

## Article

# Progress in Realizing the Value of Ecological Products in China and Its Practice in Shandong Province

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**Abstract:** Establishing a mechanism for realizing the value of ecological products is important for implementing the concept of an ecological society in China. It is a key means of acting upon the idea that green mountains and clear waters are as valuable as gold and silver, and it is a necessary requirement to promote sustainable green development and encourage harmonious coexistence between humans and nature. This article summarizes the connotations of ecological products, the accounting of ecological product value, and the progress made nationally and in Shandong province in promoting the mechanisms for realizing the value of ecological products. Based on the analysis of Shandong's practice in various means of realizing ecological product value, such as the "forest chief system +", "two mountain banks", "mining ecological restoration", "health tourism", "ecological agriculture, culture, and tourism", and "forest ecological compensation", this article summarizes and proposes three types of ecological product value realization paths: government-led, government + market, and market paths. It also proposes four types of ecological product value realization modes: ecological resource indicators and equity exchanges, ecological governance and value enhancement, ecological industrial operations, and ecological protection compensation. Furthermore, this article puts forward targeted suggestions and methods for value realization in four areas: policy, technology, industry, and markets, providing an experiential reference for exploring diversified ecological product value realization in various regions of China.

**Keywords:** ecological products; value realization; path mode; Shandong practice; recommendations



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## 1. Introduction

With its 17 Sustainable Development Goals (SDGs), the 2030 Agenda provides the goals that all 193 United Nations (UN) member states have pledged to achieve [1]. The SDGs are integrated and indivisible and balance the three dimensions of sustainable development: the economic, the social, and the environmental. These goals are thought to be mutually supportive [2,3]. SDG12 (ensuring sustainable consumption and production patterns) [4] explicitly states that, by 2030, the sustainable management and effective use of natural resources must be achieved. Ecological products are the embodiment of the efficient and sustainable utilization of natural resources. The value realization mechanism of ecological products in China is in line with the goals of SDG12. These goals support

developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of ecological product consumption and production, ensuring that people everywhere have the relevant information and awareness for sustainable development and adopting lifestyles that are in harmony with nature.

Since the 18th National Congress of the Communist Party of China, the Party Central Committee with Comrade Xi Jinping at its core has explored and developed the Xi Jinping Ecological Civilization Thought, emphasizing the need to vigorously promote the construction of an ecological civilization, provide more high-quality ecological products, and continuously meet the growing demands of the people for a beautiful ecological environment. The report of the 20th National Congress of the Communist Party of China explicitly proposed “establishing a mechanism for realizing the value of ecological products and improve the compensation system for ecological protection”, promoting green development and harmonious coexistence between humans and nature. Ecological products, which are effectively synonymous with green mountains and rivers, have become an important means for the government to promote the construction of an ecological civilization. The connotations of ecological-product-related concepts, the path towards value realization, and the modes of practice have become research hotspots in the field of ecological civilization, crossing multiple disciplines such as resource and environmental sciences, human geography, ecological economics, and management [5,6]. In April 2021, the General Office of the Communist Party of China Central Committee and the General Office of the State Council issued the “Opinions on Establishing and Improving the Mechanism for Realizing the Value of Ecological Products”, which put forward clear requirements for the principles and mechanisms of establishing the realization of the value of ecological products [7,8]. This is a Chinese initiative to explore a new path of green economic growth and a concrete embodiment of the idea of constructing an ecological civilization, which is of great significance. Under the guidance of the overall national strategy, governments at all levels in China have also issued relevant policy documents. According to incomplete statistics, 17 provinces, 50 prefecture-level cities, and more than 160 counties and districts in China have issued opinions on establishing and improving the mechanism for realizing the value of ecological products. China’s institutional advantages make it the only country in the world that can carry out the work of realizing the value of ecological products on a national scale. In the practice and application of realizing the value of ecological products, China has taken the global lead. The realization of the value of ecological products will undoubtedly become an important focus and driving force for the construction of ecological civilization in all walks of life throughout the country, contributing a “Chinese solution” to global sustainable development.

Currently, research on the mechanisms of realizing the value of ecological products as a Chinese ecosystem service is developing rapidly in China, achieving notable progress. At present, there is still no systematic literature review that focuses on the progress of the value-realization mechanisms for China’s ecological products. Based on previous related research [9–13], this article summarizes the connotations of ecological products and ecological product value realization, discusses the measurement of ecological product value, and reviews the progress of a series of policy documents and demonstration pilots from China and Shandong Province in recent years to promote the realization mechanism of ecological product value. Combined with typical cases of ecological product value realization in Shandong Province, this article summarizes the basic pathways and modes of realizing ecological product value, as well as proposing countermeasures to and ways forward regarding the problems faced in the practical process of realizing ecological product value. We aim to provide a reference and guidance for better carrying out the work of ecological product value realization.

## 2. Concept and Connotation of Ecological Products

### 2.1. Concept of Ecological Products

The concept of “ecological products” is a new concept proposed in China. A similar concept used abroad is “Eco-label products”, and the closest connotation to “ecological products” is “ecosystem services” [14–16]. At their cores, the concepts of “ecological products” and “ecosystem services” are consistent, but the former pays more attention to the impact of human activities on the production of the ecosystem, not only including natural elements such as ecosystem services, but also bringing positive benefits to human well-being, becoming a valuable “product” [17,18]. The concept of ecological products can be regarded as an upgraded version of ecosystem services. Compared with the concept of ecosystem services, the strategic intention, connotations, and extension of ecological products are more precise, scientific, and standardized, showing a strong theoretical feasibility and broad application prospects in practice [19–21].

The concept of an “ecological product” can be traced back to the “National Master Plan for Function-oriented Zones” issued by the State Council in December 2010, which defined ecological products as natural elements that maintain ecological security, guarantee ecological regulation functions, and provide a good living environment, including fresh air, clean water sources, and a pleasant climate, etc. This can be said to be the embryonic form of the narrow concept of ecological products or the concept of ecological products.

The broad concept of ecological products includes not only natural elements such as maintaining ecological security, ensuring ecological regulation functions, and providing a good living environment, but also labor products such as green organic food and ecological industrial products that are produced through green manufacturing, energy conservation and emissions reduction, and waste recycling. Initially, Zhang Linbo et al. [20] defined ecological products as “the ultimate products or services provided by ecosystems through biological production and joint interaction with humans for human well-being,” and divided ecological products into two categories: public ecological products and commercial ecological products (the “dichotomy” approach). Later, based on this foundation, the definition was continuously deepened and improved, and ecological products were defined as “terminal products or services provided to human society for use and consumption through the joint action of ecosystem biological production and human social production, including guaranteeing human living environment, maintaining ecological security, providing material resources and spiritual and cultural services, and meeting the needs of human well-being or benefits. They are essential products for a good life, parallel to agricultural and industrial products” [22]. According to different value realization modes, such as the government-led mode, government–market mixed modes, and the market pathway, ecological products are divided into three categories: public, quasi-public, and commercial ecological products (the “trichotomy” approach) (Figure 1).

(1) Public ecological products are a narrowly defined type of ecological product, similar to the regulatory services in the academic research of “ecosystem services” at home and abroad. They refer to the natural products that are mainly provided for human beings by ecosystems through biological production processes; they include human living environment products such as fresh air, clean water sources, safe soil, and clean oceans, as well as ecological security products such as species conservation, climate change regulation, and ecosystem disaster reduction. They are pure public products with non-exclusivity and non-competitiveness, and it is difficult to realize their economic value through market transactions.

(2) Ecological products for commercial purposes are a broad category of ecological products, similar to the supply services and cultural services in ecosystem services. They are the ecological products with the highest degree of human labor participation; they include raw material products that are closely related to primary industry, such as agricultural and forestry products, biomass energy, and spiritual and cultural services that rely on ecological resources, such as tourism, health and cultural products. Ecological products for commercial purposes have the same attributes and characteristics as traditional economic

products, such as ecological agricultural products and tourism products [22]. They can realize their value in market transactions through the processes of production, circulation, and exchange and have been included in the national economic classification catalogue.

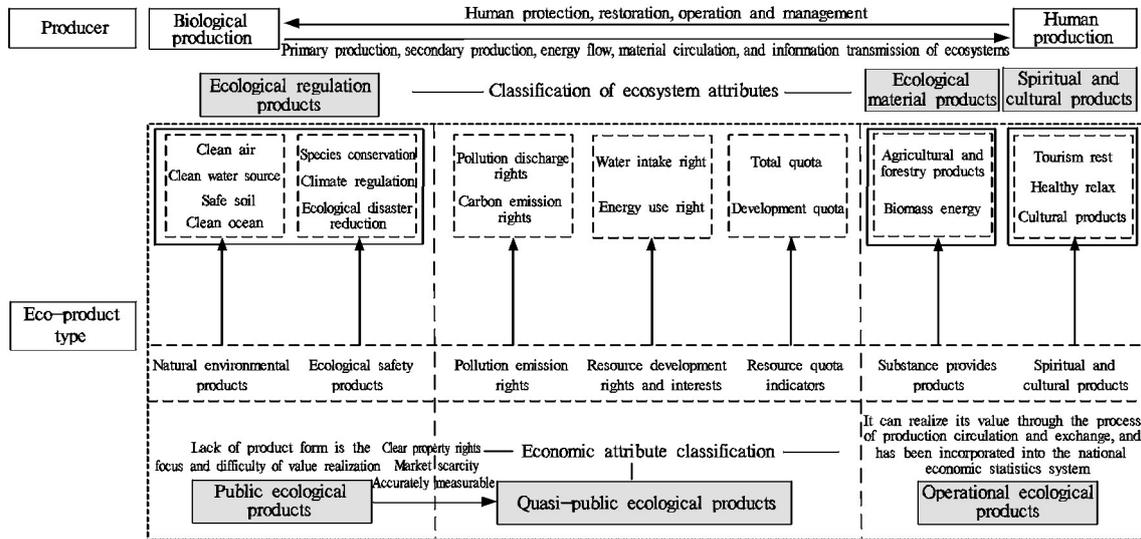


Figure 1. Basic classification of eco-products according to the “trichotomy” (modified from [22]).

(3) Quasi-public ecological products are public ecological products that meet the three conditions of clear property rights, market scarcity, and quantifiability under certain policy conditions. They have a certain degree of competitiveness or exclusivity and can be traded through market mechanisms. They are situated between public ecological products and ecological products for commercial purposes. They mainly include tradable pollution rights, carbon emission rights, water rights, energy use rights, resource development rights, total quotas, and development quotas. These ecological rights and interests have clear production and consumption interests. Under the conditions of government regulation and scarcity, market demand for trading subjects is formed, and ecological rights and interests are transformed into ecological commodities. Therefore, quasi-public ecological products can also be regarded as ecological commodities that realize exchange value in the market through public ecological products, such as China’s carbon emission rights, Germany’s ecological credits, and the United States’ water quality credits [23].

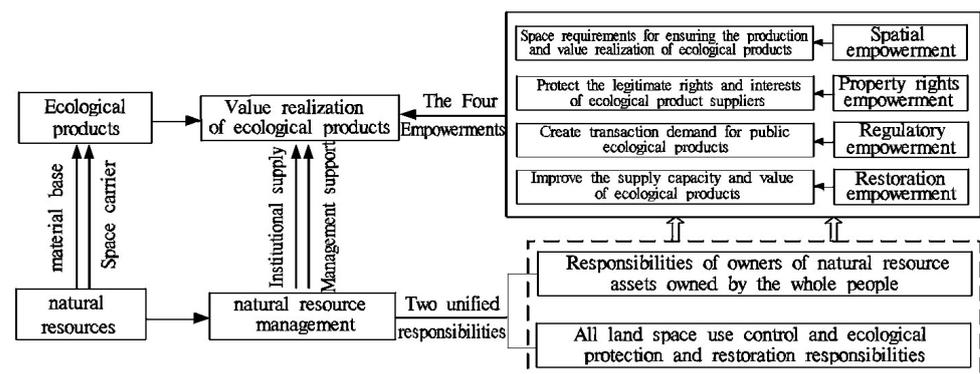
There is currently no unified standard for the classification of ecological products, and the existing classification of ecological products varies. Ecological products possess the dual attributes of “ecology” and “economy” [24]. From the perspective of ecosystem services, they can be divided into three categories: material supply products, cultural service products, and ecological regulation service products. From an economic perspective, they can be classified into three categories: public ecological products, quasi-public ecological products, and production and operation ecological products [22]. Public ecological products and production and operation ecological products are similar to the narrow and broad ecosystem attribute ecological products, respectively. Currently, in the valuation of ecological products in places such as Lishui in Zhejiang and Dongying in Shandong, ecological products are classified from the perspective of ecosystem services, mainly referring to the “Technical Guidelines for Calculating Gross Ecosystem Product (GEP) of Terrestrial Ecosystems” compiled by Ouyang Zhiyun and others. The recently issued “Guidelines for the Valuation of Ecological Products” are also based on this classification system. This classification system is widely recognized in China, and it is becoming more mature and has strong universality, laying a foundation for the comprehensive valuation of ecological products.

## 2.2. The Attributes of Ecological Products

(1) Ecological products have the obvious characteristics of product attachment, property rights attachment, and value attachment. Ecological products have difficulty entering the market for direct trading, and their production and consumption mostly rely on the primary, secondary, and tertiary industries. The property rights attachment is mainly reflected in the fact that ecological products do not have clear property rights, and their ownership often needs to be attached to the ecological resource carrier. In terms of value attachment, except for a small number of market transactions, the market value of ecological products is mainly realized through direct attachment premiums and indirect attachment methods that stimulate industrial development.

(2) The realization of the value of ecological products has the universally recognized attributes of the “four difficulties” problem of “difficult to measure, difficult to mortgage, difficult to trade, and difficult to realize”. The work of realizing the value of ecological products in China started relatively late, and the institutional systems, technical conditions, and interest relationships involved are relatively complex. In practice, there are still problems such as an unclear ecological product base, non-standard valuation, rough value realization channels, and insufficient value conversion. With the exploration and deepening of the mechanism for realizing the value of ecological products in various regions, significant progress has been made in solving the “four difficulties” problem of ecological products. In terms of the “measurement difficulty”, in October 2022, the National Development and Reform Commission and the National Bureau of Statistics issued the “Guidelines for the Calculation of Ecological Product Value”, which affixed a “value label” to green mountains and rivers. In terms of the “transaction difficulty”, various regions have developed ecological agriculture, ecological industry, and ecological tourism according to local conditions, enriching and expanding the value realization model. In terms of the “realization difficulty”, various regions have focused on giving full play to the government’s leading role, firmly carrying out ecological product protection compensation. In terms of the “mortgage difficulty”, various regions have increased their efforts in green financial services, transforming resources into assets and assets into capital, and innovatively forming a batch of green financial products that support the realization of ecological product value, such as “ancient house loans” and “two mountain loans”.

(3) The natural resource attribute of ecological products is their essential characteristic. Ecological products are products that are produced by natural ecological systems and have certain human social attributes. As natural elements, natural resources provide the most basic material foundation and spatial guarantee for the production and value realization of ecological products. As important vehicles of the construction of an ecological civilization, natural resource management departments have the “two unifications” responsibility of uniformly exercising the responsibilities of natural resource asset owners and all national land-use control and ecological protection and restoration. Natural resource management work, such as land-use planning, ecological protection and restoration, and rights registration, is closely related to the production, distribution, exchange (transaction), and value realization of ecological products. Natural resource departments are the institutional suppliers and key managers of the value realization of ecological product [25], enabling the production of ecological products, value-added development, and value realization, and providing multidimensional solutions for establishing ecological product value realization mechanisms (Figure 2).



**Figure 2.** Relationship between natural resources, natural resource management, and ecological products (value realization).

### 3. Development Process of Ecological Products and Value Realization

#### 3.1. The Development Context of Ecological Product Value Realization

The realization of the value of ecological products has become an increasingly influential approach to natural resource management. Instead of viewing natural resources as extractable raw materials for one-off uses, this approach recognizes the wide array of ecological products and services that nature provides to humans, from the provision of food, clean water, and air to the regulation of the climate and carbon storage. It seeks to identify and design innovative and diversified mechanisms that help to derive economic value sustainably from local ecological products and ecosystem services so as to benefit local communities and safeguard the long-term health and integrity of the ecological environment.

Initially, the concept of ecological products was introduced as a means of optimizing national land space, with the aim of controlling and optimizing the national land space patterns [26]. With the development of China's construction of an ecological civilization, the concept of ecological products and their value realization have gradually evolved into the core theme of ecological civilization thinking; they have become the material carrier and practical tool for implementing the ecological civilization philosophy, demonstrating strong practical feasibility and important academic theoretical value. The reports of the 18th and 19th National Congresses of the Communist Party of China both emphasized the need to enhance the production capacity of ecological products and provide more high-quality ecological products. The 20th National Congress of the Communist Party of China clearly stated the need to establish a mechanism for realizing the value of ecological products, improve the ecological protection compensation system, firmly establish the "Two Mountains" concept, and plan for development from the perspective of harmonious coexistence between humans and nature. Understanding the temporal context of the development of the concept of ecological products (Figure 3) is of great significance for understanding the connotations of ecological products and the methods for realizing their value.

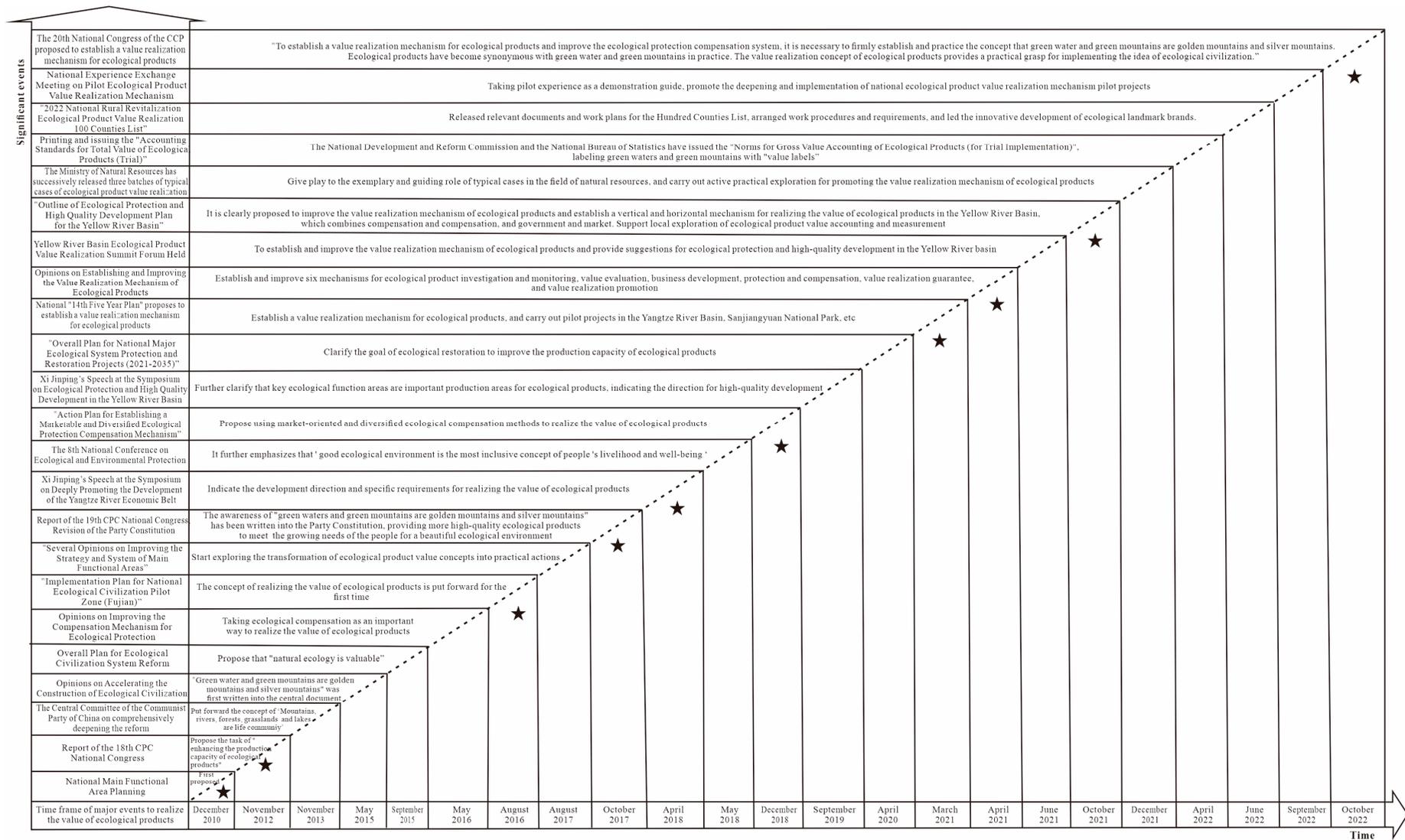


Figure 3. History of the development of the concept of eco-products (adapted from [20]). (★ Stars represent landmark events).

### 3.2. Progress in the Pilot Work of Ecological Product Value Realization

Since the 18th National Congress of the Communist Party of China, the Central Committee of the Communist Party of China, the State Council, the National Development and Reform Commission, the Ministry of Natural Resources, and other departments have approved multiple pilot regions for the mechanisms of ecological product value realization (see Table 1). The National Development and Reform Commission has successively listed six provinces, including Zhejiang and Fujian, and two cities, Lishui and Fuzhou, as pilot areas for testing the mechanisms of ecological product value realization. The Ministry of Natural Resources has identified the natural resources sector as the main stage for the realization of ecological product value; from April 2020 to December 2021, it issued 32 typical cases of ecological product value realization in 3 batches and organized pilot projects for the mechanism of ecological product value realization in 10 natural resource areas. The Ministry of Ecology and Environment launched a pilot project for the Ecological-Environment-Oriented Development (EOD) model, naming a total of 468 national ecological civilization construction demonstration areas and 187 “Green Waters and Mountains are Gold and Silver Mountains” practice and innovation bases in 6 batches. The National Forestry and Grassland Administration and the National Bureau of Statistics have launched pilot projects for the provincial-level accounting of forest resource value in five provinces. At the local level, various places have carried out a variety of practical activities in accordance with national requirements. Lishui, Zhejiang Province, has comprehensively promoted the construction of a demonstration area for the realization mechanism of ecological product value on the basis of long-term practice, created the brand of “Lishui Mountain Farming” to add value to the products, and provided a new model for promoting the construction of an ecological civilization with Chinese characteristics. The “Lishui Demonstration”, in Nanping, Fujian, carries out the innovative practice of “Forest Ecological Bank”, using the market mechanism to crack the problem of the property rights reform of rural resources, providing a demonstration and reference for the national ecological resource-rich late-developing areas to practice the “two mountains concept”. In addition, Chongqing, Shandong, Anhui, and Jiangsu, among other places, have carried out corresponding mechanism explorations. Various ecological product value realization practices have been developed, including the “ecological compensation” type, which focuses on benefiting protectors (e.g., Chishui City in Guizhou), the “green bank” type, which emphasizes the consolidation of the foundation of green mountains and rivers (e.g., the Saihanba Mechanized Forest Farm and Youyu County in Shanxi), the “mountain song and water economy” type, which explores new means of relying on mountains and water (e.g., the Yuanyang Hani Terraced Heritage Protection Area in Yunnan, which relies on terrace culture to explore the “integrated cultivation of rice, fish, and ducks + tourism” model), the “composite economy” type, which integrates multiple industries under the “ecology+” concept (e.g., Wudang County in Guiyang), the “brand-led” type, which focuses on improving quality and efficiency by creating ecological brands (e.g., Yuexi County in Anhui), and the “market-driven” type, which promotes ecological product trading (e.g., Lishui City in Zhejiang). A series of replicable and applicable ecological product value realization models have been formed across the country, and the practice of ecological product value realization has been flourishing in China.

The demand for transforming ecological factors into production factors is becoming increasingly strong, and the realization of ecological product value as a new economic growth point has become an important means for governments at all levels to promote the comprehensive green transformation of economic and social development. It is estimated that, from 2015 to 2020, the total value of ecological products (GEP for short) in China grew from CNY 70.6 trillion to CNY 82.2 trillion [28]. In terms of local practice, Nanping City, Fujian Province, focuses on “a mountain, a leaf, a bamboo, a bottle of water, a chicken” and other ecological industries, and builds five major industrial chain support systems around ecological product protection, production, processing, manufacturing and services, etc. In 2021, Nanping City’s GDP exceeded CNY 200 billion; the total output value of

the 5 ecological product industry chains reached CNY 182.923 billion, and the per capita ecological output value exceeded CNY 68,000. All of this evidence proves that the ecological product value realization mechanism is the right choice for the government to promote the sustainable development of the green ecological economy.

**Table 1.** Progress of pilot projects related to the value realization mechanism of ecological products [27].

Pilot Type	Pilot Area and Time	Pilot Number
National pilot ecological civilization zones	Fujian (2016), Jiangxi (2017), Guizhou (2017), Hainan (2019)	4
National pilot provincial-level marketization of ecological products	Since 2016, the provincial-level pilot marketization of ecological products has been carried out in Zhejiang, Jiangxi, Guizhou, Qinghai, Fujian, and Hainan	6
National ecological product value realization mechanism pilot	Lishui City, Zhejiang (2019), Fuzhou City, Jiangxi (2019)	2
National ecological civilization construction demonstration cities and counties (districts)	6 batches issued cumulatively since 2017: the first batch of 46 (2017), the second batch of 45 (2018), the third batch of 84 (2019), the fourth batch of 87 (2020), the fifth batch of 100 (2021), and the sixth batch of 106 (2022)	468
National “green water and green mountains are the silver mountain” practice innovation base	6 batches issued cumulatively since 2017: the first batch of 13 (2017), the second batch of 16 (2018), the third batch of 23 (2019), the fourth batch of 35 (2020), the fifth batch of 49 (2021), and the sixth batch of 51 (2022)	187
National pilot mechanism for realizing the value of ecological products in the field of natural resources	Chongqing, Nanping, Dongying, Jiangyin, Zoucheng, Nanyang, Lingbao, Guangzhou, Shenzhen, Suzhou, and other cities were established as pilots in 2021	10
National Forestry and Grassland Bureau, National Bureau of Statistics Pilot	In 2022, Inner Mongolia, Fujian, Henan, Hainan, and Qinghai were identified as pilots for accounting the value of forest resources	5

### 3.3. Progress in the Valuation of Ecological Products

#### 3.3.1. Development of the Valuation of Ecological Products

The valuation of ecological products builds a bridge between “green mountains and clear waters” and “golden mountains and silver mountains”. It is the core of building an ecological civilization system and an important foundational work for promoting the realization of the value of ecological products. Looking back at the development of the valuation of ecological products in China, the early stage was mainly based on scientific research exploration conducted by research institutions and relevant scholars. Later, it gradually became a pilot study led by the government, who attempted to incorporate it into decision-making; the connection between science and policy was gradually deepened and strengthened. Based on important events and time nodes, this article divides the development of the valuation of ecological products into three stages: the scientific exploration stage (1997–2012), the practical promotion stage (2012–2021), and the deepening and expansion stage (2021–present) [29].

##### (1) Scientific Exploration Stage (1997–2012)

Spanning from the quantification of global ecosystem service value by Costanza in 1997 to before the 18th National Congress of the Communist Party of China in 2012, this was a stage where the valuation of ecological products was spontaneously explored. In this stage, the relevant scholars conducted research and exploration independently, laying a solid foundation for the valuation of ecological products based on domestic and foreign research on ecosystem services. Ouyang Zhiyun et al. [30] evaluated the value of China’s terrestrial ecosystem services using modeling methods. Earlier, Xie Gao et al. [31] established a table of equivalent factors for the unit area value of China’s ecosystem services based on Costanza’s research, and Fu Bojie et al. [32] systematically analyzed the spatial pattern and

evolution characteristics of different ecological types and services in China, and the scope of valuation was further expanded from the national scale to the regional scale. Forest ecosystems were one of the earliest types of ecosystem to be studied for valuation in China, and this was gradually expanded to other types of ecosystems such as grasslands, wetlands, oceans, and watersheds. During this stage, the valuation of ecological products mainly aimed to improve the understanding of the value of ecological environmental resources; it initially covered accounting methods such as biophysical models, equivalent factors, and energy value analysis but had not yet been applied to local practices.

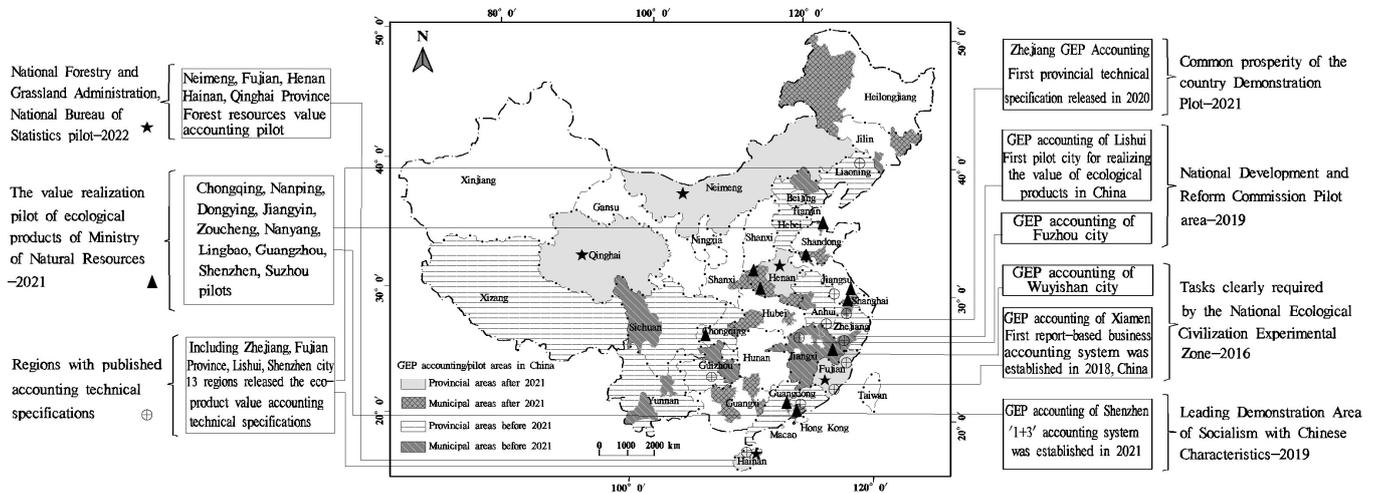
### (2) Practice Promotion Stage (2012–2021)

The period from 2012 to 2021 can be regarded as the practice promotion stage of ecological product value accounting. It was characterized by the development and implementation of pilot projects for ecological product value accounting, and the exploration and promotion of the application of accounting results. Since the 18th National Congress of the Communist Party of China, the “Two Mountains” concept has gradually become the concept at the core of constructing an ecological civilization. As a practical tool for the transformation of the “Two Mountains” concept, ecological product value accounting has gradually turned to cooperation between local governments and scientific research institutions to promote practical applications; attempts have increasingly been made to involve it in government decision-making. In 2013, Ouyang Zhiyun [33] proposed the concept of gross ecosystem product (GEP), defining it as the total value of terminal ecosystem services used to measure the operating status of ecosystems. In 2021, it was included as a comprehensive indicator in the latest SEEA-EA framework. The National Development and Reform Commission, the National Bureau of Statistics, the Ministry of Natural Resources, and other departments have successively deployed a series of GEP accounting pilot projects, exploring the provision of technical references for ecological compensation standards and government performance evaluations. Based on practical needs, the relevant scholars and scientific research institutions have attempted to develop methods and systems for GEP accounting that can be independently carried out by local business departments. Xiamen first established a business-oriented GEP accounting system based on the statistical report method in 2018, establishing a complete coding system and data reporting system based on scientific model accounting [34]. Subsequently, in 2021, Shenzhen established a “1 + 3” GEP accounting system, which is led by the implementation plan and incorporates a local accounting standard, a set of accounting statistical reports, and an automatic accounting platform. As the first pilot city for the ecological product value realization mechanism in China, Lishui City in Zhejiang Province has established a four-level GEP accounting system for the city, county, township, and village. During this stage, the relevant concepts gradually transitioned from the evaluation of ecosystem services’ value to GEP accounting, and the government department and scientific research institution model was used to promote the pilot study of regional GEP accounting; however, it was mainly carried out in local areas with better natural resource endowments and has not yet been fully rolled out nationwide.

### (3) Deepening the Implementation Stage (2012–2022)

The release of the opinions by the two offices in 2021 elevated the value assessment of ecological products to a new strategic height. The work of assessing ecological product value has been comprehensively deepened from top to bottom nationwide. Under the guidance of the overall national strategy, local governments at all levels have issued relevant implementation plans and opinions to promote related work. The pilot assessment is no longer limited to sporadic deployment by national departments but is being comprehensively promoted at the provincial, municipal, and county levels. According to incomplete statistics, as of now, various pilot assessments related to ecological product value assessments have covered 17 provinces, 50 prefecture-level cities, and more than 160 counties, with a total investment of over CNY 300 million (Figure 4). During this stage, ecological product value assessments have become a government-led initiative, with a

focus on promoting the standardization of assessment, exploring pilot assessments, and applying assessment results. The related concepts have evolved from ecosystem service value and GEP assessment to ecological product value assessment, and the connection between science and decision-making has been further strengthened.



**Figure 4.** Pilot of ecological product value accounting.

Looking back at the entire development process of ecological product value assessment research in China, it has gone through three stages of conceptual evolution, namely, ecosystem service value assessment, GEP assessment, and ecological product value assessment. This indicates that China’s understanding of the relevant theoretical connotations and the application of assessment results has gradually deepened. The introduction of important propositions such as the “Two Mountains” theory and the harmonious coexistence of humans and nature has gradually made ecological product value assessments a research hotspot and a frontier in multiple disciplines such as ecology, economics, and management. The institutional advantages of socialism with Chinese characteristics have enabled the related work to be firmly and rapidly promoted nationwide. The significant amount of investment and the wide range of pilot assessments demonstrate that China’s research on ecological product value assessment has taken the lead globally.

### 3.3.2. Development Status of Ecological Product Value Accounting Systems

In recent years, various levels of government departments in China have conducted a series of explorations around the development of technical specifications for ecological product value accounting. This has led to the preliminary formation of a three-level technical accounting system at the provincial, municipal, and district levels. This study systematically collects and organizes 12 publicly released ecological product value accounting technical guidance documents (Table 2). These documents have formed some consensus in terms of terminological definitions, the accounting process, and accounting classifications. However, there are still some differences in terms of publication formats and evaluation methods. First, these documents are mostly published in the form of local standards, group standards, or government documents. Second, ecological product value is generally equated with the gross ecosystem product (GEP), although a few documents, such as those from the National Development and Reform Commission, Fujian, and Liaoning, directly use the term “ecological product total value”. Third, the accounting process is based on physical quantity accounting for value accounting, but the evaluation models and pricing methods have not yet reached a consensus. Fourth, the accounting classification mainly adopts the methods of material products, mediation services, and cultural services, with some systems adding support services.

**Table 2.** Formation schedule of the value accounting systems for major ecological products in China [35].

No	Technical Specification	Issuing Agency	Issuing Form	Issuing Time	Number of Accounting Subjects	Subject Classification
1	“Specification for the Accounting of Gross Ecological Product”	National Development and Reform Commission, National Bureau of Statistics	Development and Reform Foundation (2022) No. 481	2022	13	Material supply, regulation services, cultural services
2	“Technical Guidance on Accounting for Gross Terrestrial Ecosystem Products (GEP)”	Ministry of Ecology and Environment (MEE)	Forwarded by the Ministry of Ecology and Environment	2020	19	Material products, regulation services, cultural services
3	“Technical Specification for Accounting of Gross Ecosystem Product (GEP)—Terrestrial Ecosystems”	Zhejiang Province (ZJ)	DB33/T 2274-2020	2020	12	Supply of products, regulation services, cultural services
4	“Technical Specification for Accounting of Gross Ecosystem Product”	Jiangxi Province (JX)	DB36/T 1402-2021	2021	13	Material products, regulation services, cultural services
5	“Technical Specification for Accounting of Gross Ecosystem Product (GEP)”	Guizhou Province (GZ)	DB52/T 1608-2021	2021	15	Material products, regulation services, cultural services
6	“Technical Guide for Accounting of Gross Ecological Products in Fujian Province”	Fujian Province (FJ)	Min Environmental Protection Comprehensive No. (2021) 7	2021	25	Supply, regulation, cultural services
7	“Technical Specification for Gross Ecological Product (GEP) Accounting”	Liaoning Province (LN)	LNSSES 001-2022 (Group Standard)	2022	26	Material products, regulation services, cultural services, support services, snow and ice services
8	“Technical Specification for Accounting of Gross Ecosystem Product”	Shenzhen City (SZ)	DB4403/T 141-2021	2021	16	Material products, regulation services, cultural services
9	“Technical Guidelines for Statistical Accounting of the Value of Ecosystem Production”	Xiamen City (XM)	Xiamen Government Office No.(2018) 139	2020	12	Ecosystem products, habitat regulation, ecohydrological regulation, soil erosion control, species conservation and renewal, spiritual and cultural services

Table 2. Cont.

No	Technical Specification	Issuing Agency	Issuing Form	Issuing Time	Number of Accounting Subjects	Subject Classification
10	“Technical Specifications for Accounting of Gross Ecosystem Product (GEP)”	Nanjing City (NJ)	DB3201/T 1041-2021	2021	18	Material products, regulation services, cultural services
11	“Technical Specifications for Accounting of Gross Ecosystem Product (GEP)”	Huangshan City (HS)	DB3410/T 12-2021	2021	17	Material products, regulation services, cultural services
12	“Technical Specification for Accounting of Gross Urban Ecosystem Product (GEP)”	Yantian District (YT)	SZDB/Z 342-2018	2018	28	Eco-products, eco-regulation, eco-culture

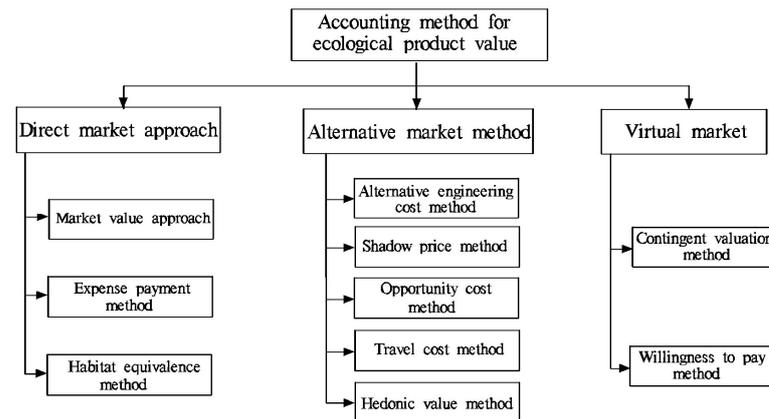
Note: the technical specifications of Hainan Province are not publicly available, and the technical specifications of Lishui City do not provide pricing methods and are not included in the analysis system.

### 3.3.3. Methods for the Valuation of Ecological Products

Currently, there are three main methods for valuing ecological products: the equivalent factor method, the functional price method, and the ecological unit method. The equivalent factor method calculates the value of ecological products by dividing the ecological system into different functions and setting specific quantitative standards. The functional price method directly multiplies the physical and service quantities of the products provided by the ecological system by their respective prices and adds them up to obtain the total value. The ecological unit method mainly calculates the quantity of ecological resources in ecological units based on the unit of solar energy value. Currently, the functional price method is mainly used for valuing ecological products in various regions of China. The total value of ecological products (ecological material products, ecological regulation service products, and cultural service products) in administrative units is calculated, following the principle of valuing quantity before value. First, the output of different ecological products provided by the ecosystem during a certain period is calculated. Then, market prices are used preferentially, and, for products without market pricing, substitute market technology and simulated market technology are used (Figure 5) to calculate the unit prices of different ecological products. Finally, the total value of the ecological products in the administrative unit is calculated. The principal method for calculating the total value of ecological products, as outlined in the “Guidelines for the Calculation of Ecological Product Value” recently issued by the National Development and Reform Commission, is based on this method. This provides guidance for the valuation of ecological products in various regions. Currently, the valuation of ecological products in areas such as Dongying City, Mengyin County in Shandong Province, and the southern mountainous area of Jinan has been carried out using this method.

In summary, the valuation of ecological products has formed a promotion pattern led by the national overall strategy and driven by local specific practices. Key efforts have been made in various regions to develop accounting standards, promote accounting pilots, and apply accounting results. Based on the extensive implementation of ecological product value accounting, various regions have actively promoted the application of accounting results, especially in performance evaluation and green credit. Many regions have explored the establishment of a “dual accounting, dual operation, and dual promotion” evaluation mechanism for GEP and GDP. Guangdong Province’s Shenzhen and Huizhou cities have fully applied GEP accounting results to the performance management of party and govern-

ment leaders to supplement and improve the evaluation system for ecological civilization performance. Implementing green financial credit based on GEP accounting results is also currently a hotspot in local practice. Zhejiang Province's Lishui City, Shandong Province's Mengyin County, and other places have implemented "GEP loans" based on GEP accounting results as the credit limit benchmark. The Dapingshan photovoltaic power generation project in Yunxian County, Zhejiang Province, uses GEP accounting results as the price benchmark for purchasing ecological products. Yanjiawan Village in Chongzhou City, Sichuan Province, relies on GEP accounting results to transform ecological resources with tourism potential into market prices for equity participation, achieving the transformation of ecological resources into economic value.



**Figure 5.** Common methods for ecological product value accounting.

### 3.4. Progress in Realizing the Value of Ecological Products in Shandong Province

In October 2021, the Development and Reform Commission of Shandong Province, the Department of Natural Resources of Shandong Province, and another five departments jointly issued the "Notice on Printing and Distributing the Implementation Plan for Implementing the Opinions of the Central Committee of the Communist Party of China and the State Council on Establishing and Improving the Mechanism for Realizing the Value of Ecological Products". The notice pointed out that, by 2025, the institutional framework for realizing the value of ecological products will have initially been formed, and a relatively scientific system for assessing the value of ecological products will be established. By 2035, a complete mechanism for realizing the value of ecological products will be established, providing strong support for achieving the goal of building a beautiful Shandong. In August 2022, the State Council issued the "Opinions on Supporting Shandong to Deepen the Conversion of New and Old Energy and Promote Green, Low-carbon and High-quality Development" (State Council Document No. 18 of 2022), which specifically mentioned that "we must earnestly implement the concept that green mountains and clear waters are as valuable as mountains of gold and silver, continuously improve the quality of the ecological environment, enhance the function of the ecosystem and carbon sequestration capacity, adhere to the integrated protection and restoration of mountains, rivers, forests, farmland, lakes, grass, sand and soil, and explore the mechanism for realizing the value of ecological products." In September 2022, the Development and Reform Commission of Shandong Province, the Department of Natural Resources of Shandong Province, and another six departments organized a pilot selection for establishing and improving the mechanism for realizing the value of ecological products at the provincial level. In total, 22 areas, including Jinan, Dongying, Yantai, Tai'an, Shanting District, Linqu County, the Lingshan Island Provincial Nature Reserve, and the Xiashan Reservoir Ecological Economic Development Zone, were included in the pilot. In August 2021, the Department of Natural Resources of Shandong Province issued the "Implementation Opinions on Establishing the Mechanism for Realizing the Value of Ecological Products in the Field of Natural Resources", which clearly pointed out that, through exploration and practice, the supply capacity of ecological

products will be significantly improved; moreover, a technical support mechanism and supporting policy measures for realizing the value of ecological products in the field of natural resources will be established, creating a model for realizing the value of ecological products in Shandong Province. In November 2021 and October 2022, the Department of Natural Resources of Shandong Province carried out two batches of solicitation and selection activities for typical cases of realizing the value of ecological products in the field of natural resources. Finally, 43 typical cases stood out, playing a demonstrative and leading role in creating a model for Shandong Province. The schedule for promoting various policies and major events for realizing the value of ecological products in Shandong Province are shown in Table 3 below:

#### 4. Exploring the Path Model for Realizing the Value of Ecological Products

The realization of the value of ecological products is still a relatively new concept, and many issues are still being explored. One reason for this is that the value of ecological products is often implicit and not manifested in the market. Therefore, the essence of realizing the value of ecological products is to make the implicit value explicit, or, in other words, to make this implicit or potential value manifest in the market. Thus, it is necessary to explore the path for realizing the value of ecological products [36].

##### 4.1. Overview of the Path Model of Ecological Product Value Realization

To date, many scholars have summarized and generalized pathways and models for realizing the value of ecological products [5,9,10,19,23,26,27,36–52]. Internationally, Costa Rica's market-based ecological compensation, the wetland banking ecological restoration model in the United States, and Brazil's financial transfer payment index trading for natural protected areas have accumulated a great deal of experience in realizing the value of ecological products. Domestically, pilot programs and market trading practices in cities such as Lishui and Fuzhou have also been explored. Overall, the "three-part division" of ecological products, namely, public, quasi-public, and commercial ecological products, and the corresponding "three paths" for realizing their value (i.e., the government path, the government–market hybrid path, and the market path) have been widely recognized by experts and scholars (Figure 6). The government path relies on financial transfer payments and the governmental procurement of services to realize the value of ecological products. The government–market hybrid path cultivates trading subjects through laws or government administrative control and policy support, promotes market transactions, and realizes the value of ecological products. The market path mainly involves the value realization of directly tradable ecological products through market allocation and market transactions, ecological industrialization, and industrial ecology. The "three-part division" of ecological products and the "three paths" for realizing their value constitute the underlying logic and basic theory of realizing the value of ecological products, which can be used to formulate various localized systems, policies, and models for realizing the value of ecological products.

**Table 3.** The development process of the value realization mechanism of ecological products in Shandong Province.

Time	Important Documents/Events	Development History	Meaningful Interpretations
May 2021	The Ministry of Natural Resources issued the “Approval on the Pilot Mechanism for Realizing the Value of Ecological Products in the Field of Natural Resources in Dongying City and Zoucheng City, Shandong Province”	Promoted the key tasks of the pilot project, focused on building a theoretical system, a technical system, and a policy system for realizing the value of ecological products in the field of natural resources, and accelerated the establishment of a sustainable government-led mechanism for realizing the value of ecological products, with the participation of enterprises and all sectors of society and market-oriented operations	To promote the transformation of the “two mountains”, promote the harmonious coexistence of humans and nature to provide more practical samples, and to provide the country with replicable, replicable typical experience
June 2021	The inauguration ceremony of “Shandong University Yellow River Basin Ecological Product Value Realization Research Center” was held on Qingdao campus	The first research institution for ecological product value realization established by a key university in China	Based in Shandong Province, it serves the national strategy of the Yellow River and provides technical support for the realization of ecological products in Shandong Province
August 2021	The Department of Natural Resources of Shandong Province issued the “Implementation Opinions on Establishing the Mechanism for Realizing the Value of Ecological Products in the Field of Natural Resources”	Through exploration and practice, localities have significantly improved the supply capacity of ecological products, initially established a technical support mechanism and supporting policy measures for realizing the value of ecological products in the field of natural resources, and created a Qilu model for realizing the value of ecological products in the field of natural resources	It identified a direction for research of ecological product value realization mechanism in the field of natural resources in Shandong Province
October 2021	Shandong Provincial Development and Reform Commission, Shandong Provincial Department of Natural Resources and other five departments jointly issued the “Notice on the Implementation Plan for Implementing the Opinions of the General Office of the CPC Central Committee and the General Office of the State Council on Establishing a Sound Mechanism for Realizing the Value of Ecological Products	In 2025, the initial formation of the institutional framework for the realization of the value of ecological products, and the initial establishment of a more scientific system for accounting for the value of ecological products. By 2035, an optimized ecological product value realization mechanism will be fully established to provide strong support for the realization of the construction goals of a beautiful Shandong.	Clarified the key tasks for achieving the value of ecological products in Shandong Province
November 2021	Circular of Shandong Provincial Department of Natural Resources on the Announcement of Typical Cases of Ecological Product Value Realization in the Field of Natural Resources in 2021	A total of 57 cases in 4 areas, including the ecological resource index and property rights trading, ecological restoration and value enhancement, ecological industrial operation, value accounting and ecological compensation, were collected, and 22 typical cases were selected to have promotion value in Shandong Province	Promoted the theoretical and practical exploration of ecological value realization mechanisms in the field of natural resources in the province, and provided demonstration and guidance of typical cases

Table 3. Cont.

Time	Important Documents/Events	Development History	Meaningful Interpretations
February 2022	The CPC Shandong Provincial Committee and Shandong Provincial People's Government issued the Plan for Ecological Protection and High-Quality Development of the Yellow River Basin in Shandong Province	To take the lead in the Yellow River Delta, Dongping Lake and other key areas to carry out a pilot ecological product value realization mechanism	To innovate the ecological environment management mechanism of the basin and increase ecological compensation in areas along the Yellow River
May 2022	Report of the Twelfth Party Congress of Shandong Province	Clearly put forward the key tasks in the next five years in Shandong Province, to establish a mechanism for realizing the value of ecological products	Deepen and improve the system of ecological compensation, ecological and environmental public interest litigation, etc., and improve the ecological civilization policy system
April–June 2022	Shandong Provincial Department of Natural Resources and Shandong Institute of Geological Sciences jointly investigate the work of ecological product value realization mechanism in the field of natural resources in Linyi, Zoucheng, Dongying, Yantai, Weifang, and other places	Preliminary understanding and grasp of the current situation, as well as the advantages and some problems of the mechanism of realizing the value of ecological products in the field of natural resources in typical cities and towns in Shandong Province	The work of the mechanism for realizing the value of ecological products in the field of natural resources in the province has blossomed at many points, but it still needs to be improved and condensed and summarized.
July 2022	Shandong Province held a training seminar on ecological product value realization mechanisms in the field of natural resources and established an expert committee in the field of natural resources	Shandong Institute of Geological Sciences, as a technical support unit, took the lead in forming and establishing the Shandong Provincial Research Committee on the value realization mechanism of ecological products in the field of natural resources	The technical support for the mechanism of realizing the value of ecological products in the field of natural resources in the province is continuously strengthened
July 2022	The Department of Rights and Interests of the Ministry of Natural Resources investigated the progress of the pilot mechanism for realizing the value of ecological products in the field of natural resources in Shandong Province in Dongying and Zoucheng	As the technical support unit for the realization mechanism of ecological products value in the field of natural resources in Shandong Province, Shandong Academy of Geosciences accompanied the leaders of the Ministry of Natural Resources and the provincial department throughout the research	Laying a good foundation for the research on the mechanism of realizing the value of ecological products in the field of natural resources in the province
August 2022	Opinions of the State Council on Supporting Shandong in Deepening the Transformation of New and Old Dynamic Forces to Promote Green, Low-Carbon and High-Quality Development (Guo Fa No. [2022]18)	It is clear that priority should be given to exploring and practicing in areas such as ecological product value realization mechanisms, and carrying out full-life-cycle carbon footprint accounting of key products	The value realization mechanism of ecological products has an important role and significance in the high-quality development of Shandong's new and old dynamic energy conversion
September 2022	National Pilot Mechanism for Realizing the Value of Ecological Products in the Field of Natural Resources—Total Ecological Product Value in Dongying City, Shandong Province Released for the First Time	According to the accounting, the total value of ecological products (GEP) in Dongying in 2020 was CNY 723.688 billion, including CNY 336.235 billion in land space and CNY 387.454 billion in sea space	In the early and pilot exploration stages, the Dongying model of ecological products value realization was created

Table 3. Cont.

Time	Important Documents/Events	Development History	Meaningful Interpretations
September 2022	Shandong Provincial Development and Reform Commission with, Shandong Provincial Department of Natural Resources and other 6 departments, organized the selection of Shandong provincial pilot work to establish a sound mechanism for realizing the value of ecological products	Jinan, Dongying, Yantai, Tai'an, Shanting District, Linqu County, Lingshan Island Provincial Nature Reserve, Xiaoshan Reservoir Ecological and Economic Development Zone, and another 22 areas were included in the pilot	To speed up the development of the ecological product value realization mechanism in Shandong Province, to address the key difficulties and blockages, to promote the transformation of green water and green mountains into golden mountains, and to demonstrate the way forward
September–October 2022	2022 Collection and selection of cases of ecological product value realization mechanism of natural resources in Shandong Province	21 cases were selected as typical cases of ecological product value realization in the field of natural resources in Shandong Province (the second batch)	To enrich the practical experience of various types of ecological products, to provide a demonstration, and to have a driving effect in the field of ecological product value realization
November 2022	Shandong announces the gross value of the terrestrial ecosystem (GEP)	Shandong's terrestrial GEP is high, at CNY 248.24669 billion (2020), with ecological products dominated by material products and cultural services, and regulation services that still need to be further explored and upgraded	It shows that the synchronous growth of GEP and GDP and the coordination of economic development and ecological protection in the province is improving

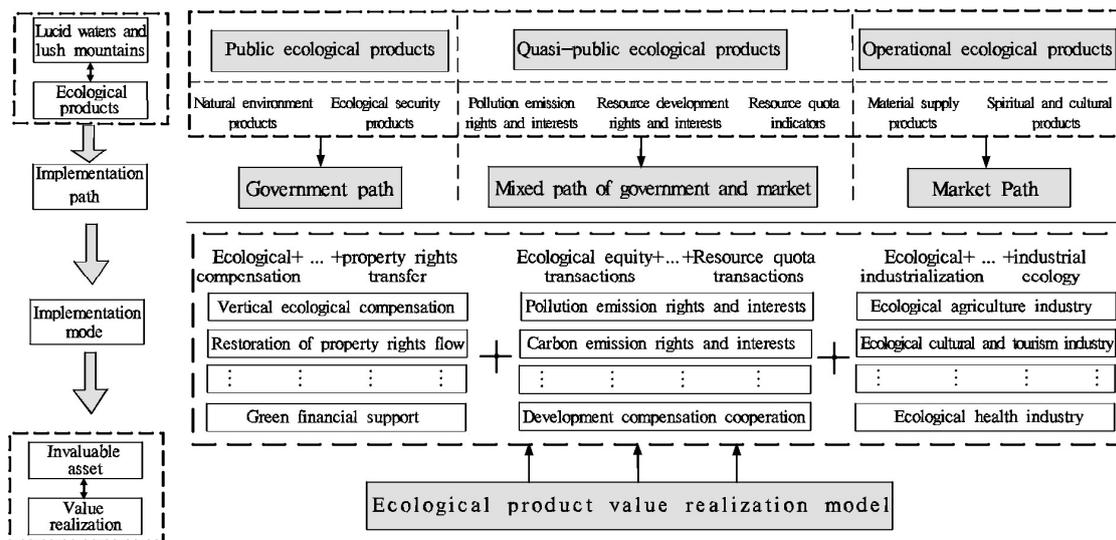


Figure 6. Paths and modes of realizing ecological product value.

Sun Bowen [27] categorized the theoretical models for realizing the value of ecological products into five categories: ecological restoration and comprehensive environmental management, ecological protection compensation, ecological private product trading and ecological industrialization, ecological resource capitalization and ecological rights trading, and industrial ecologicalization. Zhang Linbo [53] summarized domestic and foreign ecological product value realization case studies and categorized them into eight models: ecological protection compensation, regional coordinated development, resource property rights transfer, ecological carrier premium, ecological capital income, ecological rights trading, resource quota trading, and ecological industrialization. Ye Youhua [41] summarized and categorized six practical models for realizing the value of ecological products from the perspective of rural revitalization, including ecological protection compensation, ecological resource indicators and property rights trading, green finance, ecological agricultural industrialization, ecological tourism and characteristic cultural industrialization, and ecological restoration and value preservation. Zhu Wanjian [37], Zheng Donghua [38], and others summarized “three advances and three retreats” restoration, “four-in-one” coal mining subsidence area governance, comprehensive land management, government ecological compensation, ecological restoration and value enhancement, green finance promotion, and “ecological agriculture, culture, and tourism” models for realizing the value of ecological products in Jiangsu and Jiangxi provinces. The framework for the pathway of the value realization of domestic ecological products is shown in Figure 6.

#### 4.2. Pathway Model for the Realization of Ecological Product Value in Shandong Practice

To further promote the theoretical and practical exploration of the mechanism for realizing ecological value in the field of natural resources in Shandong Province, from September 2021 to the first half of 2022, Shandong Province actively collected, selected, and compiled and distributed typical cases (first batch) of ecological product value realization in the field of natural resources. These cases fully reflect the characteristic ecological resources of “mountains, waters, forests, fields, lakes, grasses, and seas” in Shandong Province, forming unique representative ecological value realization models such as Changdao Marine Ranch, Linyi Forest Ecological Compensation, Yellow River Delta Saline-alkali Land Utilization, and Zoucheng City Coal Mining Subsidence Land Restoration and Management, which have activated the value realization of ecological products.

This article refers to the classification principles of the “three-part method” of ecological products and the “three pathways” of value realization, as well as the ecological product value realization models summarized by our predecessors. Combined with the characteristics and local characteristics of typical cases in Shandong, the ecological product

value realization model is divided into four categories: ecological resource indicators and property rights transactions, ecological governance and value enhancement, ecological industrial operations, and ecological protection compensation. Table 4 below shows the value realization model, main practices, and effects of 22 typical cases in the field of natural resources in Shandong Province.

Mode I: Ecological resource indicators and property rights trading. This mode creates demand for ecological products through government control or quota setting; it guides and incentivizes stakeholders to engage in trading. It combines government leadership with market forces to realize value.

Mode II: Ecological protection, restoration, and value enhancement. It restores the functionality of natural ecosystems, increases the supply of ecological products, and develops related industries through optimizing land use and adjusting land policies. It relies mainly on government regulation to realize value.

Mode III: Ecological industrialization operation. It utilizes policy tools such as land-use planning and industrial land policies to leverage ecological and resource advantages, promote ecological industrialization and industrial ecology, and attach the value of ecological products to the value of agricultural products, industrial products, and service products. It transforms them into commodities that can be directly traded in the market, and it is a market-oriented value realization path.

Mode IV: Ecological protection compensation. It follows the principle of “who benefits, who compensates; who protects, who receives compensation.” Governments at all levels or ecological benefit areas purchase ecological products from ecological protection areas through funding compensation, industry support, and other means. It is a government-led value realization path.

### *4.3. Analysis of Path Models for the Realization of Ecological Product Value: A Case Study*

#### *4.3.1. Government Path*

Shandong Province has made strides in the top-level design and institutional construction aspects, which have been practically applied in cases such as the implementation of the “Linyi Forest Ecological Benefit Compensation Measures” in Linyi City. The province has explored the application and conversion of the value of ecological resources and actively carried out the exploration of multiple pathways for the realization of ecological product value, such as the “Forest Chief System+” in Mengyin County and Feixian County, as well as the accounting of ecological product value. These efforts are worth understanding and drawing upon within the province and even across the country. At the same time, Shandong Province has ecological compensation cases in areas such as river basins, oceans, nature reserves, and forests. For example, Yantai has formulated the “Yantai Marine Environmental Quality Ecological Compensation Measures,” and Qufu has constructed an environmental benefit assistance mechanism of “finance + support funds + ecological construction projects + poverty-stricken households.” However, the extraction of these successful cases is still quite limited, indicating that Shandong Province still needs to strengthen its awareness and initiative in the realization of ecological product value.

#### *4.3.2. Market Path*

Ecological agriculture, ecological tourism, and ecological oceans are important market paths for the realization of ecological product value in the natural resources field of Shandong Province.

**Table 4.** Typical modes of realizing ecological product value in the field of natural resources in Shandong Province.

No.	Realization Model	Main Practices	Main Effects
1	Ecological resource indicators and property rights trading—I	MengYin County promotes deeper and more practical forest manager systems and explores “forest manager system +” ecological product value realization in multiple ways	The county, township, and village forest chief organization system has been built, and forestry carbon sink trading, village ecological product value accounting, and “green bank” construction have been implemented to realize the value of “green water and green mountains” and “golden mountains and silver mountains. The organic unity of the value of “green mountains” and “golden mountains” has been realized, and ecological resources have been revitalized
2		Feixian County “Two Mountain Bank” explores a new path of rural revitalization with inclusive financial services	The bank has concentrated the storage of scattered resources in the county, developed and operated according to local conditions, and built a green financial service platform to promote the realization of resources with credit enhancement, so that the value of ecological products has a basis and channel for market realization; it also explored a new path for rural green development by transforming the advantages of ecological resources into economic development advantages
3		Jiu Ding Manor, the Green Transformation from Abandoned Mine to Beautiful Manor—the Case of Mine Rehabilitation in Laixi City	Made full use of abandoned mine pits to build wine cellars and winery castles, creating a comprehensive vineyard integrating wine production, cultural displays, tourism reception, and leisure vacation functions. The high-quality ecological environment will improve the quality of wine and realize a virtuous cycle of economic development, ecological improvement, and people’s prosperity
4		Weifang “north willow”, from “saline wasteland” to “green water and green mountains”	Construction on the south coast of Laizhou Bay’s coastal saline land is difficult; through the planting of tamarisk, this project successfully cracked the problem of saline ecological greening, using the development of the “tamarisk + Cistanches” planting model and fine chemical products to enhance the added value of tamarisk; this constitutes a new pathway for coastal saline ecological management and industrial development
5		Zoucheng City coal mining subsidence land management: “ecological restoration and industrial development” to promote the value of ecological products	Relying on the unique natural ecosystem formed after the treatment of land that has undergone coal collapses, the development of the ecological industries of “agriculture, forestry, fishing, culture and tourism” was undertaken according to local conditions, to promote the “ecological depression” into “industrial heights”. It has developed a unique ecological management and ecological product value realization path
6	Ecological protection, restoration and value enhancement—II	Case of ecological restoration and value realization of wetland in Swan Lake Slow City, Gaocheng County, and Zibo City	The implementation of the Swan Lake wetland protection and restoration project, relying on the local characteristics of cultural tourism resources, to create a “100-mile Yellow-River-style belt” and a “special industry gathering belt”, to achieve the production of clean industry, the ecological beauty of the environment, a beautiful living environment: i.e., the “three lives and three beauties” integration development goal
7		Ecological restoration and re-realization of the value of abandoned mine pits in Qilu Wine Land Town, Anqiu City, Weifang	Adopting the model of “government-led, enterprise main body, multi-capital integration and market-oriented operation” to carry out ecological restoration of mine pits and create a comprehensive industrial town of “tourism + culture + health”; the ecological products have increased significantly and the scale of the industrial agglomeration effect is beginning to show, which represents the practice of combining ecological restoration and industrial development
8		Heze City Walnut Garden Town ecological restoration “repair” out of the green water and green mountains, the development of cultural tourism to realize the “gold mountain silver mountain”	With the core of the mountain pit resources, Jinshan culture as the soul, the expansion of traditional villages as the carrier, the construction of high-quality rural tourism parks, increases are achieved in income for farmers, the village collective economy, social capital profits, and government social benefits to enhance the multi-win situation
9		Ecological restoration and value realization of the international slow city of culture in Qufu Shimenshan Town and Wucun Town, Jining City	Ecological restoration is carried out with Confucian culture as the soul and “slow” as the basis, creating an international slow city that integrates ecological experience, cultural tourism, slow living and leisure, and creative experience, promoting the joint development of “ecology + tourism”, “ecology + culture”, and other industrial forms, and realizing the value-added premium of ecological products. Culture and other industrial forms realize the value-added premium of ecological products
10		The Case of Ecological Restoration and Value Realization of Sibao Mountain Mine Park in Zibo City	The construction of Sibao Mountain Mine Park in accordance with local conditions has created a lifestyle that integrates ecological technology, national sports, and cultural interpretation, turning the once mining site into a “good work” where ecological, economic, and social benefits are realized together and ecological construction and economic development complement each other

Table 4. Cont.

No.	Realization Model	Main Practices	Main Effects
11		Dongying Runsong Agricultural Company implements ecological restoration of saline land and develops forest economy to promote the value of ecological products	Through cooperation with scientific research institutions, the Dongying Runsong Agricultural Company has improved the heavily saline land, developed ecological forestry according to local conditions, developed a compound forest medicine, forest fungus, and forest animal three-dimensional cycle industry under the forest, and turned ecological forestry into an ecological product production workshop without walls, which has realized the value of ecological products
12		Ancient villages revitalized to a new look—Zoucheng City revitalized idle ancient mountain villages to create a special tourism complex	Based on the cultural advantages of ancient villages, the comprehensive development of the idle ancient village of Shangjiushan has cultivated a new business model that integrates the exploration of ancient monuments, folklore displays, film and television shooting, ecological tourism, and leisure and entertainment, promoting the employment of farmers to increase income and promoting a win-win situation for the development of resource conservation and intensive use and rural revitalization
13		Exploring the path of revitalizing mountain villages with ecological forestry—Taian Jiuyinfeng	In the face of the shortage of ecological advantages in the industry, the Jiuyinfeng district of Tai'an City has chosen to thicken the ecology of mountainous areas, beautify the landscape of mountain villages, upgrade traditional forest fruits, strengthen special forest medicine, and break through forest culture and tourism, so as to turn ecological advantages into economic advantages and realize the comprehensive benefits of "green water and green mountains"
14		Realizing the "ecological industrialization and industrial ecologicalization" of Yinan County Maquan Creative Leisure Park	Yinan County introduced entrepreneur Sheng Qing to invest in the establishment of Shandong Jili Tourism Development Co., Ltd., to build a modern forestry leisure park based on ecological restoration in Maquanshan, which has significantly increased the production capacity of high-quality ecological products and realized the development mode of the mutual linkage and deep integration of primary, secondary, and tertiary industries
15	Ecological industrialization operation—III	Qingdao West Coast Yangjiashanli Rural Cultural Tourism Industry Development Promotes Ecological Product Value Realization	Fully exploiting the red culture and green resources in Yangjiashanli area, innovating the development mode of "red culture + green ecological tourism", realizing the value-added premium of ecological products through the "entry consumption" of tourists, promoting the ecological industrialization operation, and exploring the new path of Qilu model for rural revitalization
16		Weifang city HuangHua town development, "hazelnut whole industry chain"	Transforming 10,000 mu of barren hills into high-standard hazelnut plantations and building a whole industry chain operation mode of "seedling breeding + hazelnut acquisition + deep processing R&D + storage logistics + platform trading + online and offline sales" has promoted farmers' employment and income and enhanced the production and supply capacity of ecological products
17		Weifang Anqiu Weilu Valley National Forest Recreation Tourism Comprehensive Development	Focusing on the three aspects of "cultural recreation, ecological recreation, and life recreation", the Weilu Valley Forest Recreation Tourism Base featuring "forest + field + countryside" has achieved a high degree of integration of primary, secondary, and tertiary industries, created a series of special regional brands, and promoted the value-added premium of ecological products
18		"Strategize the ocean, to the sea," Changdao marine ecological pasture industry model	Relying on the excellent ecological resources and sea environment, the Long Island Comprehensive Experimental Zone focuses on the development of modern fishery industry systems with marine pasture, which successfully solves the conflict between humans and sea supplies, promotes the coordinated and sustainable development of the ecological environment, resource restoration, and the fishery industry, and realizes the harmonious coexistence of humans and nature
19		Development of "ecological agriculture and cultural tourism" in Daolang Town, Taian City	Using the characteristic resources of the village, it vigorously develops "ecological cultural tourism", building a beautiful village with intensive and efficient production space, livable and comfortable living space, and beautiful ecological space; it has emerged from a "multi-win" path with a sustained improvement of the ecological environment, the gradual manifestation of ecological product value, and a remarkable effect of rural revitalization
20		Weihai City vigorously develops blue carbon economy to accelerate the realization of the value of marine ecological products	Based on the advantages of the sea, the city has built a blue carbon economy system with industrial ecology and ecological industrialization as the mainstay, promoted the integrated development of green farming, the reuse of marsh moss, ecological tourism and other industries, and conducted a comprehensive and systematic exploration and innovation of the realization of the value of marine ecological products

Table 4. Cont.

No.	Realization Model	Main Practices	Main Effects
21	Ecological protection compensation—IV	Linyi City implements horizontal compensation for forest ecological benefits and explores the path of ecological resource value conversion	Forest cover and the annual afforestation area are used as assessment criteria to carry out horizontal compensation for forest ecological benefits in each county and district. The forest cover index trading is essentially a kind of quota trading implemented under the total ecological resource control system, and the experience of this mechanism can be replicated to other ecological resource types, such as wetlands and arable land
22		Linyi Mengyin County actively carries out the exploration of ecological product value accounting and produces a new path of ecological value realization	It actively carries out ecological product value accounting and explores the “ecological loan” model linked with ecological product value accounting according to local conditions, so as to solve the problem of “difficult quantity, collateral, transaction and realization” of ecological products; it gradually reveals the value of ecological products

(1) Ecological Agriculture: agricultural products are the most intuitive ecological products, and, as an agricultural province, Shandong Province has no shortage of such cases. The cases also demonstrate the achievements of Shandong Province in various aspects of ecological agricultural products, especially in various cities, where significant scientific research efforts have been invested, from breeding to product processing, relying on domestic and foreign scientific and technological teams to achieve qualitative breakthroughs. Huanghua Town in Zhucheng City has fully enhanced the added value of hazelnut agricultural products through deep processing, achieving the full development of the hazelnut industry chain. The Jiunvfeng area in Tai'an has implemented the "forest-fruit + technology + brand + e-commerce" action by prioritizing protection, cultivating the ecological environment in mountainous areas, strengthening the development of Tai'an's famous medicines, introducing new agricultural varieties such as Tai'an ginseng, Tai'an tea, Venus golden apples, and so on, forming various new business formats such as research and study, picking, catering, and homestays, and achieving new added value for ecological products. However, the overall implementation scale and highlights are not prominent enough.

(2) Ecotourism: ecotourism is another form of ecologically conscious product realization that is most in line with conscious thinking. Shandong Province has taken a comprehensive and distinctive approach to ecotourism, covering various themes including red culture, slow cities, nostalgia, health and wellness tourism, and industrial culture. Qingdao's Xihaiyang "Yangjiashanli," represented by red culture, is known as the "Little Yan'an" of the region and was successfully selected as a red study base in Shandong Province in 2021. Gaoqing in Zibo created the first international slow city in the Yellow River Basin. Lu Mountain Valley has formed a characteristic health and wellness tour, relying on local Chinese herbal medicine planting, rehabilitation medicine, and wellness centers. Zibo's Sibaoshan mine restoration plan, based on ecological background space restoration principles, preserves industrial characteristic elements such as the thousand-year-old iron smelting history research and teaching module and the mine fun park area, becoming an artistic presentation of industrial heritage with both material and cultural value, achieving an increase in ecological product value.

(3) Ecological Ocean: Shandong Province has a long coastline and abundant marine resources, with obvious marine advantages. Chang Island and Weihai rely on their marine advantages to develop a blue carbon economy; these include marine ranching, marine ecotourism, and modern marine fisheries. Significant results have been achieved. As a national leader in marine science and education industry, Qingdao has a few cases of marine ecological value realization that involve national strategic emerging frontiers such as blue carbon financial innovation, marine pharmaceuticals, marine biology, and deep-sea resources; these should have been unique ecological product value realization highlights in the country, but they have not been highlighted.

#### 4.3.3. The Combination of Government and Market in Ecological Restoration Pathways

(1) Ecological Restoration: the ecological restoration field in Shandong Province covers various ecological land types, including oceans, wetlands, and barren mountains, and especially saline-alkali lands, but excluding mines. Based on the government's supply of public ecological products (the ecological restoration of coal mining subsidence areas), the value realization potential of operational ecological products (specialized breeding, edible fungi, ecological tourism, etc.) has been stimulated in the coal mining subsidence areas of Zoucheng, achieving the coordinated development of its social, economic, and ecological aspects. The restoration, improvement, and reuse of saline-alkali lands and wetlands in Dongying, Weifang, and other places have realized the further enhancement of ecological value realization from "investing money to turn green" to "making money from green". There are no cases involving marine ecological restoration yet, but Binzhou, Yantai, and Weihai are currently implementing a national special project for marine ecological restoration. By actively carrying out the restoration of seagrass beds and seaweed fields, the carbon sequestration capacity of seagrass beds is being restored, and the level of marine

biodiversity is effectively being increased. It is believed that there will be highlights of marine ecological restoration value realization in the future.

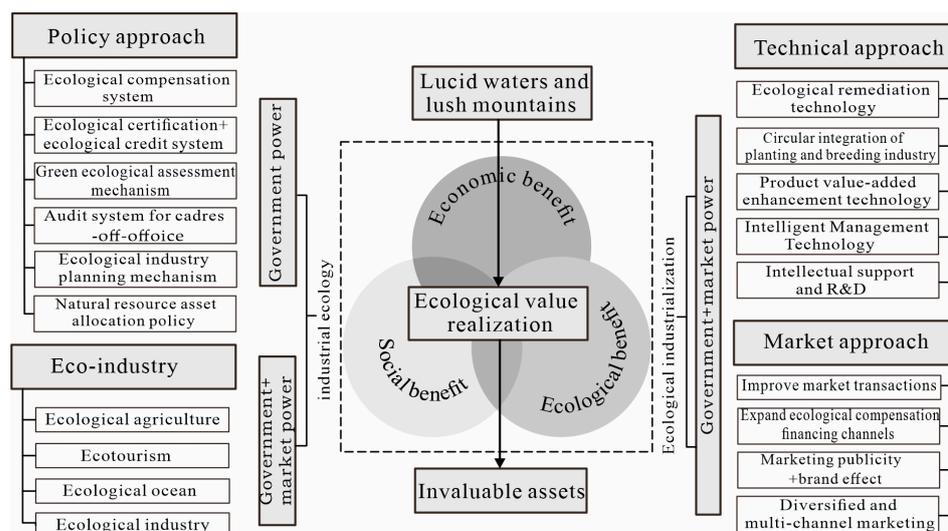
(2) Ecological Finance: few cases of ecological product value realization have been submitted in Shandong Province's research and development of green financial products. Feixian has implemented the "Two Mountains Commercial Bank" and developed green finance in a pioneering way, proposing eight system financial loan products. Mengyin County has even explored GEP accounting. These explorations of ecological product value realization are unprecedented in Shandong Province and deserve greater efforts to form experiences that can be promoted in Shandong. In terms of marine finance, Yantai has introduced the first Taiping Marine Insurance Innovation and Development Center in the country, using the average annual particle organic carbon content of seawater as a reference index, further enhancing the enthusiasm of market entities to participate in marine ecological restoration. However, due to the lack of case refinement and submissions, the connection between and implementation of ecological product value realization and specific work need to be further strengthened.

The value realization mechanism of ecological products in Shandong Province has achieved significant results in the field of natural resources. The cases submitted by various cities show that the province has formed a series of diversified ecological product value realization models, including the combination of government, market, and government-market methods. These models cover various ecological resources such as oceans, forests, wetlands, mountains, and mines. At the national level, the importance of the marine industry and the restoration of saline-alkali land has been highlighted. However, when extracting existing cases, localities lack an understanding of ecological products, and policies for emerging ecological industries such as marine biomedicine, marine resource reuse, and green finance are not well condensed, neglecting many established achievements. In addition, there is a lack of innovation in institutional construction, the indicator trading of ecological resource rights and interests, and innovative financial support models, which need to be strengthened.

The model and exploration of the value realization of ecological products in Shandong highlight the ecological resource characteristics of Shandong compared to other regions in China. This region exhibits wide coverage of ecological industries, obvious ecological regional features, the strong regional branding of ecological products, and strong adaptability to local conditions. It has innovated the exploration of the value realization of ecological products in China, whether in ecological agricultural economy, ecological tourism, the ecological industrial economy, or the blue ocean economy; it has also diversified the green and sustainable development path of the Chinese economy. It has achieved high-quality demonstrations of the green economy and circular economy and provided a reference and guidance for the sustainable development path of the global economy. It is in line with the sustainable development goals of the 2030 Agenda for Sustainable Development and has made positive explorations for the realization of SDG12 (ensuring sustainable consumption and production patterns) [4].

## **5. Recommendations for Countermeasures of the Ecological Product Value Realization Mechanism**

As ecological products continue to be explored and their value improved across the country, they play a positive role in promoting ecological environmental protection and realizing high-quality economic and social development. Despite the progress that has been made in promoting the value realization of ecological products in Shandong Province and the practice cases in the field of natural resources, there are still some common shortcomings [8,54,55]. Therefore, the author believes that the new system for realizing the value of ecological products in Shandong Province should be promoted and improved through the coordinated efforts of policy, technology, industry, and markets (Figure 7).



**Figure 7.** Countermeasures and suggestions for the realization of the value of ecological products.

The four approaches of policy, industry, technology, and market should be effectively combined and coordinated to form a systematic, stable, rich, and active new ecological economic system. At its core are “the ecological transformation of traditional industries,” “the industrialization of ecological construction,” and “the marketization of diversified financing.” Currently, the following work needs to be steadily promoted:

(1) Policy approaches include establishing a green ecological assessment mechanism to strengthen the direction of green development; establishing a system for auditing the departure of leading cadres to eliminate the development concept of sacrificing the environment for economic growth; constructing vertical and horizontal ecological compensation mechanisms to promote benign interactions between protectors and beneficiaries; improving the natural resource property rights system to guide social capital to participate in the rational use of the ecosystem; establishing an ecological credit system to restrict ecologically damaging behavior, etc.

(2) Industrial approaches include implementing the development of agricultural ecology, scale, standardization, branding, and e-commerce, forming a new pattern of green and high-quality agricultural product supply, mainly relying on market forces; developing eco-industries such as energy conservation, environmental protection, green low-carbon activities, and precision manufacturing to enhance the net value of industrial products; strengthening the ecological tourism and health industries to expand tourism resource benefits; implementing the integration of primary, secondary, and tertiary industries in rural areas to promote agricultural efficiency, increase farmers’ income, and rural prosperity; developing the comprehensive utilization of ecological marine resources and a blue carbon ocean economy, etc.

(3) Technological approaches include strengthening ecological restoration technology [46] and ecological value accounting and evaluation systems, and promoting the standardization of ecological product value accounting; developing integrated farming and breeding industries, producing value-added technology, and enhancing the intrinsic growth potential of product value; developing support technology for big data, data management, and other approaches.

(4) Market approaches include creating regional public brands, promoting the construction of characteristic advantageous product brands; conducting multi-channel marketing such as online, e-commerce, and micro-businesses, promoting accurate supply and demand docking and efficient transactions; opening up and attracting diversified capital investment to enhance market vitality, etc.

## 6. Conclusions

(1) Research into the mechanisms for realizing the value of ecological products has become increasingly important in the context of constructing a national ecological civilization and the “Two Mountains” concept. It was explicitly mentioned in the government report of the 20th National Congress of the Communist Party of China and has significant theoretical and practical significance. With the favorable policies of the government and the continuous practice and deepening of the mechanism for realizing the value of ecological products in various regions, the combination of basic theoretical research and studies of practical application will promote the establishment of a more robust mechanism for realizing the value of ecological products.

(2) The conceptual classification of ecological products has become more refined and clear, with the dual attributes of “ecological” and “economic”. Ecological products have important natural resource attributes, and the natural resources department will encourage the production, addition of value, and value realization of ecological products, providing multidimensional solutions for establishing a mechanism for realizing the value of ecological products. The “three-part method” of ecological products and the “three paths” for realizing their value constitute the basic theory for realizing the value of ecological products. To effectively realize the value of ecological products, it is necessary to rely on the dual driving forces of the government and the market.

(3) The current method for calculating the value of ecological products mainly adopts the GEP accounting technology system. Generally, administrative regions are taken as the unit, and the principle of first material quantity and then value quantity is adopted. The market price, substitute market, and virtual market methods are used for classification and value accounting summary. Based on this benchmark method, the nation and many regions have formed their own ecological product value accounting systems and standards, and the accounting technology standards have become more mature.

(4) By analyzing typical case studies in Shandong Province, we can summarize four path models for realizing the market value of ecological products: ecological resource indicators and equity exchange (a government + market path), ecological governance and value enhancement (a government + market path), ecological industrial operation (the market path), and ecological compensation (the government path). The case studies highlight the ecological attributes of natural resources such as “mountains, waters, forests, fields, lakes, grasses, and seas” in Shandong Province, presenting a diversified pattern. However, there are also problems, such as weak innovation in ecological resource indicator trading and financial support models, insufficient awareness of the connection between emerging advantageous ecological industries such as marine biomedicine, green finance, ecological compensation, and policies, and the realization mechanism of ecological product value. It is necessary to further strengthen the popularization and understanding of the local government’s mechanism for realizing the value of ecological products, transform work implementation, and design relevant support policies.

(5) There are still major theoretical and technical bottlenecks in realizing the value of ecological products. The marketization mechanism of ecological products is still a global ecological economics problem. In the field of ecological product market transactions, there are still constraints such as unsupported policy mechanisms and imperfect technical systems. It is necessary to organize scientific researchers in the natural and social sciences to carry out long-term joint research and promote relevant theoretical and practical studies. To solve the difficulties in practice and in mechanisms, it is necessary to strengthen top-level design and industrial practice optimization from four perspectives: policy, market, industry, and technology. It is necessary to closely observe and combine the six mechanisms mentioned in the “Opinions on Establishing and Improving the Mechanism for Realizing the Value of Ecological Products” and adopt targeted measures such as strengthening government leadership, regulating markets, improving technical methods and systems, establishing overall coordination and assessment mechanisms, establishing overall business-related linkage mechanisms, and strengthening scientific and techno-

logical intelligence and platform support. It is necessary to carry out interdisciplinary, cross-regional, and cross-industry collaborative innovation research, contributing to the international community a Chinese model for realizing the value of ecological products.

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