissions enter a plateau or a decline period by 2030, which will force the country to change its economic development towards a green and low-carbon development path. Present Xi Jinping pointed out that green development is the trend in today's world, and Asian countries should coordinate their economic growth, social development, and environmental protection to achieve green development across the world [54]. China, as the world's largest developing country and the second largest economic entity, must actively adapt to the global green development trend by actively improving ecological governance and participating strongly in the practice of global ecological restoration and environmental governance to promote the establishment of fair, reasonable, cooperative, and win-win international environmental rules; China must also try to take responsibility and make greater contributions to global green development.

3.1.2. Domestic Pressure for Resource Conservation and Environmental Protection

Although China's economy has undergone remarkable achievements benefiting from the country's reform and opening-up policies over the past 40 years, it still has serious resource and ecological problems because of its long-term extensive development mode, which has led to a large amount of resource and energy waste [55]. China is a country with a vast territory and abundant resources, but the per capita natural resource consumption is relatively low. The water resources are also deficient, especially in the arid and semi-arid regions in the northwest. Moreover, the reserve resources for cultivated land are also insufficient, especially since oil and iron ore are highly dependent on foreign markets, which leads to the problem of energy security. In addition, serious environmental pollution has also been increasingly troubling for this large country. China's economic growth model during the past several decades can be described as "high investment, high consumption, high pollution, and low efficiency". As a consequence, serious water, air, and soil pollution has occurred in most parts of the country [56,57]. The environmental pollution even approached or exceeded the upper limit of the carrying capacity of China's ecological environment and has become a hindrance for sustainable economic development [58]. Furthermore, ecosystems in China have already been severely degraded. The per capita forest area in China is only 25% of the world's average level, indicating that the forest resources are greatly insufficient. In fact, many areas in China, especially the northwest region, have serious soil erosion, and the phenomenon of land desertification is even more serious [59].

The shortage of resources and the deterioration of the ecological environment have become major problems, indicating that it is the right time for China to achieve the sustainable and healthy development of its economy [60,61]. Green development emerged in this serious situation. Therefore, how to effectively solve the resource shortage and ecological crisis in China has become a major and urgent issue [62].

The enhancement of public awareness of environmental protection is another important pressure leading to the promotion of green development [63,64]. Public awareness of environmental protection can urge people to put forward higher requirements for en-

vironmental quality that will lead to a strong social pressure forcing the government to improve environmental standards and relevant environmental regulations, and will urge production enterprises take greater environmental responsibilities [65].

3.2. Pulling Force

In fact, there has been a strong demand for green development from both the natural and social perspectives, which consist of the pulling force of green development in China.

3.2.1. The Strong Demand for a Beautiful Ecological Environment in China

Providing high-quality ecological products to meet people's growing demand for a beautiful ecological environment is an important goal in the modernization of China [66]. People's demands for a better life have undergone major changes, including the increasing desire for clean air, clean drinking water, safe food, and a beautiful environment after the reform and opening up of the country [67]. President Xi Jinping pointed out that "The environment is people's livelihood, green mountains are beauty, and blue sky is happiness. So we must protect the ecological environment like protecting our eyes, and treat the ecological environment like life" [68]. The long-term rapid growth of the economy in China has caused serious environmental pollution and ecological damage [69]. However, green development can provide more high-quality ecological products to meet people's expectations. The insufficiency of natural resources and the deterioration of the environment have brought about a lot of serious problems such as impacts on the safety of people's property and quality of life and restrictions on the sustainable development of the economy and society [70,71]. The ultimate goal of green development is to improve the living environment and increase the quality of life. To achieve the expectations for a beautiful ecological environment and a high-quality life in China, it must follow the path of green development oriented towards an ecological civilization [72].

3.2.2. The Strong Demand for Green Consumption in China

Since the massive economic development has increased the incomes of consumers in China, people's ideas regarding consumption have undergone a profound change towards green consumption, especially since green and environmentally friendly products have become the mainstream of consumption [73]. The prior factor considered by consumers, i.e., the price, is now becoming a consideration of the quality of the products [74]. Many consumers have begun to avoid the unsafe and substandard products by purchasing imported green and environmental products, which makes green products more competitive in the market [75]. Under the reality that the market for non-green products is shrinking and with the potential profit opportunities brought about by the green transformation of products, some companies have taken the initiative to adapt to the demand for green products, paying close attention to the market, conducting green research and production, and developing green products that consumers need [76]. They try to meet the green consumption needs of consumers to gain more market share [77]. In addition, the strong demand for ecological products by consumers has a significant impact on business operations that will also force some companies to fully consider consumer needs [78]. The demands from consumers will stimulate the development of related green industries and promote green development, such as green production materials, green production processes, green service methods, and ecological products and services [79].

3.3. Pushing Force

Green development is not only a new development vision but also an important goal of the modernization of national governance. In green development, the government, the most important driving force, plays a vital role in the initial stage of green development, which can be mainly reflected in the following aspects: (1) Establishing and improving the policy system to promote green development. The government formulates a series of measures, including industrial policies, financial policies, procurement policies, technology

policies, fiscal and tax policies, investment policies, and talent policies to promote green production, green lifestyles, green circulation, and green consumption. (2) Formulating and improving green laws and regulations related to green development. In recent years, the Chinese government has successfully formulated and revised a series of laws and regulations, focusing on promoting ecological environment governance and protection, as well as promoting the improvement of ecological environment system construction. For example, the Energy Conservation Law, the Environmental Protection Law, the Air Pollution Prevention and Control Law, the Water Law, the Land Management Law, the Circular Economy Promotion Law, the Renewable Energy Law, the Mineral Resources Law, the Forest Law, the Mineral Resources Law, and other regulations. The green development legal system has been gradually improved, forming a full coverage of natural resource management, environmental protection, the comprehensive utilization of resources, and a green and low-carbon circular economy. (3) Establishing the appraisal system for measuring the performance of green development, which is an important guarantee for the implementation of green development. It is necessary to set up reward and punishment mechanisms that accord with the requirements of implementing the development concept. Indexes such as ecological consumption and the degree of ecological environment restoration are included in the performance evaluation system of green development [80]. Thus, this will help policymakers to change their traditional development concepts, establish a scientific view of political achievements, and increase the enthusiasm of governments and departments in promoting green development. (4) Formulating green development plans. Green development not only requires governments to invest funds, talents, and technologies, but also requires planning in which the government must be participate. The government plays a significant role in planning, guiding, managing, and guaranteeing the creation of a favorable policy environment for green development and promoting the development of green plans [81]. Generally speaking, the government is the most important external driving force for green development.

3.4. Supporting Force

With social and technological developments, some supporting forces exist for achieving green development.

3.4.1. Green Technology

Green technology is the key supporting force for achieving green development, preferring the technologies that can improve resource utilization, reduce consumption, reduce pollution, improve the ecological environment, promote the construction of an ecological civilization, and achieve the harmonious development of man and nature. This technological progress can include new energy development and utilization technologies, clean energy technology, waste utilization technology, environmental engineering technology, energy saving, emission reduction technology, cleaner production technology, ecological protection, and restoration technology [82,83]. Green technology can break through the constraints of resources and the environment, minimize the impact of economic development on the ecological environment, and achieve harmony between human beings and nature as well as coordination between economic development and environmental protection. Green technology supports green industrial and agricultural production, the promotion of industrial structure optimization, industrial localization, and green consumption [84–86]. It also allows the possibility for the construction of an ecological civilization and the realization of green development. Furthermore, green technology is conducive to economic transformation and upgrading, improving the quality of economic growth, and cultivating new competitive advantages. Innovation is the primary driving force of development. Without green technology innovation, it is difficult to achieve high-quality green development, and it is difficult to form continuous support for green development. To promote green technology innovation and strengthen its support, in the future, efforts should be made to create an institutional and social environment, to build a green development technology

innovation system, to carry out independent innovation around key core areas, and to actively establish the transformation of green technology achievements to promote the industrialization of green technology.

3.4.2. Green Culture

Green culture, an endogenous force, is another important force supporting green development. Culture affects people's ideas, lifestyles, and consumption patterns, and it has the function of educating, guiding, and shaping people [87]. Green culture is an important invisible influence, advocating an ecological vision in which humans and nature coexist in harmony. It emphasizes that human beings should respect nature, conform to nature, cherish nature, and use it appropriately [88–91]. By influencing people's value orientations, green culture can promote the formation and development of green values, such as a sense of green production and green consumption [92]. Long-term green culture education is a driving force for green development that can promote the formation of green values, root the concept of an ecological civilization in people's minds, and allow people to become resource saving and environmentally friendly [93]. Green culture can effectively condense concept identification and enhance value consensus. It helps to enhance people's ecological and environmental protection awareness and restrains people's daily bad behaviors that are not conducive to the development of an ecological environment. Therefore, China should vigorously advocate and promote green culture, attach importance to the establishment of green culture, and offer solid conceptual support for promoting green development.

4. The Dynamic Mechanism Model and Action Mechanism of Green Development

As mentioned above, the four kinds of driving forces behind the dynamic mechanisms of green development are pressure, the pulling force, the pushing force, and the supporting force. Although these may not exist simultaneously, they can have an interactive influence on each other. This study discusses the dynamic mechanism model of green development from these four aspects (shown in Figure 1).

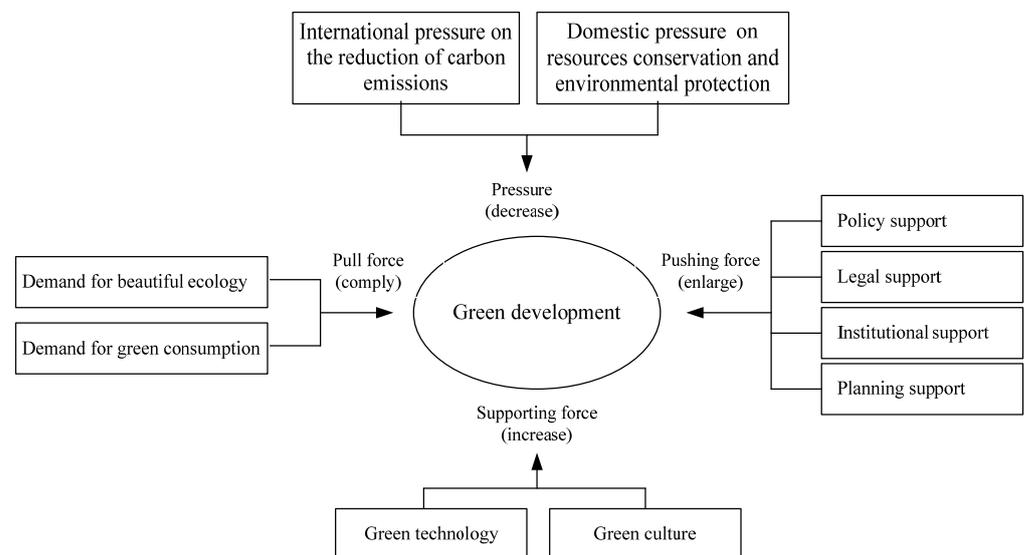


Figure 1. Dynamic mechanism model of green development.

Among the four forces, pressure includes international pressure (the global ecological crisis has led to green development becoming a common consensus and plan of action of all the countries in the world) and domestic pressure (the increasing public awareness of environmental protection and the fact of ecological environment deterioration). The pulling force includes people's demand for a beautiful ecological environment and green consumption, and the pushing force mainly comes from the government, which is the most

important external pushing force for green development. Currently, green development without government participation is unrealistic, as it plays a crucial role in the initial stage of green development. The supporting force comes from green technology and green culture, both of which are the key supporting forces for realizing green development.

In the face of international pressure due to the intensifying global ecological crisis (including global warming and environmental degradation) and the increasingly popular consensus of green development, as well as domestic pressure due to resource shortages, the deterioration of the ecological environment, and the enhancement of public awareness of environmental protection, the Chinese government is entrusted with the responsibility of improving the ecological environment and transitioning to green development by issuing relevant policies, laws, institutions and plans and performing its functions. In addition, there is an increasing demand for a beautiful ecological environment and green consumption, which promotes the transition to green development through cooperation with the government's green transformation policy. However, the transition to green development cannot be accomplished without the supporting force composed of green technology and culture, where green technology provides the physical supporting force and green culture provides the spiritual supporting force. In this way, the above four driving forces are not isolated but interact and influence each other, which, together, constitute the dynamic mechanism of green development.

The four key driving forces of the dynamic mechanism have different roles and effects in different stages of green development. Technological and cultural support runs through the whole process of green development. The pressure and pulling forces play more obvious roles in the initial stage of green development, and they directly promote the government to reform traditional development concepts and to undertake industrial transformation and upgrades and the greening of business operations and people's lifestyles. Strong government support is always the most important guarantee for green development. To promote green development, we should actively reduce international and domestic pressure, comply with the people's demand for a beautiful ecological environment and green consumption, increase the government's driving force, strengthen green technology and cultural support, and optimize the combination of different influencing factors to form a joint force to promote green development.

5. The Institutional Framework of China's Green Development

Green development, which is a complex and long-term project, requires the participation of multiple stakeholders, elements, and mechanisms for coordinated advancement. This study analyzes the institutional framework for achieving green development, which includes education, the legal system, multi-stakeholder participation, ecological compensation, scientific and technological innovation, regional cooperation, and other institutional paths from the dimensions of conceptual synergy, legal synergy, stakeholder synergy, incentive synergy, technology synergy, and regional synergy, as presented in Figure 2.

5.1. Conceptual Synergy

Thought is the precursor to action and determines human behavior. To effectively popularize the concept of green development and guide society towards developing in the direction of saving resources and energy and protecting the ecological environment, it is necessary to build a green development education system to conduct self-regulation and restraint and to form a green development consensus. The conceptual synergy can be achieved through the following aspects: (1) Strengthening the publicity of the idea of green development. At present, in response to the increasing shortage of resources and prominent ecological and environmental problems, governments and relevant departments should increase publicity and guidance through public services, including advertisements, social networks, media publicity, and other channels to increase the attention from society to green development and to enhance the green development of enterprises and the public. (2) Incorporating green development content into the education system. The government

should incorporate green development-related content into primary, secondary, and pre-school education systems because of the powerful guiding function of education. It is also necessary for the government to provide legal education on green development for primary and secondary school students, guiding them to learn the related laws and regulations of green development, which will allow the students obey the rules and improve their ecological civilization. (3) Putting the concept of green development into action. Promoting ecological civilization and green development not only requires citizens, enterprises, and governments to have ecological civilization and green development awareness but also needs them to convert this awareness into conscious green actions.

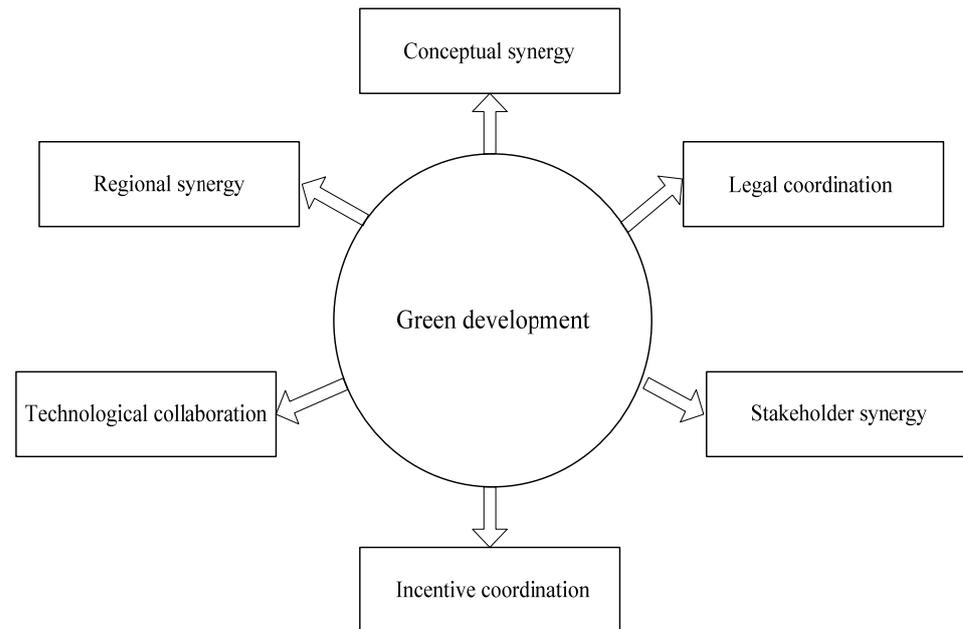


Figure 2. Institutional framework of China's green development.

The government needs to call on enterprises and the public to integrate green environmental protection awareness into their daily production and life, advocate environmentally friendly and low-carbon production and lifestyles, and conduct green production and green consumption. It is also necessary for the government to strengthen environmental protection training for leading cadres and business leaders. Based on increasing participation awareness and participation ability, the government should continuously improve ecological environment information disclosure mechanisms, information disclosure, and the transparency of enterprises' environmental protection behavior, environmental quality monitoring, and environmental management to ensure the public's rights, such as the right to know, the right to participate, and the right to supervise, in green development. In addition, improving the channels for public participation in green development will create a good atmosphere for the whole society to actively participate in green development. In particular, the development plans, construction projects, and major issues involving the public's environmental rights and interests should be guided by soliciting opinions, hearings, demonstrations, public announcements, and so on to accept supervision from the public.

5.2. Legal Coordination

As legal support is an important pushing force for achieving green development, it is necessary to improve the relevant legal systems and regulations to provide legal support for green development.

Promoting green development is inseparable from the construction of laws and regulations. To improve the level of green development, the central government should formulate

the environmental protection laws and regulations. Moreover, provinces and cities should also improve environmental protection rules and regulations based on the local conditions and relevant national laws. The formulation of local regulations for ecological and environmental protection should consider the level of ecological construction and actual development needs in the region, and this should enhance the feasibility and operability of the laws and regulations without violating national laws. The formulation of local regulations should pay attention to the refinement of environmental laws and regulations and should clarify the rights and responsibilities of specific government departments, the terms of pollution reduction, environmental taxation, and illegal fines.

In addition, strictly enforcing the law and strengthening government functions and responsibilities are necessary. Strict law enforcement should strengthen the construction of professional law enforcement teams by implementing a post-responsibility accountability system, clarifying the responsibilities of each law enforcement officer, and investigating the relevant responsibilities for those who fail to perform their duties. Strict law enforcement also must be carried out in accordance with the detailed rules and regulations of various places so that the processing results are rationalized and transparent; various media forces should be used skillfully to enhance the prestige and height of law enforcement. For intentional illegal acts, malicious illegal acts, and other misconduct, the punishment should be increased to set an example so as to eradicate unlawful acts of inaction and even chaotic acts.

5.3. Stakeholder Synergy

The stakeholder synergy concerns establishing a multi-stakeholder governance system and building a community of green development.

The report of the 19th National Congress of the CPC emphasized that it is essential to build an environmental governance system led by the government; the main body is enterprise, and the participants are social organizations and the public. The public nature of the ecological environment determines the necessity of the participation of enterprises, social organizations, and the public in green development. Increasing the participation of non-governmental organizations in environmental protection, which can provide an endogenous impetus for the modernization of the green development governance system and governance capacity, is an important measure by which to promote green development.

An important experience in the successful governance of the Rhine River was the active and extensive participation of the government, enterprises, social organizations, and the public in forming a multi-stakeholder governance pattern [94]. Green development in China should fully mobilize social forces, stimulate the vitality and enthusiasm of social subjects, and improve the willingness and level of governance. Additionally, the government ought to improve the system of participation of multiple stakeholders in ecological environment governance and clarify the public's right to know and participate in ecological environment governance in order to achieve the effective coordination of multiple stakeholders.

5.4. Incentive Coordination

Incentive coordination attempts to provide an optimal ecological compensation system and stimulates the green development momentum of the relevant stakeholders.

A reasonable ecological compensation system can stimulate the momentum of the relevant stakeholders in pursuing green development. Therefore, the government ought to establish a cross-administrative regional ecological compensation system, in which the beneficiary regions make reasonable compensation for the regions responsible for ecological protection, in accordance with the principles of "whoever pollutes, controls" and "whoever benefits, compensates". The cross-regional ecological compensation measures are formulated mainly with local compensation, and there is a mainstay and special support from the central finance. The form of compensation should adopt a flexible method that combines monetary compensation and counterpart cooperation, industrial support, park

construction, and technical guidance so as to effectively mobilize the enthusiasm and initiative of the ecological product supply area.

Thus far, the price reform of resource-based products such as water, minerals, and energy has not been fully implemented. Although the system of the paid use of resources has been established, it has not fully reflected its due ecological value, and ecological compensation is still being explored. At present, it is necessary to deepen the reform of resource product prices and taxes to establish a paid use system that truly reflects the supply and demand and scarcity of resources, as well as resources of ecological value. More importantly, it is important to improve the ecological compensation system and reasonably divide the rights and obligations of the ecological protectors to form an institutional mechanism whereby by ecological damage is compensated and the beneficiaries and protectors receive reasonable compensation. The government ought to carry out in-depth pilot projects for water rights trading, carbon sink trading, and emission trading in river basins to explore comprehensive compensation methods. The ecological compensation system will assist in achieving the coordinated development of beneficiary areas and ecological protection areas through. In April 2020, the Ministry of Finance, the Ministry of Ecology and Environment, the Ministry of Water Resources, and the State Forestry and Grassland Administration jointly issued a document to support and guide the nine provinces and regions of the Yellow River Basin to establish a horizontal ecological compensation mechanism. This is a beneficial exploration of the cooperative protection and governance of the Yellow River among the nine provinces and regions in the Yellow River Basin, and it also provides experience for ecological compensation for green development in other regions.

5.5. Technological Collaboration

Green development calls for technological support, and the improvement of green technology and innovation systems will provide technical support for green development.

Green technology, an important support for green development, is still lagging behind in China. In order to accelerate the promotion of green development, an institutional and social environment conducive to green technology innovation should be created. Measures regarding how to accelerate the adoption of green technology are suggested as follows. On the one hand, policymakers should actively build an innovation platform for the promotion of green technology to help enterprises open cooperation channels with universities, scientific research institutions, and key laboratories, promoting a combination of production, education, and research in universities, scientific research institutes, and enterprises to form technological synergy and provide high-quality technical support for green development. Innovations that focus on the research of high-tech equipment with high scientific and technological support for the control of pollution should also be explored for the purpose of saving resources and protecting the environment. On the other hand, policymakers should make full use of social capital for green technology because the promotion of green technology, especially the research process, requires a large amount of capital investment and the funds invested by the government are not enough. For major environmental protection projects and ecological construction projects of green development, various means such as free funding and pilot funds can be used to support them.

In order to promote technological innovation, one suggestion is to guide and support a group of key universities, research institutes, and enterprises in joint scientific and technological research and achievement transformation in the green field, and to cultivate a group of advanced green high-tech products and products with independent intellectual property rights. Additionally, it is necessary to actively cultivate the green technology market, give play to the decisive role of the market in resource allocation, and enhance the overall green technology strength to promote green development. To improve the level of green technology, talents are indispensable. Therefore, the implementation of talent strategies and increasing the introduction and training of relevant high-end talents are useful.

5.6. Regional Synergy

Due to the cross-regional nature of the ecological environment, ensuring cross-regional cooperation is an important measure by which to promote green development, and it is also a new way to coordinate the current regional and river basin ecological environment governance. The government should actively promote the construction of an institutional environmental protection coordination system across administrative regions, effectively give full play to the leading figures, and further deepen the construction of the ecological civilization system.

In cross-regional cooperation, local governments are the main body at all levels. The local governments should establish the concept of win–win cooperation, abandon the concept of vicious competition, change the environmental governance thinking of beggar-thy-neighbor, consciously cooperate with surrounding areas, coordinate interests and responsibilities between regions, and avoid transferring environmental responsibility. Many eco-environmental governance systems in green development are inter-provincial, and the provincial governments are the most important responsible subjects. Therefore, each province should strengthen government cooperation with neighboring provinces and innovate cross-regional provincial government cooperation mechanisms. With the help of inter-provincial regional planning, it is important to establish an inter-provincial environmental protection coordination management mechanism and an environmental monitoring network mechanism, thereby strengthening regional ecological environment governance and protection and forming regional green development synergy.

6. Conclusions and Discussion

Green development can reduce the pressure on resources and the environment, resolve the conflict between economic development and ecological protection, and promote the construction of an ecological civilization in China. The dynamic mechanism is of great significance in achieving green development, and the improvement of institutional frameworks is a fundamental guarantee for improving the quality of green development. The existing literature lacks discussion of the driving forces as well as the dynamic mechanisms of green development, and there is even less literature that systematically analyzes the institutional path for green development from a synergistic perspective. By analyzing the four kinds of driving forces of green development and the dynamic mechanisms, as well as by providing institutional paths, the contributions of this study can be drawn as follows:

- The four aspects of the driving forces, namely, pressure, the pulling force, the pushing force, and the supporting force, were identified and analyzed regarding China's transition to green development.
- The dynamic mechanism of green development in China has been discussed, and it is believed that the four driving forces may interact with each other, and, together, they generate the power that promotes the transition to green development.
- The institutional framework for achieving green development is provided, which involves aspects of education, law, interest coordination, ecological compensation, technological innovation, and regional cooperation from the dimensions of conceptual synergy, legal synergy, stakeholder synergy, incentive synergy, technological synergy, and regional synergy.

The limitations of this study lie in the following aspects. Firstly, our study mainly focused on the driving forces and institutional frameworks of green development through a theoretical analysis; no empirical analysis was conducted in this study. Some empirical studies have investigated the influence of a series of factors including economic growth, macroeconomic uncertainty, market openness, urbanization, industrial structure, foreign investment dependence, corporate ownership structure, technological innovation, environmental regulation, and fiscal policy on green development, and most of them have been proved to have positive or negative effects on green development. However, the impacts of the driving forces mentioned in this study have seldom been involved in empirical studies. Thus, in future research, an empirical analysis can be conducted to investigate the

specific influence of these driving forces on green development by taking the provinces and cities in China as a sample, and the effectiveness of the institutional frameworks can also be tested and verified in this empirical analysis. Secondly, various driving forces of green development in China have been summarized in this study, and future research can compare the driving forces of green development in different countries, especially the differences between developed and developing economies.

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