The Interplay between Agricultural Water and Soil Engineering and Ecological Civilization Construction

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Abstract: As the global construction of an ecological civilization deepens, agricultural water and soil engineering, a crucial support for agricultural development in China, has increasingly drawn attention to its interactive relationship with ecological civilization construction. This paper aims to explore this interplay, analyze the intrinsic connections between the two, and provide a theoretical basis for sustainable agricultural development in China. Initially, the paper outlines the concept, characteristics, and development history of agricultural water and soil engineering, elucidating its role and status in ecological civilization construction. Subsequently, through methods such as literature analysis and logical analysis, it delves into the interactive mechanisms between agricultural water and soil engineering and ecological civilization construction. Furthermore, by comparing successful cases domestically and internationally, the paper summarizes practical experiences of their interactive relationship. Finally, considering China's actual conditions, it proposes policy recommendations for the interactive development of agricultural water and soil engineering and ecological civilization construction. The research findings indicate a close intrinsic connection between agricultural water and soil engineering and ecological civilization construction, with mutual promotion and joint development. Strengthening agricultural water and soil engineering helps advance ecological civilization construction, while the latter provides a favorable development environment for the former. Therefore, China should leverage the role of agricultural water and soil engineering in ecological civilization construction to promote sustainable agricultural development.

Keywords: Agricultural Water and Soil Engineering; Ecological Civilization Construction; Interactive Relationship; Sustainable Development; Policy Recommendations

1. Introduction

1.1 Research Background and Significance

Faced with the pressures of global climate change and population growth, agricultural production is encountering unprecedented challenges. Scarcity of water resources and soil degradation have become major constraints on sustainable agricultural development. Under these circumstances, the advancement of agricultural water and soil engineering is particularly crucial. This field, through scientific management of water resources and soil, aims to enhance agricultural productivity while minimizing environmental impacts, making it a key technology for achieving sustainable agriculture.

Ecological civilization construction emphasizes harmony between humans and nature, seeking a balance between economic development and environmental protection. The integration of agricultural water and soil engineering with ecological civilization construction not only aids in boosting agricultural productivity but also promotes the protection and restoration of the ecosystem, which is significant for achieving green, circular, and low-carbon development.

In recent years, significant technological advancements have been made in the field of agricultural water and soil engineering. The development of intelligent irrigation systems has made water use more efficient and precise. Through sensor and data analysis technologies, farmers can monitor soil moisture and crop water needs in real-time, thereby supplying water on demand and reducing waste.

Additionally, innovations in soil improvement techniques, such as the application of biochar and the development of microbial fertilizers, have effectively improved soil structure and fertility, enhancing water retention and nutrient supply capabilities. The integration of agricultural water and soil engineering with ecological civilization construction is manifested at multiple levels. Firstly, by promoting water-saving irrigation techniques and soil conservation measures, negative impacts on water resources and soil from agricultural activities are reduced. Secondly, the implementation of ecological agricultural models, such as rice field ecosystems and wetland agriculture, not only increases agricultural efficiency but also enhances ecosystem services like water purification and biodiversity protection. Lastly, while promoting green agricultural development, agricultural water and soil engineering also provides new opportunities for rural eco-tourism and leisure agriculture, enhancing the diversity and sustainability of rural economies. Despite the significant achievements in promoting sustainable agriculture, challenges remain, including uneven technology dissemination, varying farmer acceptance of technology, and insufficient investment. Future efforts should focus on strengthening policy support, enhancing technical training and education for farmers, and encouraging close collaboration between research institutions and agricultural producers.

1.2 Review of Domestic and International Research Status

In China, the interactive relationship between agricultural water and soil engineering and ecological civilization construction has become a focal point for academia and policymakers. With the increasing emphasis on ecological civilization construction by the state, the role of agricultural water and soil engineering in promoting environmental protection and sustainable development has become more prominent.

In literature [1], Qiu Wenshan analyzed the effective application of soil and water conservation ecological restoration technologies in hydraulic construction, emphasizing their practical application effects. Literature [4] and [7] respectively explored comprehensive management technologies for soil erosion in red soil areas and small watersheds, providing a practical basis for the innovation of soil and water conservation technologies. In literature [8], Cheng Leifei discussed the relationship between soil and water conservation and ecological civilization construction in Shaanxi Province, indicating that soil and water conservation is a crucial component of ecological civilization construction. This aligns with the spirit of the National Two Sessions, which advocates for the promotion of ecological civilization construction through soil and water conservation projects to achieve green development. Literature [3] and [5] discussed from the perspectives of project management and demonstration projects, respectively, how to enhance the implementation level and management efficiency of soil and water conservation projects. These studies provide a reference for the standardization and standardization of soil and water conservation projects. Literature [12], taking Gangu County as an example, explored how the comprehensive management of soil erosion on sloping farmland contributes to the construction of beautiful villages. This study highlights the significant role of soil and water conservation projects in improving rural ecological environments and enhancing village appearance.

Internationally, the interactive relationship between agricultural water and soil engineering and ecological civilization construction is also a subject of interest. Foreign scholars have accumulated rich experiences in research on soil and water conservation technologies, policy formulation, and project implementation.

Foreign research has advanced in soil erosion control and vegetation restoration technologies. For example, the United States and European countries are leading in the development and application of soil and water conservation technologies, which have high promotion value globally. There are also many experiences in foreign soil and water conservation policy formulation that are worth learning from. For instance, the European Union has promoted soil and water conservation efforts through the formulation of strict environmental protection regulations and policies. These policies provide a reference for China's ecological civilization construction.

There are also many successful cases in the implementation and management of foreign soil and water conservation projects. For example, Australia's "Great Green Wall" project has effectively improved the local ecological environment through vegetation restoration and soil protection measures. These cases provide valuable experience for the implementation of soil and water conservation projects in China.

Currently, China is at a critical juncture in the construction of an ecological civilization, with the spirit of the Two Sessions emphasizing the importance of green, circular, and low-carbon development. Soil and water conservation, as a foundational work in ecological civilization construction, has a significant interactive relationship with agricultural water and soil engineering for realizing the national green development strategy. Soil and water conservation projects, by reducing soil erosion, protecting water sources, and improving the ecological environment, provide basic safeguards for green development. This aligns with the green development concept emphasized in the spirit of the Two Sessions. As society increasingly focuses on environmental issues, the role of soil and water conservation projects in improving rural ecological environments and enhancing residents' quality of life becomes more prominent. This meets the social expectations and demands for ecological civilization construction. The state continues to increase policy support for soil and water conservation projects, encouraging and guiding social capital investment through fiscal subsidies, tax incentives, and other measures. These policies provide strong support for the implementation of soil and water conservation projects.

2. Theoretical Basis of Agricultural Water and Soil Engineering and Ecological Civilization Construction

2.1 Connotations and Characteristics of Agricultural Water and Soil Engineering

Agricultural water and soil engineering, as a highly interdisciplinary field, focuses on the rational regulation and optimal allocation of water resources and soil in agricultural production through engineering techniques and management methods. This field encompasses not only the development and utilization of water resources but also various aspects such as water-saving irrigation technologies, soil improvement technologies, and soil and water conservation technologies. The implementation of agricultural water and soil engineering aims to enhance agricultural productivity while protecting and improving the ecological environment for sustainable agriculture. The characteristics of agricultural water and soil engineering are mainly reflected in the following aspects:

Agricultural water and soil engineering involves multiple disciplines such as hydraulics, agriculture, and environment, requiring interdisciplinary integration. For example, in designing irrigation systems, knowledge from hydrology, soil science, plant physiology, and other disciplines is needed to ensure the system's efficient operation and environmental sustainability.

Agricultural water and soil engineering relies on advanced engineering techniques and scientific management methods. Modern agricultural water and soil engineering widely applies information technology, automation technology, remote sensing technology, etc., to improve the precision and efficiency of water and soil management. For instance, intelligent irrigation systems use sensors and data analysis technology to monitor soil moisture and crop water needs in real-time, enabling on-demand water supply.

Agricultural water and soil engineering emphasizes protecting and improving the ecological environment while enhancing agricultural productivity. This includes adopting eco-friendly technologies and methods such as the application of biochar and the development of microbial fertilizers to improve soil structure and fertility, enhancing water retention and nutrient supply capabilities.

2.2 Connotations and Goals of Ecological Civilization Construction

Ecological civilization construction refers to the process of adhering to the principle of harmony between humans and nature during economic and social development, achieving a virtuous cycle of economic development and ecological environmental protection through scientific planning and management. This concept emphasizes protecting and improving the ecological environment while pursuing economic development for sustainable

development. The main goals of ecological civilization construction include:

Improving ecological environmental quality through measures such as reducing pollution and protecting biodiversity. For example, promoting the use of environmentally friendly pesticides and fertilizers to reduce agricultural non-point source pollution and protect water and soil quality.

Optimizing resource allocation, improving resource utilization efficiency, and reducing resource waste. This includes promoting water-saving irrigation technologies and soil improvement technologies to enhance the efficiency of water and soil use.

Advocating for low-carbon, environmentally friendly lifestyles to reduce negative environmental impacts. For example, encouraging farmers to adopt organic farming methods, reducing the use of chemicals, and promoting the use of renewable energy.

The combination of agricultural water and soil engineering with ecological civilization construction aims to achieve sustainable agricultural production through scientific water and soil management while protecting and improving the ecological environment, promoting harmony between humans and nature. This integration not only helps to enhance agricultural productivity but also promotes the protection and restoration of the ecological environment, which is significant for achieving green, circular, and low-carbon development.

In practice, the integration of agricultural water and soil engineering with ecological civilization construction is reflected at multiple levels. Firstly, by promoting water-saving irrigation technologies and soil protection measures, negative impacts on water resources and soil from agricultural activities are reduced. Secondly, the implementation of ecological agricultural models, such as rice field ecosystems and wetland agriculture, not only increases agricultural efficiency but also enhances ecosystem services like water purification and biodiversity protection. Lastly, while promoting green agricultural development, agricultural water and soil engineering also provides new opportunities for rural eco-tourism and leisure agriculture, enhancing the diversity and sustainability of rural economies.

Despite the significant achievements in promoting sustainable agriculture, challenges remain, including uneven technology dissemination, varying farmer acceptance of technology, and insufficient investment. Future efforts should focus on strengthening policy support, enhancing technical training and education for farmers, and encouraging close collaboration between research institutions and agricultural producers to deepen the integration of agricultural water and soil engineering with ecological civilization construction, achieving green, sustainable, and high-quality agricultural development.

3. Analysis of the Interplay between Agricultural Water and Soil Engineering and Ecological Civilization Construction

3.1 Role of Agricultural Water and Soil Engineering in Ecological Civilization Construction

Agricultural water and soil engineering plays a crucial role in ecological civilization construction. Through scientific management of water resources and soil protection measures, it effectively enhances agricultural productivity while reducing negative environmental impacts. The application of water-saving irrigation technologies can significantly reduce water consumption, while soil improvement technologies help enhance soil fertility and reduce erosion. These measures not only contribute to food security but also promote the health and stability of ecosystems.

By optimizing water resource allocation, agricultural water and soil engineering improves water use efficiency. For example, drip and micro-sprinkler irrigation technologies precisely deliver water and nutrients to the root zones of crops, reducing evaporation and loss, thereby significantly lowering irrigation water usage. Additionally, intelligent irrigation systems, by real-time monitoring of soil moisture and meteorological conditions, can automatically adjust irrigation times and amounts, further enhancing water resource efficiency.

Through soil improvement technologies, agricultural water and soil engineering enhances soil fertility and structural stability. For instance, the application of biochar increases soil organic matter content, improves soil structure, and enhances water retention

and nutrient supply capabilities. The development and application of microbial fertilizers not only reduce the use of chemical fertilizers but also promote soil microbial diversity and activity, strengthening soil ecological functions.

Agricultural water and soil engineering also improves the ecological environment through ecological restoration projects, such as wetland recovery and vegetation reconstruction. These projects help increase biodiversity and enhance ecosystem services, providing a solid ecological foundation for ecological civilization construction. For example, wetland recovery projects not only purify water quality but also provide habitats for wildlife, promoting biodiversity restoration. Vegetation reconstruction projects restore degraded land vegetation cover by planting native trees and grasses, reducing soil erosion and improving the ecological environment.

3.2 Impact of Ecological Civilization Construction on Agricultural Water and Soil Engineering

The advancement of ecological civilization construction has a profound impact on the development of agricultural water and soil engineering. With enhanced environmental protection awareness, the design and implementation of agricultural water and soil engineering increasingly emphasize ecological friendliness. In irrigation system design, greater emphasis is placed on water conservation and recycling to reduce over-exploitation of water resources. Soil protection measures also focus more on long-term sustainability, such as using organic fertilizers and biological control methods to reduce chemical pollution of soil and environment.

Ecological civilization construction promotes the integration of agricultural water and soil engineering with ecological agriculture, driving a shift in agricultural production methods. Ecological agriculture emphasizes the harmonious coexistence of agricultural production and ecological environment, achieving a win-win situation for economic and ecological benefits through the comprehensive utilization of agricultural resources. For example, the promotion of organic agriculture not only reduces the use of chemical pesticides and fertilizers but also improves the quality and safety of agricultural products. Ecological agricultural models such as rice field ecosystems and wetland agriculture not only enhance agricultural productivity but also strengthen ecosystem services like water purification and biodiversity protection.

Ecological civilization construction drives technological innovation and application in agricultural water and soil engineering. For instance, in irrigation technology, greater emphasis is placed on water-saving and recycling technologies, such as rainwater collection systems and wastewater treatment and reuse systems. In soil protection technology, greater emphasis is placed on the development and application of organic fertilizers and biological control methods to reduce chemical pollution of soil and environment. The application of these technologies not only enhances the ecological value of agricultural water and soil engineering but also provides new pathways for sustainable agriculture.

Ecological civilization construction also promotes the integration of agricultural water and soil engineering with rural development. By implementing agricultural water and soil engineering projects, not only are agricultural production conditions improved, but rural economic development and farmer income are also increased. For example, by promoting water-saving irrigation and soil improvement technologies, farmers can reduce production costs, increase crop yield and quality, thereby increasing income. At the same time, the implementation of agricultural water and soil engineering projects also drives the development of related industries, such as agricultural machinery and agricultural technology services, providing new impetus for rural economic development.

3.3 Interactive Mechanisms between Agricultural Water and Soil Engineering and Ecological Civilization Construction

The interactive mechanisms between agricultural water and soil engineering and ecological civilization construction are manifested at multiple levels. Firstly, the implementation of agricultural water and soil engineering needs to follow the principles and requirements of ecological civilization construction to ensure the environmental friendliness and sustainability of the projects.

For example, during the project planning and design phase, environmental impact assessments should be conducted to ensure that the projects do not negatively impact the ecological environment. During the project implementation process, eco-friendly technologies and methods, such as water-saving irrigation and organic fertilizer application, should be used to minimize environmental pollution and damage.

The advancement of ecological civilization construction provides policy support and market orientation for the development of agricultural water and soil engineering. With the strengthening of environmental protection policies and the expansion of the green consumer market, agricultural water and soil engineering projects receive more policy and financial support. For example, the government provides fiscal subsidies, tax incentives, and technical support to encourage farmers and businesses to adopt water-saving irrigation and soil improvement technologies. At the same time, the increasing demand for green and organic products from consumers also provides market momentum for the development of agricultural water and soil engineering. Farmers and businesses, by providing high-quality, environmentally friendly products, not only meet market demand but also enhance their competitiveness and brand image.

The interaction between agricultural water and soil engineering and ecological civilization construction also occurs in technological research and innovation. With the advancement of ecological civilization construction, new technologies and methods continue to emerge in the field of agricultural water and soil engineering, such as intelligent irrigation systems, biochar application, and microbial fertilizers. The research and application of these technologies not only improve the efficiency and effectiveness of agricultural water and soil engineering but also provide technical support for ecological civilization construction. At the same time, the needs of ecological civilization construction also promote the innovation and improvement of agricultural water and soil engineering technologies, forming a virtuous cycle of technology research and application.

The interaction between agricultural water and soil engineering and ecological civilization construction also occurs in social participation and public education. With the enhancement of ecological civilization awareness, public attention and participation in agricultural water and soil engineering continue to increase. Government, businesses, research institutions, and non-governmental organizations participate together in agricultural water and soil engineering projects, forming a good social governance situation. At the same time, through public education and publicity activities, the awareness and understanding of agricultural water and soil engineering and ecological civilization construction among farmers and consumers are enhanced, strengthening social environmental awareness and responsibility.

In summary, there is a close interactive relationship between agricultural water and soil engineering and ecological civilization construction. Agricultural water and soil engineering plays an important role in ecological civilization construction by scientifically managing water resources and soil protection measures, enhancing agricultural productivity, and protecting and improving the ecological environment. At the same time, the advancement of ecological civilization construction also provides policy support, market orientation, technological innovation, and social participation for the development of agricultural water and soil engineering. In the future, further integration of agricultural water and soil engineering with ecological civilization construction should be strengthened to promote green, sustainable, and high-quality agricultural development, achieving harmony between humans and nature.

4 Discussion on the Interactive Mechanisms of Agricultural Water and Soil Engineering and Ecological Civilization Construction

4.1 Policy Regulations and Institutional Guarantees

Policy regulations and institutional guarantees are important mechanisms for promoting the interaction between agricultural water and soil engineering and ecological civilization construction. By formulating and implementing relevant policies, guidance and support can be provided for the development of agricultural water and soil engineering. For

example, the government can encourage agricultural producers to adopt water-saving irrigation and soil protection technologies through fiscal subsidies, tax incentives, and other measures. At the same time, the establishment of sound environmental protection regulations and strengthening the supervision of agricultural production activities ensure that the implementation of agricultural water and soil engineering meets the requirements of ecological civilization construction.

The formulation of policy regulations needs to fully consider the characteristics and needs of agricultural water and soil engineering. Agricultural water and soil engineering involves multiple aspects such as water resource management, soil protection, and ecological restoration, so policy regulations should be comprehensive, systematic, and forward-looking. For example, the government can formulate special regulations such as the "Agricultural Soil and Water Conservation Law" and the "Water-Saving Irrigation Promotion Regulations," clarifying the goals, principles, measures, and responsible entities of agricultural water and soil engineering, providing a legal basis for its implementation.

The implementation of policy regulations requires supporting institutional guarantees. Institutional guarantees include fiscal support, technical services, supervision and management, and other aspects. Fiscal support is an important means to promote the implementation of agricultural water and soil engineering. The government can reduce the investment costs of agricultural producers, increase their enthusiasm for adopting soil and water protection technologies through the establishment of special funds, provision of loan interest subsidies, and implementation of tax reductions. Technical services are the key to ensuring the effective application of scientific research achievements. The government and research institutions can establish a technical promotion system, providing technical training, consulting services, demonstration promotion, and other support to help agricultural producers master and apply advanced soil and water protection technologies. Supervision and management are necessary measures to ensure the quality of agricultural water and soil engineering. The government can establish a monitoring and evaluation system, implement regular inspections, and carry out law enforcement supervision to ensure that the implementation of agricultural water and soil engineering meets regulatory requirements and achieves expected results.

Policy regulations and institutional guarantees need to be updated and improved in a timely manner. With the deepening of ecological civilization construction and the development of agricultural water and soil engineering technologies, policy regulations and institutional guarantees also need to be continuously adjusted and optimized. For example, with the advancement of water-saving irrigation technologies, the government can adjust fiscal subsidy policies in a timely manner, increasing support for efficient water-saving technologies. With the improvement of soil protection awareness, the government can strengthen the construction of regulations for soil pollution control and restoration, raising the standards and requirements for soil protection.

The implementation of policy regulations and institutional guarantees requires multi-party participation and collaborative promotion. The implementation of agricultural water and soil engineering involves multiple subjects such as the government, agricultural producers, research institutions, social organizations, and the public. Therefore, the implementation of policy regulations and institutional guarantees requires the formation of a multi-party participation and collaborative promotion mechanism. The government should play a leading role in formulating and implementing policy regulations and providing institutional guarantees. Agricultural producers should actively respond to policies, adopt soil and water protection technologies, and improve production efficiency. Research institutions should strengthen technological research and development and provide technical support. Social organizations should participate in supervision and evaluation and provide suggestions and opinions. Through multi-party participation and collaborative promotion, the effective implementation of policy regulations and institutional guarantees can be ensured, promoting the of agricultural water and soil engineering and ecological civilization construction.

4.2 Technological Innovation and Achievement Transformation

Technological innovation is a key factor in promoting the interaction between agricultural water and soil engineering and ecological civilization construction. By developing and applying new technologies, the efficiency and ecological friendliness of agricultural water and soil engineering can be improved. For example, the development of intelligent irrigation systems can achieve precise management of water resources and reduce waste. The application of biotechnology can enhance soil biological activity and strengthen soil self-repair capabilities. The promotion and application of these technologies require close cooperation between research institutions, universities, and enterprises, as well as an effective achievement transformation mechanism.

Technological innovation needs to be problem-oriented, focusing on key issues in agricultural water and soil engineering. The issues faced by agricultural water and soil engineering include water resource scarcity, soil degradation, and ecological destruction. Technological innovation should focus on these issues, developing technologies and products that can effectively solve these problems. For example, in response to water resource scarcity, research institutions can develop intelligent irrigation systems, using sensors, data analysis, and automated control technologies to achieve precise management and efficient utilization of water resources. In response to soil degradation, research institutions can develop products such as biochar and microbial fertilizers, enhancing soil fertility and self-repair capabilities by improving soil biological activity.

Technological innovation requires interdisciplinary and cross-sectoral cooperation. Agricultural water and soil engineering involves multiple disciplines such as hydraulics, soil science, ecology, and agriculture. Technological innovation requires experts and scholars from these fields to cooperate, forming interdisciplinary research teams. Through interdisciplinary cooperation, knowledge and technologies from different fields can be integrated, forming comprehensive solutions. For example, hydraulic experts can provide theories and technologies for water resource management, soil experts can provide methods for soil protection and restoration, ecological experts can provide strategies for ecosystem protection, and agricultural experts can provide technologies and experiences for agricultural production. Through the cooperation of these experts, more efficient and ecologically friendly agricultural water and soil engineering technologies can be developed.

Technological innovation requires an effective achievement transformation mechanism. The transformation of research achievements is a key link in technological innovation. Only by transforming research achievements into practical applications can their role in promoting agricultural water and soil engineering be realized. The achievement transformation mechanism includes technical promotion, technical services, technical transactions, and other aspects. Technical promotion is an important way to transform research achievements. The government and research institutions can establish a technical promotion system, promoting research achievements to the forefront of agricultural production. Technical services are the key to ensuring the effective application of research achievements. The government and research institutions can provide technical training, consulting services, demonstration promotion, and other support to help agricultural producers master and apply new technologies. Technical transactions are a market-oriented way to transform research achievements. The government and research institutions can establish a technical trading platform, promoting the market-oriented transaction of research achievements and improving the transformation efficiency of research achievements.

Technological innovation requires continuous investment and support. Technological innovation is a long-term and complex task that requires continuous investment and support. The government should increase investment in technological innovation in agricultural water and soil engineering, providing research funds, talent support, policy preferences, and other support to encourage research institutions and universities to strengthen technological innovation. At the same time, the government should establish an incentive mechanism for technological innovation, stimulating the innovation

enthusiasm of researchers through scientific and technological awards, project support, intellectual property protection, and other methods, enhancing the positivity and initiative of technological innovation.

4.3 Social Participation and Public Awareness

Social participation and the enhancement of public awareness are equally crucial for the interaction between agricultural water and soil engineering and ecological civilization construction. Public environmental awareness and participation directly affect the choice of agricultural production methods and the implementation of environmental protection measures. Through education and publicity activities, the importance of agricultural water and soil engineering can be enhanced, encouraging public participation in agricultural water and soil protection practices. For example, community-participated ecological agriculture projects can increase public identification with ecological agriculture, promoting its adoption.

Social participation requires the establishment of a multi-party decision-making mechanism. The planning and implementation of agricultural water and soil engineering involve multiple stakeholders, including the government, agricultural producers, research institutions, social organizations, and the public. Establishing a multi-party decision-making mechanism can ensure that the planning and implementation of agricultural water and soil engineering are more democratic and transparent, better reflecting public will and needs. For example, the government can organize public hearings, inviting the public to participate in the planning and evaluation of agricultural water and soil engineering projects, listening to public opinions and suggestions. Social organizations can participate in the supervision and evaluation of agricultural water and soil engineering, providing suggestions and opinions. Agricultural producers can participate in the implementation and management of agricultural water and soil engineering, increasing their participation and sense of responsibility.

Public awareness needs to be enhanced through education and publicity activities. Public environmental awareness and participation are important factors in promoting the interaction between agricultural water and soil engineering and ecological civilization construction. Through education and publicity activities, the importance of agricultural water and soil engineering can be enhanced, encouraging public participation in agricultural water and soil protection practices. For example, the government can carry out agricultural water and soil protection publicity activities, popularizing knowledge and methods of agricultural water and soil protection through television, radio, internet, and other media. Schools can offer agricultural water and soil protection courses, educating students about the importance and methods of agricultural water and soil protection. Social organizations can carry out agricultural water and soil protection practice activities, organizing the public to participate in agricultural water and soil protection practices, enhancing public participation and sense of responsibility.

Social participation and public awareness need to form a long-term mechanism. Enhancing social participation and public awareness is a long-term and systematic task that requires the formation of a long-term mechanism. The government should establish a long-term mechanism for enhancing social participation and public awareness, ensuring the continuity and effectiveness of social participation and public awareness enhancement work through the formulation of relevant policies, provision of support measures, establishment of a supervision system, and other methods. For example, the government can establish a public participation platform for agricultural water and soil protection, providing opportunities and channels for public participation. The government can establish a public education system for agricultural water and soil protection, providing opportunities and resources for public education. The government can establish a public supervision system for agricultural water and soil protection, providing opportunities and means for public supervision.

Social participation and public awareness require multi-party cooperation and collaborative promotion. Enhancing social participation and public awareness involves multiple subjects such as the government, agricultural producers, research institutions,

social organizations, and the public, requiring the formation of a multi-party cooperation and collaborative promotion mechanism. The government should play a leading role in formulating and implementing relevant policies, providing support measures, and establishing a supervision system. Agricultural producers should actively respond to policies, adopt soil and water protection technologies, and improve production efficiency. Research institutions should strengthen technological research and development and provide technical support. Social organizations should participate in supervision and evaluation and provide suggestions and opinions. The public should actively participate in agricultural water and soil protection practices, enhancing environmental awareness and participation. Through multi-party cooperation and collaborative promotion, the effective implementation of social participation and public awareness enhancement work can be ensured, promoting the of agricultural water and soil engineering and ecological civilization construction.

In summary, the interactive mechanisms between agricultural water and soil engineering and ecological civilization construction involve policy regulations and institutional guarantees, technological innovation and achievement transformation, social participation and public awareness, and other aspects. By formulating and implementing relevant policies, guidance and support can be provided for the development of agricultural water and soil engineering. By developing and applying new technologies, the efficiency and ecological friendliness of agricultural water and soil engineering can be improved. By enhancing public environmental awareness and participation, the importance of agricultural water and soil engineering can be recognized, encouraging public participation in agricultural water and soil protection practices. Through multi-party cooperation and collaborative promotion.

In terms of policy regulations and institutional guarantees, the government should continue to improve relevant laws and regulations to ensure that the implementation of agricultural water and soil engineering is lawful and orderly. At the same time, the government should strengthen regulatory efforts to ensure the effective implementation of various policy measures and prevent deviations and loopholes in policy execution. In addition, the government should establish a sound incentive mechanism, encouraging agricultural producers to adopt advanced soil and water protection technologies and methods through rewards and subsidies, enhancing the ecological and economic benefits of agricultural production.

In terms of technological innovation and achievement transformation, research institutions and universities should strengthen their connections with the forefront of agricultural production, understanding the actual needs of agricultural water and soil engineering, and conducting targeted technological research. At the same time, research institutions should strengthen cooperation with other fields, integrating multidisciplinary resources to form comprehensive solutions. In terms of achievement transformation, the government and research institutions should establish a more efficient technical promotion and service system, helping agricultural producers master and apply new technologies through technical training, demonstration promotion, technical consulting, and other methods, improving the popularity and application effect of technologies.

In terms of social participation and public awareness, the government should continue to strengthen public education and publicity efforts, raising public awareness of the importance of agricultural water and soil engineering through various channels and forms. For example, the government can organize lectures, exhibitions, seminars, and other activities to popularize knowledge and methods of agricultural water and soil protection, stimulating public participation enthusiasm. At the same time, the government should encourage and support social organizations and non-governmental institutions to participate in agricultural water and soil protection practices, allowing the public to experience and participate in agricultural water and soil protection actions through community projects, volunteer activities, and other forms, enhancing public practical skills and sense of responsibility.

Furthermore, the government should establish and improve mechanisms for public participation, ensuring that the public has more

voice and decision-making power in the planning and implementation of agricultural water and soil engineering through public hearings, environmental impact assessments, community consultations, and other methods. By doing so, the planning and implementation of agricultural water and soil engineering can better align with public will and needs, increasing public satisfaction and support. In terms of multi-party cooperation and collaborative promotion, the government, agricultural producers, research institutions, social organizations, and the public should strengthen communication and collaboration, forming a joint force to jointly promote the interaction between agricultural water and soil engineering and ecological civilization construction. The government should play a leading role in formulating and implementing relevant policies, providing institutional guarantees, while also encouraging and supporting other parties to leverage their respective strengths, forming complementary and synergistic effects. Agricultural producers should actively respond to policies, adopt soil and water protection technologies, and improve production efficiency. Research institutions should strengthen technological research and development, providing technical support. Social organizations should participate in supervision and evaluation, offering suggestions and opinions. The public should actively participate in agricultural water and soil protection practices, enhancing environmental awareness and participation.

In conclusion, the interactive mechanisms of agricultural water and soil engineering and ecological civilization construction involve multiple aspects such as policy regulations and institutional guarantees, technological innovation and achievement transformation, social participation and public awareness, and multi-party cooperation and collaborative promotion. By improving policy regulations and institutional guarantees, strengthening technological innovation and achievement transformation, enhancing social participation and public awareness, and forming a multi-party cooperation and collaborative promotion mechanism, the implementation of agricultural water and soil engineering can be made more scientific, efficient, and sustainable, making a positive contribution to achieving green, sustainable, and high-quality agricultural development, and promoting harmony between humans and nature.

5 Pathways for the Interaction between Agricultural Water and Soil Engineering and Ecological Civilization Construction

5.1 Optimizing Agricultural Water and Soil Resource Allocation

Optimizing the allocation of agricultural water and soil resources is a crucial pathway to achieve the interaction between agricultural water and soil engineering and ecological civilization construction. Through scientific planning and management, efficient utilization of water and soil resources can be achieved. For example, adopting precision irrigation technologies, based on crop water needs and soil moisture conditions, can significantly improve water resource utilization efficiency. Additionally, promoting crop rotation and fallow systems, and rationally arranging crop planting structures, help restore and maintain soil fertility, reducing soil erosion.

5.2 Promoting Agricultural Industry Structure Adjustment

Adjusting the agricultural industry structure is another pathway to facilitate the interaction between agricultural water and soil engineering and ecological civilization construction. By developing ecological and organic agriculture, the use of chemical fertilizers and pesticides can be reduced, lowering the environmental pollution from agricultural production. Furthermore, developing agricultural product processing and agritourism can extend the agricultural industry chain, enhancing the comprehensive benefits of agriculture, while also providing economic support for ecological environmental protection.

5.3 Strengthening Ecological Environmental Protection and Restoration

Strengthening ecological environmental protection and restoration is a key pathway for the interaction between agricultural water and soil engineering and ecological civilization construction. By implementing ecological restoration projects, such as wetland protection, returning farmland to forests and grasslands, the ecological environment can be restored and improved, enhancing the stability and service

functions of ecosystems. At the same time, strengthening environmental supervision during agricultural production processes, strictly enforcing environmental protection regulations, ensures that the implementation of agricultural water and soil engineering does not negatively impact the ecological environment.

6 Conclusion

This study analyzed the interactive relationship between agricultural water and soil engineering and ecological civilization construction, and explored the pathways to achieve this interaction. The study concludes that agricultural water and soil engineering plays a significant role in ecological civilization construction, and through optimizing resource allocation, adjusting industry structures, and strengthening ecological environmental protection, sustainable agricultural production can be achieved while promoting the protection and improvement of the ecological environment.

To further promote the interaction between agricultural water and soil engineering and ecological civilization construction, the following policy recommendations are proposed:

Strengthen Policy Support: The government should formulate and implement policies conducive to the development of agricultural water and soil engineering, such as providing fiscal subsidies, tax incentives, etc., to encourage agricultural producers to adopt environmentally friendly technologies and management measures.

Promote Technological Innovation: Increase investment in technological innovation for agricultural water and soil engineering, support research institutions and enterprises in developing new technologies, and enhance the technological content and ecological benefits of agricultural water and soil engineering.

Enhance Public Awareness: Through education and publicity activities, raise public awareness of agricultural water and soil engineering and ecological civilization construction, and encourage public participation in agricultural water and soil protection practices.

Establish Multi-party Participation Mechanisms: Establish a decision-making mechanism involving the government, enterprises, research institutions, and the public, to ensure that the planning and implementation of agricultural water and soil engineering are more democratic and transparent, better reflecting public will and needs.

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