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Regional Coordinated Development of China's Ecological Civilization Progress in the New Era

The Comprehensive Research Group for *Research on Several Strategic Issues on Ecological Civilization Construction*

Abstract: Based on the comprehensive research results of the Chinese Academy of Engineering's major consulting project, "Research on Several Issues on Ecological Civilization Construction (Phase III)," we investigated the development level and dynamic changes in China's ecological civilization progress in 2017. Focusing on the regional imbalance of ecological civilization development in China, we selected several typical areas as research objects, including Eastern China, Central China, the ecologically fragile region in Western China, and the Beijing-Tianjin-Hebei region. Then, we summarized and analyzed the regional differences and prominent problems in the development of ecological civilization in China from the aspects of the integrated and comprehensive improvement of the urban agglomeration environment, the ecological protection and green evolution of the key zones for development, the coordinated development of ecological resources and assets in ecologically fragile regions, and the value realization of ecological products in the developed regions. Finally, we proposed relevant countermeasures and strategies that provide suggestions for the macro decision-making and the coordinated development of an ecological civilization in China in the new era.

Keywords: new era; ecological civilization; regional coordination; Beijing-Tianjin-Hebei urban agglomeration; Central China; Eastern China; ecologically fragile region in Western China

1 Introduction

The construction of an ecological civilization is of paramount importance for the sustainable development of China. Since the 18th National Congress of the Communist Party of China (Nov. 8, 2012), China has been advancing in exploring the ecological civilization construction path with the blend between ecological society construction and the consumption concept, the integration between ecological industry construction and urban ecology, and the harmony between ecological agriculture construction and rural ecology. Moreover, this study shows that it has been focusing on the strategies between resources-and-environment-carrying capability and the development pattern of the economic society, on the use of classified solid waste as resources, etc. [1,2]. Since the 19th National Congress of the Communist Party of China (Oct. 17, 2017), China has entered another phase of ecological civilization construction, which has advanced on a fast track with unprecedented achievements due to the idea of ecological civilization having received popular support [3]. However, some issues in ecological civilization construction still need to be resolved, such as the imbalance between urban areas and rural areas, that among different regions, and that between economic development and eco-conservation. Based on previous studies

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and focusing on regional issues, this paper analyzes the interregional coordinated development of eco-civilization by selecting typical areas of the region, province, city, and county, in order to fulfill the strategic demands arising from the coordinated development of the Beijing–Tianjin–Hebei region, the rise of the middle region, the construction of an ecological safety curtain in the western region, and the establishment of national pilot sites of eco-civilization. This study focuses on evaluating China's national performance in ecological civilization development and uncovering the regional differences and problems in eco-civilization construction. By considering regional coordination as the solution, it proposes a strategy and countermeasures in eco-civilization development and demonstrates the strategic importance of employing a new development philosophy, adjusting economic structure, promoting the evolution of green finance, improving the ecological environment, and continuing eco-civilization development.

2 The achievements of eco-civilization construction in the new era

In order to achieve the objective of eco-civilization construction and ecological civilization development of China, the comprehensive research group has upgraded the index system, the standard, and the evaluation method of the ecological civilization index (ECI) established in "Research on Several Issues on Ecological Civilization Construction (Phase II)" by evaluating the level of ecological civilization development in 2017 and analyzing the change from 2015 to 2017 [4,5].

2.1 China's ecological civilization development was generally close to "Good"

In 2017, as 179 Chinese cities were ranked "Excellent" or "Good" in terms of ecological civilization development, the country's score was 69.96, which accounted for more than 55% of all the evaluated cities and for around 44% of China's national land area. Out of all the evaluated cities, 0.62% were ranked "Excellent" (A), 54.46% were ranked "Good" (B), 42.46% were ranked "Average," and 2.46% were ranked "Poor" (Table 1). The best three provincial administrative regions were the Fujian Province, Zhejiang Province, and Chongqing City, whereas the best ten cities were Xiamen, Hanghzou, Zhuhai, Guangzhou, Changsha, Sanya, Huizhou, Haikou, Huangshan, and Dalian with the average score of 78.47.

Table 1. China's scores of ECI in 2017.

ECI Level	Numbers of city	Average score	Percentage (%)
A	2	80.47	0.62
B	177	73.34	54.46
C	138	66.16	42.46
D	8	58.09	2.46

2.2 The improvement in the efficiency of eco-civilization construction was prominent

Compared to that in 2015, China's score in the ECI increased by 2.98 in 2017 as the improvements in 37 cities were significant and those in another 198 cities were satisfactory—around 60% of China's land area has clearly progressed (Table 2). During these two years, the environmental quality continuously improved, and the economic society advanced rapidly. From 2015 to 2017, China's per capita gross domestic product (GDP) increased by 6.2% per year, which contributed to an enhancement of 0.19 in its ECI score, while those for the air quality index (AQI) and the city water quality index (CWQI) declined by 11% and 20%, respectively, which contributed to respective improvements of 0.53 and 0.48 in the ECI scores.

Table 2. China's ECI level change between 2015 and 2017.

ECI Level	Number of Cities in 2015	Number of Cities in 2017	Change of Number of Cities
A	0	2	2
B	105	177	72
C	192	138	–54
D	28	8	–20

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2.3 China's obvious shortage in eco-civilization was clearly alleviated

The severe environmental issues creating problems for public health were alleviated. The percentage of unqualified cities in the environmental quality index (EQI) declined from 18% in 2015 to 9% in 2017, and the scores of 157 cities for ambient air quality and 89 cities for surface water quality increased by more than 5 points. Environmental equality in the key areas improved evidently. Beijing's improvement in ECI by 7.54 made it the fastest among other cities, with its environmental equality contributing 6.38 to the ECI score. The incoordination between economic development and environmental conservation was alleviated. A total of 142 cities enhanced scores in both the EQI and the industrial optimization index (IOI), accounting for 43% of all the evaluated cities.

3 China's regional differences and issues in ecological civilization development

China's ECI scores in the eastern region, the middle region, and the western region were 71.17, 69.91, and 68.98, respectively. The "Excellent" and "Good" cities were primarily from the Anhui Province, Zhejiang Province, Fujian Province, and Guangdong Province, the "Average" cities were scattered, and the "Poor" cities were primarily from North China and Northwest China. Based on the data, 62% cities in the eastern region were either "Good" or "Excellent," whereas no city in the middle region and the western region was "Excellent," but 59% cities in the middle region and 46% cities in the western region were "Good" (Table 3). The data indicate that the coordination among regions and the imbalance between economic development and ecologic environmental development are still key problems in China's ecological civilization development.

Table 3. ECI of China's eastern region, middle region, and western region.

Eastern Region				Middle Region				Western Region			
Field	Score	Index	Score	Field	Score	Index	Score	Field	Score	Index	Score
Green environment	67.85	Ecological condition	60.56	Green environment	69.95	Ecological condition	65.20	Green environment	70.77	Ecological condition	56.93
		Environmental equality	72.71			Environmental equality	73.12			Environmental equality	80.00
Green production	71.47	Industrial optimization	71.78	Green production	68.09	Industrial optimization	65.78	Green production	67.44	Industrial optimization	65.48
		Industrial efficiency	71.02			Industrial efficiency	71.54			Industrial efficiency	70.38
Green life	69.20	Urban-rural coordination	67.84	Green life	66.14	Urban-rural coordination	64.84	Green life	61.62	Urban-rural coordination	59.22
		Urban life	70.82			Urban life	67.69			Urban life	64.40
Green infrastructure	79.64	Pollution treatment	95.88	Green infrastructure	77.56	Pollution treatment	95.16	Green infrastructure	76.81	Pollution treatment	92.25
		Natural conservation	47.56			Natural conservation	46.38			Natural conservation	51.68

3.1 China's eastern region's imbalance between eco-conservation and economic development

The economy of the eastern region is better than that of China's other regions; hence, its ecological civilization development is also better. In 2017, the eastern region's average score in ECI was 71.17, which was "Good," having increased by 2.95 from 2015. In this region, two cities were "Excellent," 61 were "Good," 38 were "Average," and only one was "Poor," accounting for 1.96%, 59.80%, 37.26%, and 0.98%, respectively. Nonetheless, the region's economic development had no coordination with its eco-conservation. The region's green production scored 71.47, which was 3.38 higher than the middle region's score or 4.03 higher than the western region's; the eastern region's green production score was 67.85, which was 2.1 lower than the middle region's or 2.92 lower than the western region's; the gap between the green environment score and the green production score was 3.62, which was much higher than those of the middle region and western region; the eastern region's imbalance between urban development and rural development was evaluated by the ratio of per capita disposable income of urban residents divided by that of rural residents, i.e., 2.03, which was 0.17 higher than that

of the middle region or 0.64 higher than that of the western region. In the eastern region, the disposable income per capita of urban residents was twice as high as that of rural residents. As the eastern region was given priority in development, the region paid the cost in resources and environment; some areas were initially polluted but became pollution-free after receiving the treatment. In the future, the value of ecological products should be realized by optimizing industrial structure, better utilizing resources, and devoting more efforts to treating pollution.

3.2 China's middle region under the pressure of both eco-conservation and economic development

The middle region is of strategical importance in China's regional development. The region is China's base for grain production, energy and raw material, modern equipment manufacturing, and high-tech industry, and the country's comprehensive transportation hub [6]; therefore, it is considered its core region in modern agricultural development and new national urbanization. In 2017, the middle region scored 69.91 in ECI, which was "Average" and 2.78 higher than that in 2015. In this region, no city was "Excellent," whereas 61 cities were "Good," accounting for 59.22% of all the evaluated cities in the region, 39 cities were "Average," accounting for 37.86%, and three cities were "Poor," accounting for 2.92%. Nevertheless, the middle region had problems, such as the overall industrial structure being irrational, the structures within all three industries leading to unfavorable economic results, the percentage of light industry being unreasonable, and the eco-environment being damaged by extensive resource exploitation. The added value of the tertiary industry amounted for only 43%, which was 4% lower than that of the eastern region; its green environment score was 69.95, which was 2.1% higher than that of the eastern region and 0.82 lower than that of the western region. The middle region was still in the phase of late industrialization. The region's dependence on resources, labor forces, and investments made it difficult to upgrade its emerging industries. In the future, the region should emphasize high-quality development and balance the relation between "development with conservation" and "conservation with development."

3.3 China's western region's eco-safety was threatened, and the task of alleviating poverty urgent

China's western region, the key ecological safety curtain of China, plays an important role in water conservation, wind prevention and sand fixation, the conservation of a variety of creatures, and more. It is very difficult for the region to balance conservation with development since it must speed up its economic development in order to maintain national unity and stabilize the situation around the frontier under the pressure of both the conservation of "clean waters and green mountains" and the creation of "gold and silver mountains." In 2017, the western region ECI score was 68.98, which was 3.17 higher than that in 2015. In the western region, no city was "Excellent," 55 cities were "Good" accounting for 45.83%, 61 cities were "Average" accounting for 50.83%, and four cities were "Poor" accounting for 3.34%. In the western region, infrastructures and public services were lagging behind. The region scored 76.81 on "green infrastructure," which was 2.83 lower than the eastern region; with the unbalanced economic development between urban areas and rural areas, the percentage of the income of the urban residents divided by that of the rural residents was 2.67, which was 0.64 higher than that of the eastern region and 0.17 higher than that of the middle region. In the western region, the disposable income per capita of urban residents was three times higher than that of rural residents. In this region, the ecosystem was fragile. The slow economic society led to a slow ecological civilization development. In the future, the region should emphasize pollution treatment, the construction of infrastructures (such as transportation), and the development of the tourism industry to further consolidate achievements in alleviating poverty and developing ecological civilization.

3.4 In the Beijing–Tianjin–Hebei region, ecological civilization development was unbalanced among different areas as well as between urban areas and rural areas

The Beijing–Tianjin–Hebei region is considered a world-class urban agglomeration, the pioneer in interregional coordinative development and reform, the new engine of national economy driven by innovation, and the model of recovering ecology and improving environment. In 2017, the Beijing–Tianjin–Hebei region scored 64.83 in ECI, which was 4.28 higher than that in 2015. From 2015 to 2017, Beijing's progress in the score was 7.54, which was the largest in the region as Beijing's atmosphere equality and water equality increased by 15.84 and 14.53, respectively. However, it completely differs in terms of comprehensive treatment because the heavily polluted

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areas in the region had the problems of heavy effluent and emission as well as much compound pollution, as Hebei separately scored 59.76 in the "industrial efficiency" index. Consequently, both a wide gap between urban areas and rural areas and the poor development made the enhancement of the whole ecologic environment difficult. Beijing, Tianjin, and Hebei scored 72.61, 74.06, and 60.57 in the "urban-rural coordination" index as Hebei's gap between rural development and urban development was higher than Beijing's and Tianjin's. The Beijing–Tianjin–Hebei region should emphasize the strategy of integration, bridging the gaps among different areas as well as between urban areas and rural areas in order to develop ecological civilization by bringing innovation in the system and/or the mechanism.

4 Coordinated development strategy in eco-civilization

4.1 General goal

China should follow the strategy of eco-civilization construction and national economic development, aim to help people pursue a good life, and establish green-oriented industries in order to encourage a green production and lifestyle. In economic development, green and low carbon should be considered as a powerful engine, and both people's material livings and eco-assets should be upgraded.

By 2035, economic development and eco-assets will have improved as China's per capita GDP will reach 20 000 U.S. Dollars; the eco-assets will have improved by 35% from 2015, the society will have become low-carbon, with minimum waste materials, and without toxin, and the eco-industry will be the powerful engine for economic development. By 2050, the amount of material and ecological resources will have become as great as the average level of developed countries as China's per capita GDP will reach 30 000 U.S. dollars, and eco-assets will have improved by 50% from 2015. China will basically form a "zero waste society" and fully complete the construction of the "beautiful China" in the new era, featuring socialism with Chinese characteristics in order to set the "Chinese example" for the sustainable development of the world.

4.2 Basic principle

China should adhere to symbiosis development, providing people with highly qualified ecological products while simultaneously maintaining their material prosperity. China should adopt harmony and a win-win strategy—coordinately developing economic growth, eco-conservation, and social welfare for the purpose of a win-win and coordinative growth between urban areas and rural areas, among industries, and among different areas. China should follow the principle of carbon balance—facilitating nature's absorption of all waste materials from carbon during production. China should strictly implement recycling without waste—establishing a system in which all production waste should be recycled. China should devote efforts from the perspectives of both cultivating market demand for green and supporting eco-products in order to form a developed market mechanism.

4.3 Clarifying the strategy

The first step is driving major functions to balance developments. We should determine the developmental directions of different regions according to their major functions. The advantage of the eastern coastal region being an economic pioneer should be spread to the middle region and the western region so that both regions are positively affected. The agricultural strengths of the middle region and the benefits of its location should be exploited by the other two regions. In the western region, the priorities of the strategic base reserving eco-assets that conserve and construct the eco-environment should be strengthened, and developed cities should assist villages and industries in supporting the agriculture sector in order to integrate development between the urban economic society and the rural economic society. China should devote more efforts to environmental conservation and eco-construction to promote the sustainable development of the economic society.

The second step is driving the markets to cultivate a new ecologic industry. As markets are the fundamental base of economic development, only they can motivate the development of enterprises. Currently, consumers' demand for beautiful ecology becomes increasingly stronger, and their patterns of consumption are gradually improving, so the demand for policies and markets will assist in boosting the powerful green engine of social-economic development.

The third step is driving innovation to support high-quality development. We should take a completely new step toward ecological environment and the efficient utilization of resources and energy by using collective breakthroughs in green science and technology. We should develop a collaboration between basic green theoretical research and green applied research, coordinated technology development, and the explosion among creation, innovation, and integrated innovation. We should convert green technology innovation into productivity as soon as possible and boost the integrated innovation and cross-area development among new technologies, new industries, new forms of industries, and new modes to provide high-quality development with endless energy.

The final step is driving institutions to maintain coordinated interregional development. We should promote reforms of taxation, finance, price, and investment at the same pace. We should perfectly reinforce the fair and just mechanism constraining and motivating the market and perfectly implement the mechanism clarifying punishments and rewards as well as realize the government's responsibility and power. We should construct a scientific, normative, and efficient system that has the people at its core. Consequently, the institution will function as a powerful safeguard for interregional coordinated development.

4.4 Measures

4.4.1 We should enhance interregional environment treatment of urban agglomerations and innovate relevant systems and mechanisms.

Interregional coordinated development relates to various local governments, sections, and so forth. It is then proposed that we establish a coordinative mechanism for eco-construction and environment protection of large urban agglomerations, formulate regulations for preventing and treating regional environmental pollution, and actively apply the technology that helps both preventing and controlling atmospheric pollution. We should establish a mechanism of cooperation in interregional environmental protection and a system for joint supervision and law enforcement in order to enhance the ability of monitoring, early warning, and dealing with emergencies. We should optimize the system of supervision and statistics so that all the counties in a region can be covered, and the supervision should be regular so that the ECI at the county level can be evaluated.

4.4.2 We should devote more efforts to realizing the value of ecologic products in major ecological zones to alleviate poverty.

Following the rule of nature, we should scientifically administer and protect nature reserves to benefit from both ecologic and economic development. Based on the project of caring "mountains, water, woods, farmlands, lakes, and grass," we should coordinately implement the project eco-remediation and eco-treatment in order to consolidate and improve the ability to supply economic products. We should plan the strategy realizing the value of eco-products in the "ecological red line". Based on a stable improvement in the supply of products, both the eco-product producers and protectors should be benefited. When farmers have skills to continuously improve their lives, poverty will overcome. We should devote more efforts to infrastructure construction in poverty-stricken areas to help realize the value of eco-products and to narrow the gap between urban areas and rural areas [7].

4.4.3 The regions should identify their features to intensively implement industrial ecologicalization in major development zones.

The major development zones should firmly maintain the "ecological red line" during a developing economy—meaning to develop without threatening the environment. We should focus on economic development transformation and major environmental and ecological problems such as atmosphere pollution, water pollution, and soil pollution; we should collectively organize resource utilization and environmental protection and collectively plan the industrial layout and ecosystem protection. The green environment should be the orientation of industrial development; we should promote emerging industries to be green ones and support the striving industries to develop energy-conserving and environmentally friendly farming and forestry, with key features as well as eco-tourism in order to encourage new green economic growth, reinforce energy conservation and emission reduction and develop a low-carbon economy. We should select the new eco-civilization construction mode emphasizing specialty industries, biomass, water environment, and resource-based economic transformation to drive the development of the entire region. In order to intensively implement the thought of "development with conservation," we should customize the development plan in speeding up emerging industries, biomass energy

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optimization, water environment conservation, and resource-based economic transformation.

4.4.4 We should identify the poor, eco-fragile areas in the western region and establish development plans to ensure the coordinative growth of eco-assets.

We should accelerate the establishment of a system conserving the western ecological safety curtain and improve ecological remediation for the growth of eco-assets as well as intensively implement various projects in ecological remediation, perfectly reinforce the mechanism of investment in ecological remediation, and intensify the proper regulation and utilization of eco-assets. We should actively explore the industrial system that is green and uses low carbon in the western region, develop eco-tourism and green specialty agriculture, protectively exploit ore resources, develop the circular industry, and explore China's western carbon sink industry. We should provide the unitive fund only for national ecological compensation, and environmental protection tax should be considered part of the fund; land-transferring fees in major development zones and optimization development zones should be charged according to the percentage; we should also consider fund procurement methods such as issuing eco-lottery, eco-bond, and eco-insurance in order to add sources of the fund. The amounts of compensation should be paid based on the demands of different counties or districts in eco-conservation, livelihood improvement, and public service, and we should devise a plan and budget for supplying eco-products and eco-production. With an eco-product license, the farmers' profit should be related to eco-equality so that they will be motivated to support eco-conservation.

5 Conclusion

The major consulting project of "Research on Several Strategic Issues on Ecological Civilization Construction (Phase III)" fulfills the strategic demand in ecological civilization construction in typical areas during the thirteenth five-year period. This paper proposes strategies for the interregional coordinative development of eco-civilization in the new era by studying and analyzing the cases from various perspectives; for this reason, the study is considered important in promoting China's ecological civilization construction.

Currently, China's eco-civilization construction is in a key phase where the construction is under multiple pressures, where we should provide high-quality eco-products to meet the increasing demand for a beautiful eco-environment on a daily basis, and where we have the abilities to find opportunities for managing important problems related to the eco-environment. We should genuinely accept the fact that China still has shortcomings in eco-civilization construction, and that it is far behind the developed countries in terms of major indices of eco-civilization, such as environmental equality and industrial efficiency.

This comprehensive research group will continuously and intensively monitor China's eco-civilization construction and devote efforts to developing a green and low-carbon environment, establishing a new industrialization, urbanization, and ecologicalization with intelligent agriculture, as well as to cultivating new motivation for green development, improving green consumption and education, and speeding up the establishment of the five major systems of eco-civilization construction. At the right time in the future, the group will study strategies to implement this approach in the Yangtze River Economic Zone and the Yellow River basin and offer new viewpoints, perceptions, and measures for China's ecological civilization construction.

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