

EOD Model of Ecological Watershed protection and Green Development: A case study of a certain river basin in the Yangtze River

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Abstract:

This EOD model study is guided by the idea of ecological civilization, takes sustainable development as the goal, takes ecological protection and environmental governance as the basis, takes characteristic industrial operation as the support, and takes regional comprehensive development as the carrier. Through flood control and drainage, river treatment, pollution interception and pollution control,

ecological restoration, road improvement, port upgrading, urban file upgrading, etc., we will build a hundred miles of Yangtze River ecological and cultural corridor, improve the overall quality of the Yangtze River ecological basin, transform environmental resources into development resources, and transform ecological advantages into economic advantages.

Keywords: *EOD model, watershed ecological governance, comprehensive development of precincts*

1. INTRODUCTION

In the context of ecological civilization construction, in order to promote the benign development of the ecological and environmental protection industry, reduce the pressure of the state's investment in environmental governance, as well as achieve the coordinated and sustainable development of the ecological environment and the economy, it is necessary to establish the ecological environment oriented urban development pattern (EOD model) (Hu,

X., Dong, C., & Wang, Y., 2023). It could integrate ecological environment governance, resources, and industrial development projects. In addition, it could build an ecological economic system of ecological industrialization and industrial ecology and accomplish the socio-economic attributes of the ecological environment (Song, C., Yin, G., Lu, Z., & Chen, Y., 2022).

The ecological environment-oriented development (EOD) model is an effective way to solve the bottleneck of ecological environment governance and industrial development, and it is a useful attempt to achieve the innovative development of ecological environment governance (Wang, K., Liu, P., Sun, F., Wang, S., Zhang, G., Zhang, T., ... & Cao, S., 2023). Through the EOD model, the industrial development project can feed back the investment in the ecological environment governance project and reach the effective integration of ecological environment governance and related industrial development projects, organically integrate ecological construction and community function construction throughout (Mao, C., Wan, J., & Yang, M., 2023). At the same time, it can transform the ecological resource elements in the region into economic factors, industrial factors and scientific and technological elements through the planning and shaping of the ecological environment and formulate the development model according to the difference in factor endowments in the development area (Hao, Y., Huang, J., Guo, Y., Wu, H., & Ren, S., 2022).

2. EOD MODE CONNOTATION

EOD is the abbreviation of Ecology-Oriented Development, which is an innovative project organization and implementation model, EOD mode realizes ecological industrialization and industrial ecology through the comprehensive implementation of related industrial projects and promotes the high-quality development of regional economy (Xue, L., Li, M., Zheng, Z., Xi, S., Yang, Y., Yang, W., & Hou, Q., 2023).

In the comprehensive development system, the systematic and holistic restoration of key ecological areas with a wide range of ecological benefits can promote the improvement of human settlements and the increase of residents' income and the value of natural resources. At the same time, resource development and utilization projects and related characteristic industry projects conform to local characteristics and can generate good operating income. Ecological protection, the development and utilization of natural resources and the development of characteristic industries complement each other, which can promote regional ecological protection and high-quality development (Zhang, Y., & Dilanchiev, A., 2022).

The EOD model coordinates ecological environment governance and industrial development,

regional development and sustainable operation, investment and financing and project implementation, transforming environmental resources into development resources, transforming ecological advantages into economic resources, and establishing a balance between economic development and ecological environmental protection (Mao, C., Wan, J., & Yang, M., 2023).

3. DIFFICULTIES IN THE EOD MODEL OF THE WATERSHED

3.1 Environmental status and main problems

Due to the limitations of historical development, the river course of the Yangtze River section has been affected to varying degrees, mainly reflected in the low flood control standard of the river embankment, resulting in the continuous occurrence of dangerous situations near the river bank, the decline of dry water level leads to the increase of water intake difficulty, and the serious flooding of the Yangtze River Basin during the rainy season (Chen, J., & Chen, J., 2020).

Most of the channels in the irrigation area are inverted trapezoidal channels supported by half-dug and half-filled pulp blocks and unlined earth channels, which have a large roughness, serious siltation, and slow water flow rate. Since the original channel fill is mostly silty clay mixed with gravel soil layer excavated by hillside channels, the soil filling quality of the fill embankment is poor and the permeability is large, so the water loss along the way is large. In the current situation of the Yangtze River Basin, the embankment needs to be reinforced and raised, the dike is rerouted, the embankment is not connected, and the embankment collapses, resulting in the flood control road at the top of the embankment is not connected, the current road is dilapidated, cracked, and cannot meet the traffic demand at the top of the embankment (Zheng, S., Zhong, Z., Zou, Q., Ding, Y., Yang, L., & Luo, X., 2021).

The problem of water pollution needs to be solved urgently, the existing sewage facilities have problems such as small scale, outdated facilities, unreasonable pipe network pipe diameter and direction, small slope, mixed rain and sewage discharge, low collection rate, unsystematic drainage, serious siltation, upstream and downstream elevation cannot be connected, the dike management facilities are backward, there are no observation and testing facilities, and the office facilities are simple, which is extremely unsuitable for the needs of dike management (Dwyer, K. T., 2022).

3.2 Industry status and main issues

From the perspective of the overall development of the industry, the development of the industrial level is slightly unbalanced, and the spatial connection needs to be strengthened. In

this study, the 49.3km urban belt along the river is a key area for industrial economic development. While industrial development is rapid, it also faces problems such as lagging living facilities and insufficient ecological protection (Yurui, L., Xuanchang, Z., Zhi, C., Zhengjia, L., Zhi, L., & Yansui, L., 2021).

There are many historical and cultural resources along the river, but most of them are in an abandoned state. The surrounding environment is lacking, and the overall environment needs to be improved. The spatial distribution of the existing cultural resources in the towns along the river is scattered, and the vertical resources along the river have no spatial series, and there is no direct connection with the culture of the Yangtze River (Zhang, Z., Li, Q., & Hu, S., 2022).

The total amount of modern service industry is insufficient, the development of life service industry is lagging behind, and the proportion of productive service industry is high. The tourism base is weak. The health care industry has good potential, but it is still in an extensive development trend, waiting for joint development with other tertiary industries, and it is necessary to accelerate the transformation of traditional tourism and focus on the development of health care and vacation tourism (Deng, F., & Yomkerd, J., 2022).

3.3 Current situation and main problems of supporting facilities.

The old urban areas face serious space congestion, old and backward facilities, and other problems, which affect the happiness of urban residents. There are problems such as road surface damage and water accumulation in the old urban areas of the towns along the river. Some road classes have difficulty meeting the growing demand for cars (Luo, P., Mu, Y., Wang, S., Zhu, W., Mishra, B. K., Huo, A., ... & Nover, D., 2021).

The distribution of green space in parks is not balanced, and the green space in small parks and streets is insufficient. The newly built residential green space is weak in openness, and the overall green space is separated from the north and the south. The types of parks are not extensive enough, the types of residential parks and strip parks are lacking, there is no organic connection between different types of green spaces, and the quality of productive and living green spaces needs to be improved (Semeraro, T., Scarano, A., Buccolieri, R., Santino, A., & Aarrevaara, E., 2021).

4. DEVELOPMENT IDEAS OF EOD MODEL IN WATERSHED

4.1 Ideas for the integration and development of ecological environmental protection and industry

Many regions are faced with the dual tasks of ecological environment governance and industrial transformation and upgrading. Promoting the organic integration of industry and ecology is conducive to the coordinated development of economic, social, and ecological benefits. The integration of ecology and industry to achieve the goal of ecological industrialization. Under the new situation and new requirements, we will improve the quality of economic development and protect ecological environment resources (Awan, U., 2022).

4.1.1 Ecological industrialization

"Ecological industrialization" refers to the moderate development of ecology as an industry. While managing the ecological environment, the industrial value of the ecology itself is emphasized, social forces are fully introduced, the current investment mechanism for ecological governance is optimized, and the market mechanism is used to promote ecological construction. Integrate ecology into the market, create a market, and then improve the market (Yang, W., Chen, Q., Dao, Y., Huang, X., & Shao, W., 2022).

4.1.2 Industrial ecologicalization

"Industrial ecologicalization" refers to the orientation of regional industrial development, guided by green, circular, and low-carbon, and develops environmental protection industries with high correlation, strong driving force, green and low-carbon, and the integration of industrial activities into the cycle of the ecosystem to maximize economic and ecological benefits. Industrial ecology is an important way to ensure the transformation of economic development mode from extensive to intensive and achieve sustainable economic, ecological, and social development (Fu, C., Huang, Y., Zheng, Y., & Luo, C., 2022).

4.2 The idea of fund realization of ecological environment protection and industrial integration

4.2.1 Strengthen financial support for ecological and industrial integration projects.

Guided by government financial funds, we should make full use of social capital, establish a special fund for ecological and industrial integration, provide key support for ecological projects with industrialization prospects and industrialization projects serving ecology, and vigorously promote ecological industrialization and industrial ecologicalization. We will explore various financing models to promote the integrated development of ecology and industry and establish a diversified investment and financing mechanism for the integrated development of ecology and industry (Wang, K., Liu, P., Sun, F., Wang, S., Zhang, G., Zhang, T., ... & Cao, S., 2023).

4.2.2 Using the market mechanism to promote the integration of ecology and industry.

We will develop ecology as a special public product, actively explore resource pricing and raising prices appropriately, and use price leverage to adjust resource use. The enterprise management and industrialization operation of ecological construction projects should be promoted, and the ecological projects should be promoted to the market by means of bidding by owners and transfer of project management rights. Special attention should be paid to the introduction of private capital to "take care of the landscape", so that the market-oriented operation of ecological projects will be implemented. In practice, we should strengthen the self-hematopoietic function of ecological resources (Shi, J., Huang, W., Han, H., & Xu, C., 2021).

5. EOD INNOVATION MODEL FOR ECOLOGICAL WATERSHEDS

5.1 Innovation of development concept

This study integrates the concept of ecological protection into regional development planning, ecological environmental protection planning, resource utilization and other related planning. At the project level, adhere to ecological priority, practice the concept of green development, and build an ecological economic system of "ecological environment governance + industry/resource development". Based on the ecological governance and protection of the Yangtze River Basin, with environmental improvement and bamboo industry development and utilization as the carrier, and with the development and utilization of resources along the route as the support, explore the promotion of ecological environment governance projects and industrial introduction, industrial operation, eco-tourism, urban construction, land development and other projects (Zhou, C., Shi, Z., & Kaner, J., 2022). Establish a benign mechanism for industrial income subsidies for ecological environment governance input. Through the optimization of the ecological environment, the gathering of superior resources will drive the overall value of the urban area to enhance and achieve sustainable development (Ming, L. E. I., YUAN, X. Y., & YAO, X. Y., 2021).

5.2 Integrated development and innovation

Focusing on the needs of ecological environment governance, we will strive to promote the ecological environment construction project of the Yangtze River, release the effective demand of environmental protection industries in the river basin, promote the marketization and industrialization of ecological environment governance, and normalize and long-term the integrated development of ecological environment (Wang, B., Zhu, J., Gao, M., Xie, J., Yang, L., Lu, N., & Wang, B., 2023). At the same time, combined with the economic development and social development, we will vigorously promote third-party industries with high correlation with the ecological environment in the river basin and strong driving force for

economic development, create tourism and cultural industries and related service industries centered on the river basin, and actively explore the establishment of a benign mechanism for industrial income subsidies for ecological environment governance investment in urban areas, so that more natural resources can flow to ecological and environmental protection industries, and realize the full integration of ecological environment governance and industrial economic development (Wen, Y., 2022).

5.3 Implementation path innovation

Based on the EOD concept, the project relies on the government platform company, introduces specialized market entities, adopts equity cooperation, establishes joint venture subsidiaries, etc., integrates implementation, improves governance and development efficiency, and continuously releases the vitality of market entities. During the operation of the project, policies can be classified according to the sub-project situation and project implementation plan, and a variety of project operation methods can be adopted, including PPP, EPC+O, government procurement of services and other project operation methods, to attract social capital investment and promote competition and innovation (Nikjow, M. A., Liang, L., Qi, X., & Sepasgozar, S., 2021).

6. ANALYSIS OF THE DIFFERENCES BETWEEN THE TRADITIONAL WAY OF IMPLEMENTATION

6.1 Analysis on the difference of investment and financing mechanism of ecological environment governance

The EOD model is a systematic project, specific to each region, industry and sub-projects will have many differences, it is necessary to concentrate resources and professional advantages from all aspects, build a platform with the extensive participation of various stakeholders, introduce different partners, and systematically and forward-looking consider the whole life cycle of investment, financing, construction, management and operation, and design a set of cooperation plans for all parties to share benefits and risks. Specifically, the differences between the investment and financing system implemented by the EOD model and the traditional investment and financing system of this project are reflected in the following aspects, which can solve the difficulties of traditional ecological environment governance projects:

1. The needs of ecological civilization construction: ecological environment governance belongs to the strong public welfare and insufficient operational projects where the market cannot effectively allocate resources, mainly government investment, single source of funds,

limited overall investment, insufficient marketization, and difficult transformation of environmental benefits.

2. Investment financing: how to solve the problem of large investment volume of ecological environment governance projects, broaden the sources of funds and financing methods, and realize market-oriented financing.

3. Project implementation entities: how to introduce market-oriented entities in a legal and compliant manner to improve investors' enthusiasm for ecological environment governance projects.

4. Full-cycle management: project comprehensive system, coordination and unification of ecological environment governance goals and construction timing, progress quality, and investment cost control; Systematic control to prevent debt risks; Realize long-term operation management and sustainable development of the ecological environment.

6.2 Analysis of differences in environmental governance effectiveness

The traditional environmental governance model is decentralized collection, decentralized processing, and has not formed the linkage of environmental governance, which is a model of inorganic integration, and there are the following drawbacks when implemented in this way: First, it has never reflected the systematization and integrity of environmental governance, and failed to form a governance synergy; Second, it is impossible to form a long-term mechanism for environmental governance, and it is difficult to manage operation and maintenance after governance, and there is no unified organization and implementation unit for monitoring and implementation; Third, due to the poor linkage, integrity and systematization of governance, the problem of excessive environmental governance costs is further derived, which undoubtedly puts greater pressure on the government or social capital (Esposito, P., & Dicorato, S. L., 2020).

The EOD model adopts the integrated implementation mode of "environmental governance + industrial improvement", and its main advantages are reflected in the following points: integrating the government and private parties, forming a joint force of project companies, and effectively solving ecological problems; Stable and long-term operation mechanism, through the operation management period, supplemented by performance evaluation mechanism, continue to put pressure on the project company, so as to stabilize the governance results and keep ecological intractable diseases from rebounding; By maintaining the linkage, systematization and integrity of ecological environment governance, the cost of

environmental governance is greatly reduced (Chen, Z., Yang, Y., Zhou, L., Hou, H., Zhang, Y., Liang, J., & Zhang, S., 2022).

In summary, the adoption of the EOD model is to further organically integrate the forces of all parties, form a governance synergy, reduce governance costs, highlight governance effectiveness, and also ensure the long-term maintenance of post-governance results.

6.3 Analysis of propulsion path differences

Traditional ecological protection projects focus mainly on a single environmental or economic benefit. The one-sided pursuit of economic benefits is an important reason for modern environmental problems, and the pursuit of a single environmental benefit cannot solve the comprehensive problems of resources, assets, and related industries in the river basin (Liu, G., & Nie, W., 2023).

The EOD model is based on ecological protection and environmental governance, supported by characteristic industry operations, and takes regional comprehensive development as the carrier, adopts industrial chain extension, joint operation, portfolio development and other methods to promote the effective integration of ecological environment governance projects with strong public welfare and poor profitability with related industries with better returns, and promotes overall planning and integrated implementation, internalizes the economic value brought by ecological environment governance, which is an innovative project organization and implementation method, that is, the EOD model is aimed at sustainable development. A bridge of cooperation has been built between economic development and ecological environment, so as to realize the overall premium and value-added of the region, and ecological construction and economic development promote each other (Mao, C., Wan, J., & Yang, M., 2023).

6.4 Analysis of differences in organizational management methods

The EOD model runs ecological guidance through the whole process of planning, construction, and operation, and comprehensively considers the ecological environment, industrial structure, infrastructure, and urban layout. There are three phases in EOD mode rollout:

The first stage is to reconstruct the ecological network, create a good ecological foundation for urban development through environmental governance, ecosystem restoration and ecological network construction, and drive the improvement of urban comprehensive value.

The second stage is the overall improvement of the urban environment, improving the overall environmental quality of the city by improving public facilities, transportation capacity, urban layout optimization, and characteristic shaping, so as to provide high-quality conditions for subsequent industrial operations.

In the last stage, through the introduction of industries, talents, and other means, activate the economy and increase the overall premium, including taxation, natural resources, etc.

7. DISCUSSION

7.1 Ecological environment

This research project relies on the characteristics of rivers and rivers to integrate urban features to do a good job in the restoration of the ecological environment of the Yangtze River. The ecological environment could be improved through the implementation of shore slope greening and ecological restoration projects, sewage interception and pollution control projects, and then we could create a green waterfront shoreline. Flood control and drainage capacity could be improved through the implementation of river treatment and water system connection projects, flood control road improvement projects, and flood drainage renovation projects, and we could build a safe and stable waterfront space foundation (Zhou, Y., Sharma, A., Masud, M., Gaba, G. S., Dhiman, G., Ghafoor, K. Z., & AlZain, M. A., 2021). The efficiency of port shoreline resource utilization could be further improved through the implementation of port upgrading projects, innovative operation, and development methods, and we could steadily promote the construction of modern green port areas. Through the implementation of the upgrading of towns along the river and the development and protection of resources, we will improve urban supporting service facilities, promote the transformation and upgrading of the tourism industry, cultivate and expand characteristic cultural industries, and drive the economic development of towns along the river (Xiaodan, L., & Yamaguchi, K., 2023).

The implementation of ecological environment governance projects under the EOD model takes regional resource endowments and industrial environment into account in a planned manner from the perspective of ecological construction, in consideration of planning, investment, financing, development, construction and operation of ecology, resources and industries as a whole system. It takes interconnected strategic planning, land and spatial planning, industrial development planning and investment and financing planning as the core, meanwhile supporting financial planning, land supply/resource development planning, industrial planning, and investment promotion, etc. It could promote the integration of

comprehensive improvement of the ecological environment with resource development and utilization, as well as with industrial development. It could also coordinate and promote high-level protection of the ecological environment and high-quality development of the regional economy (Peng, B., Sheng, X., & Wei, G., 2020).

7.2 Urban development

The reinforcement and upgrading of embankments along the river, the renovation and upgrading of the drainage system along the river, the construction of sewage interception and pollution control projects, the ecological restoration of the shoreline and the construction of urban ecological civilization, and the scale construction of historical and cultural nodes along the river, etc., will improve the flood prevention and drainage capacity of the riverside area, which will effectively solve the problem of water pollution, protect the safety of people's lives and property, improve the city's appearance, improve the level of hygiene, and protect people's health. Relying on the Yangtze River, Qingjiang River and other water systems to build urban ecological corridors, various urban parks, ecological parks, and street green spaces are embedded in towns along the river, forming a blue and green intertwined green space system along the river (Zuo, Q., Zhou, Y., & Liu, J., 2022).

Through the improvement of the ecological environment, the protection and construction of urban infrastructure and history and culture, we will drive the continuous improvement of the urban governance system, fully tap the value of land, continuously improve the investment environment in urban areas, attract more foreign investment, and promote local employment, which can not only directly and indirectly increase the income of local residents, but also greatly improve and enhance the quality of life and level of local residents. The industry in the region involves a wide range of industries, has a high degree of correlation with other industries, and the continuous extension of the industrial chain not only expands employment opportunities, but also develops the agricultural economy in the region, so that farmers in the region can increase their income and become rich. In addition, with the development of the region, it will directly drive the development of commerce, transportation, catering, accommodation, entertainment, and leisure, thereby bringing indirect employment opportunities (Faturay, F., Vunnava, V. S. G., Lenzen, M., & Singh, S., 2020).

7.3 Industrial upgrading

Carry out the pilot EOD model in the Yangtze River Basin, explore the effective integration of ecological environment governance projects with resource and industrial development projects, accelerate the industrialization process of the Yangtze River region, improve the sustainable development capacity of the environmental protection industry, and promote the

high-level protection of the ecological environment and the high-quality development of the regional economy in the Yangtze River Basin.

Accelerate the technological transformation and upgrading of the traditional chemical industry, implement the green development project of chemical enterprises, and vigorously promote the upgrading and transformation of coal gasification energy-saving technology and the new green process improvement project of ultraviolet absorber; Accelerate the popularization and use of new technologies, new materials, new processes, and new equipment.

Accelerate energy conservation, emission reduction and recycling, promote advanced clean production methods such as industrial agglomeration, effective energy utilization, and centralized emission treatment, vigorously promote the use of waste recycling and reuse technology, encourage waste heat power generation, wastewater recycling and utilization, realize waste reduction and recycling, and build a circular economy industrial chain.

Accelerate the comprehensive development of clean production by enterprises, standardize the development of chemical parks, eliminate enterprises and projects that do not meet environmental protection standards, safety is not guaranteed, and low-end backward technology in accordance with laws and regulations, promote the transformation of the chemical industry to centralization, large-scale, specialization and base, and support qualified chemical parks to establish national new industrialization demonstration bases.

Accelerate the cultivation of green emerging industries, continuously expand the scale of green strategic emerging industries such as energy conservation and environmental protection, biotechnology, new medicine, biotechnology, and new materials, accelerate the cultivation and formation of new momentum, focus on the green logistics industry, and accelerate the green and low-carbon development of the warehousing, transportation, packaging, and distribution logistics supply chain.

7.4 Economic improvement

The results of the financial evaluation and calculation show that the economic indicators of the project are reasonable, and the project is economically feasible. After the completion of the project, it can bring better economic benefits to the operator (Jin, X., Liu, Q., & Long, H., 2021). Due to the construction of the project, the organic combination of environmental efficiency and urban life in this area has improved the living environment and urban quality

of the construction land in the relevant area, combined with the preliminary analysis of the project planning, the project will bring significant land value-added benefits after implementation. In addition, it will also increase the income of the tourism industry for the area, drive up local tax revenue and employment.

8. CONCLUSION

In practice, this study summarizes the development model of EOD for comprehensive management of river basins from the top-level design and planning personnel, and comprehensively organizes the technical system, business model, financing scheme, and industry leading-in. The core meaning of the EOD model is to take ecological environment governance as the input element of development projects, lock in the benefits generated by ecological environmental protection in advance and transform them into feedback for the investment of ecological environment governance projects.

Based on the benign development of the ecological and environmental protection industry under the EOD model, there are the following considerations: 1. The EOD model is not mature enough, and there are certain risks, such as large industry span, long effective period, unclear land development income policy, unclear business model, imperfect policy support, and uncertain import income of related industries. 2. The development idea of EOD model is based on the "ecology + industry" integration model. It is based on the environmental governance and ecological protection of urban mines, urban polluted sites, urban watershed water environment, urban waste, etc., supporting infrastructure construction, and expanding high-tech and high-quality characteristic industries (cultural tourism, health care, education, modern agriculture, new energy, intelligent manufacturing, financial industry, etc.); 3. It can explore multiple sources of income, and realize the value income of ecological products, ecological compensation, environmental resource property rights transaction, pollution control service fee, environmental protection tax, land value-added income, tax income, and imported industrial income through resource development.

The EOD model is a specific implementation method for the sustainable development of the ecological environment and economy, which needs to be considered from the aspects of ecological environment, industrial structure, infrastructure construction, urban layout, etc., so as to truly achieve the goal of green ecology and to promote economic development and environmental quality.

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