Construction of Regional Ecological Capital Operation Mechanism System from the Perspective of Green Economy Development

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Abstract Green development has gradually become the main theme of the current world economic development. Green transformation development and cracking the contradiction between ecology and economy need to build an effective ecological capital operation system and mechanism to support, encourage the effective operation of regional ecological capital, promote the appreciation and preservation of ecological capital, and escort the operation. This paper constructs a four-in-one regional ecological capital operation mechanism system, in which the "accumulation mechanism" is the prerequisite, the "conversion mechanism" is the key link, the "compensation mechanism" is an important supplement, and the "incentive mechanism" is the safeguard measure, which aims to ensure the smooth progress of the construction of beautiful China in the new era and realize the socialist modern power.

Key words Green economy; Value realization of ecological products; Ecological capital operation

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The constraints of ecological capital and the increasingly scarce supply of resources and environment, coupled with global climate change and the continuous deterioration of the ecological environment, pose a serious threat to human social health and economic and social development. Human society has realized the need to enhance crisis awareness, establish the concept of green development, shift the economic development model towards the "green development model", improve incentive and constraint mechanisms, accelerate the construction of resource-saving and environmentally friendly production and consumption modes, and enhance sustainable development capabilities. Since then, green development has gradually become the main theme of current world economic development. The contradiction between ecology and economic development has become a major problem that troubles the world today, and how to solve it has become a focus of academic research and exploration. The mainstream research viewpoint believes that the transformation of ecological resource value is the key to solving the coordinated development of ecology and economy. How to realize the value of ecological products requires the construction of an effective ecological capital operation mechanism, which has become an urgent problem to be solved. Green transformation and development require institutional mechanisms as support, to encourage effective operation of regional ecological capital, and promote the appreciation and preservation of ecological capital. It should safeguard operation by constructing a regional ecological capital operation mechanism system. The "accumulation mechanism" is a prerequisite, the "conversion mechanism" is a key link, the "compensation mechanism" is an important supplement, and the "incentive mechanism" is a safeguard measure.

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1 Literature review

Ecological capital is a useful resource and environmental stock[1], and allows owners or users of ecological assets to obtain relevant economic benefits[2]. Ecological capital is significantly different from other forms of capital, and its purpose is to achieve the preservation and appreciation of assets[3]. Due to the diversity of forms of ecological capital, the wide range of its action scope, and the complexity of its action mode, how to reasonably present its value is particularly important. Costanza *et al.* [4] scientifically evaluated global ecological resources for the first time, with an assessed ecosystem value of 3.3 billion yuan. This is the first time in human history that the value of ecological services has been measured, but the measurement methods and results have attracted great attention from the academic community. Scholars have elaborated on the evaluation methods of ecological capital based on different types of systems, and constructed a framework system for evaluating the value of ecological capital[5]. The United Nations launched the SEEA system in 2003, which became the main method of national environmental accounting systems. Subsequently, scholars have continuously constructed a human green development indicator system from social, ecological, and economic perspectives, showcasing the natural capital development capabilities of countries around the world[6]. Ouyang Zhiyun *et al.* [7 - 10] conducted evaluations on the service values of terrestrial ecological service value system, different inter provincial ecosystem, grassland ecosystem, forest ecosystem, and water ecosystem, achieving good results. There are many risks and difficulties in the process of cap-

italizing ecological resources, and it is necessary to establish an ecological capital operation framework and system to comprehensively promote the capitalization process. Scholars have comprehensively and deeply explored the theoretical framework, path methods, value issues, element composition, external effects, mechanism construction, minimum safety standards, and other issues of ecological capital operation[11-16]. However, due to the huge regional differences in China, ecological capital operation faces complex and deep challenges, which require a re examination of its operation mechanism and the construction of a rational mechanism to ensure its operation.

2 Connotation of ecological capital and logic of value realization

2.1 Connotation of ecological capital The ecological products and services provided by ecosystem should be regarded as a resource and a fundamental factor of production. Therefore, effective management is essential, and the carrier of these ecological services or values is the "ecological capital". Ecological capital can provide certain services to human society, which come from the ecosystem. Its carrier is environmental quality and resource stock, manifested in functions and services. These functions and services are necessary for human survival, production, and life. It enters the human social and economic system in a comprehensive service flow and acts on all aspects of production and reproduction. Its existence categories are diverse, including natural resource stock, ecological environment function, product flow, information flow, and overall ecosystem service flow. These factors all exist in the biosphere and are "separated" from it to become objects of human dependence and utilization, that is, they become "dependent products" for human survival and life, and "utilized products" for production and reproduction. Especially the part of the service flow that has already entered the real socio-economic production system is crucial and indispensable for people in real life. In order to highlight the importance of the function and value of these factors, ecological economists use the core element of economic growth——capital to be "metaphorically" referred to these factors, thus giving rise to the concept and theory of "ecological capital". The theory of ecological capital holds that ecological capital is primarily capable of meeting certain human needs, that is, ecological capital has use value for humans. It is precisely because of this natural attribute that it is called ecological capital. Environmental resources with unknown or zero and negative use value cannot become ecological capital, and use value is a prerequisite for the formation of ecological capital.

2.2 Realization logic of ecological value The value theory of Marxist economics indicates that use value is the attribute of goods satisfying people's needs, and the determination of use value depends on people's level of understanding and social productivity. Whether an item has use value and how much use value it has is largely subject to people's understanding and judgment, and the non supremacy and phased nature of human understanding inevitably determine the timeliness and limitations of the use value of the item. Therefore, the use value of ecological capital inevitably exhibits practical characteristics and scope limitations. An obvious truth is that when a substance in the ecological environment (such as unknown organisms) has not been recognized by people or judged to be of no use, it can never be treated as ecological capital, only as a natural existence. Only when people realize that it can meet certain human needs and be actually relied upon and utilized by people, will it become ecological capital because it has value. From this, it must draw a conclusion: in the real world, not all ecological environments and natural resources are ecological capital, and a considerable number of environments and resources cannot become real ecological capital, at least at the current stage. Only those environments and resources that have already entered the real socio-economic system are ecological capital. This is determined by the use value elements of ecological capital. Moreover, in the context of the increasing scarcity of ecological capital and the global trend towards sustainable development, the labor value theory should be further promoted to expand the scope of labor, including natural labor. The value of commodities is jointly determined by natural labor and human labor. Therefore, the labor value theory that includes natural labor can be called ecological labor value theory. Its main content determined by commodity value can be expressed as follows: the value of a commodity is the sum of undifferentiated natural labor and human labor condensed within it, and its value is measured by the energy value of the commodity or monetary value.

3 Construction of regional ecological capital operation mechanism from the perspective of green economy development

3.1 Accumulation mechanism of regional ecological capital operation To some extent, the process of globalization is the process of capital expanding globally in terms of geography and deeply penetrating social life, thus forming a world controlled and dominated by capital. This has given rise to a series of global problems such as the coercion of development and progress, the worship of technological rationality, the plunder and destruction of ecological capital, and false consumption, ultimately threatening the survival and development of humanity. Therefore, it should be guided by the scientific outlook on development, advocate for "systematic theory and methods", abandon the idea of "human domination over nature", and practice the "sustainable development paradigm"; implement the strategy of prioritizing resource conservation, comprehensively control the total amount of resource utilization, regulate supply and demand in both directions, and implement differentiated management. One is to focus on the two major fields of production and consumption. In the field of production, through policy incentives and indicator assessments, it aims to support the better and overcome the worse, and improve the level of clean production. Additionally, through industrial policies, market mechanisms, and information platforms, the material and energy circulation between enterprises could be guided. In the field of daily life, it will continue to improve the waste recycling network. Through publicity, education, and market guidance, it could establish a green, ecological, and moderate public con-

sumption awareness, advocate consumption behavior of resource conservation and environmentally friendly, cultivate public participation awareness, establish social supervision mechanisms, and create a social atmosphere for the healthy operation of regional ecological capital. Two is to focus on the circulation of material and energy. Focusing on agriculture, industry, construction, and transportation, it should actively promote the utilization of clean and renewable energy, develop green agriculture, green buildings, and green transportation, and maximize the efficiency of resource and energy utilization. Three is to focus on the two major chains of industrial chain and value chain. By optimizing and adjusting the regional industrial structure and layout, promoting the scale of ecological capital circulation, minimizing the radius of ecological capital circulation, and achieving optimal efficiency in the benign operation of regional ecological capital, the integration of industrial chain and value chain can be achieved; it should support the research and development of industrial chain node technology, and vigorously promote the extension and cross-linking of the industrial chain; it should improve resource pricing policies and pollution discharge fee policies, eliminate external behaviors of enterprises, and achieve value chain appreciation of ecological capital. On the one hand, it is required to promote the ecological development of industries. By changing new organizational forms and adjusting policies, various forms of economic, social, and ecological regulation functions are restored and maintained, integrating human activities, land use, ecological cycles, and functional coordination into an integrated ecosystem, that is, ecological transformation of traditional industries is carried out. On the other hand, there is a demand for the development of ecological industrialization, which means innovating institutional mechanisms for industries that have both ecological and economic benefits, including marketization, scalability, and socialization. Ecological industrialization and industrial ecologicalization refer to the process of industrial development that closely integrates the comprehensive utilization of ecological capital with environmental protection. It requires all industries to meet the requirements of ecological economy and ultimately develop into circular ecological industries. Compared with traditional industries, ecological economic industries have comprehensive benefits and characteristics. Four is to attach great importance to the dual innovation of technology and system. It should improve the technical support system for ecological capital operation through the construction of research and development bases, incubators, and technology innovation alliances. By improving existing relevant policies and exploring laws and policies that coordinate resources, environment, and economic development, a system and mechanism conducive to the accumulation of regional ecological capital can be formed.

3.2 Conversion mechanism of regional ecological capital operation In real life, the importance of the use value corresponding to each function of ecological capital is gradually emerging. From the perspective of utility, the scarcity of each use value is becoming increasingly prominent. The decline in environmental capacity (population growth) has made people realize the scarcity of human environmental welfare, and the degradation of environmental quality has made people realize the scarcity of life support functions. The depletion of resource stocks has made people realize the scarcity of production support functions, and the ecological crisis has made people realize the scarcity of overall ecosystem service functions. Driven by the scarcity of ecological capital, rational people will have the desire to possess ecological resources that have important functions and use value as their own. Therefore, defining the property rights of ecological resources has become an unavoidable reality. The process of defining the property rights of ecological resources is essentially the assetization process of ecological resources, that is, specific ecological capital is formed in the process of transforming ecological resources into ecological assets with clear property rights, and then investing ecological assets as elements into the social and economic production. Ecological capital transforms its value into ecological products and services through operation, thus completing the form transformation of ecological capital, namely ecological resources – ecological assets – ecological capital – ecological products. In this process, ecological assetization is the first and crucial step, with use value as a prerequisite, scarcity as an external driving force, and property rights demarcation as a necessary path.

The process of determining the value of ecological capital indicates that existence value – use value – production factor value – exchange value is the inherent logic of realizing the value of ecological capital. That is, the existence value of ecological resources is converted into the use value of ecological assets, the use value of ecological assets is input into the production process as a factor to form the value of production factors, the value of production factors is transformed into ecological products to form exchange value through the specific operation process of ecological capital. Finally, the monetization of exchange value is achieved through ecological consumption transactions in the ecological market. In this complete value chain, every link is essential, and the value assessment of ecological assets is directly related to whether they can become a real production factor. To evaluate the value of ecological assets, the prerequisite is that they have clear property rights. Because the scope and quantity of ecological assets with unclear property rights boundaries cannot be determined, an ecological asset whose scope and quantity cannot be determined cannot be valued at all, and an ecological asset that cannot be valued cannot become a real production factor. As a result, the value chain of ecological capital will inevitably be interrupted, leading to the inability to continue the operation of ecological capital. In summary, from the perspective of ecological capital value assessment, property rights are a key element in establishing ecological capital as capital.

3.3 Compensation mechanism of regional ecological capital operation With the expansion of China's economic scale and the rapid increase of urban population, the ecological environment has been damaged, and the carrying capacity of the environment has decreased, resulting in a rapid increase in environmental risks in China. From January to July 2010, the Ministry of Environmental Protection received and properly handled 119 sudden environmental incidents, an increase of 35.20% compared to the same period in 2009. Especially, there have been multiple sudden environmental incidents such as the explosion and fire of the Dalian oil

pipeline of PetroChina, the explosion of the propylene pipeline at Jinling Petrochemical Alkyl Benzene Plant in Nanjing of Jiangsu, and the chemical raw material barrel in Jilin City flushing into the Songhua River. After the 18th National Congress of the Communist Party of China, there has been a significant reduction in environmental safety accidents, which has prompted the urgent need to establish and improve the compensation mechanism for ecological capital operation.

At present, the utilization of ecological capital in China has resulted in a growth rate of economic potential far exceeding that of ecological potential, leading to imbalances between local and even global ecosystems and economic systems. The restoration and maintenance of damaged ecological capital and its ecological potential are major issues that urgently need to be addressed. Regional ecological compensation is an effective institutional arrangement and approach to compensate for ecological losses and maintain ecological potential. The establishment of a compensation mechanism for regional ecological capital operation is based on the principle of internalizing external costs. The compensation for the external economic benefits of protective behavior is based on the additional protection and related construction costs paid by protectors to improve ecological services, as well as the development opportunity costs sacrificed for this purpose. The compensation for the external uneconomical nature of destructive behavior is based on the cost of restoring ecological services and the loss of development opportunity costs for the compensated due to destructive behavior.

3.4 Incentive mechanism for regional ecological capital operation Capital is a value that can bring surplus value, and it has both natural and social attributes. The natural attributes are manifested as proliferation, mobility, value, and competitiveness, belonging to the category of productive forces, while the social attributes are manifested as the rights of capital, that is, who owns capital, belonging to the category of production relations. In real socio-economic activities, whether capital can maintain and increase its value, and to what extent it can increase, is not determined by the social attributes of capital, but by its natural attributes. Capital, as a factor of production, is inevitably invested in certain social production activities under its profit driven domination. It combines with other factors of production in the production process to produce specific products, and then realizes its capital value in the form of exchange value or price through the sale of products in the market. It is obvious that the market is the carrier through which the value of capital is ultimately realized. Ecological capital, as capital, must also follow the general laws mentioned above. The mechanism of ecological capital operation also indicates that the ecological market is the node of ecological capital operation, which is both the destination of the previous round of ecological capital operation and the starting point of the new round of ecological capital operation. It is not only the carrier of realizing the value of ecological resources, but also the platform for the overall proliferation of ecological resources. Therefore, the ecological market is a key factor in realizing the value of ecological capital.

Ecological market is an inevitable product of ecological commodity economy, including ecological investment market, ecological technology market, and ecological consumption market. Like general commodity markets, ecological markets operate according to competition rules and are governed by the law of value. The provision and consumption of ecological products are the foundation of forming ecological markets, and the ecological trading system and management are the guarantee for the healthy operation of ecological markets. But unlike general commodity markets, because ecological products are luxury consumer goods, and ecological capital is "native" capital, the operation of ecological markets is not only governed by economic laws, but also follows ecological laws. Therefore, it is necessary to require ecological market entities to actively play their role under the dual laws and establish a sound incentive mechanism for regional ecological capital operation. Among them, the government's responsibility is to leverage the open agglomeration effect of ecological capital through institutional and management innovation, actively cultivate and construct an ecological market system, increase financial investment in ecological construction, drive and guide enterprises and the public to invest in ecology, and enhance the financing function of ecological capital. The responsibility of enterprises is to continuously adopt and innovate ecological technologies, leverage the symbiotic effect of ecological capital, develop high-quality ecological value-added products, improve the utilization and output rates of ecological capital, and pursue the maximization of long-term overall profitability of ecological capital. The responsibility of the general public is to advocate green consumption, moderate consumption, and rational consumption by improving consumption patterns, promote the public's awareness of "ecological consciousness" to continuously enhance by promoting ecological civilization education, establish ecological cultural values, establish ecological capital concepts, and form the social foundation of the ecological consumption market.

4 Conclusions

At the 2023 National Ecological and Environmental Protection Conference, General Secretary Xi Jinping proposed to accelerate the development of green and low-carbon transformation, adhere to green and low-carbon development as the fundamental solution to ecological and environmental problems, accelerate the formation of green production and lifestyle, and cultivate a green background of high-quality development. The essence of green development transformation is to increase the intrinsic value of the ecosystem, resolve the contradiction between ecology and economy, and effectively solve the regional development imbalance and enhance the internal driving force of regional development by constructing a regional ecological capital operation mechanism system. The effective operation and implementation of the four-in-one operation mechanism can enhance the preservation and appreciation of ecological capital within the ecosystem, provide new ecological elements for the construction of a modern strong country in the new era, achieve coordinated development of mountain, river, field, lake, grass and sand systems, and truly achieve the goal of building an ecological strong country.

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