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Research on the Paths of Digital Ecological Civilization Construction in County Areas from Perspective of Chinese-style Modernization

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Abstract: In the era of irreversible global digital trends, building a green and smart digital ecological civilization has become an urgent priority. Integrating ecological civilization construction (ECC) with digital technology not only enhances environmental governance and drives high-quality economic growth, but also promotes harmonious coexistence between humans and nature in China's modernization process. This can be achieved by empowering green technology through digital transformation, establishing legal frameworks, and fostering digital and ecological cultures, thereby overcoming ECC challenges. I will discuss the following: (1) the connotation of ecological civilization and digital ecological civilization; (2) theoretical basis; (3) current challenges in digital ecological civilization construction in Chinese counties; (4) paths to advance igital ecological civilization construction in Chinese counties.

Keywords: Chinese-style Modernization; Digital Ecological Civilization; County area; Ecological Governance

1. Introduction

In today's digital and information era, traditional means of ecological civilization construction can no longer meet the needs of the new era. The rapid updates of digital technology with its new formats and models, injects new momentum into all fields and processes of ECC in county areas. Rapid digital advancements offer new momentum for ecological progress in counties. Counties, which handle tasks like agricultural modernization and rural revitalization, are crucial for ecological civilization. Thus, exploring digital ecological civilization in counties is essential for implementing China's modernization strategy and achieving high-quality development.

2. Connotation and theoritial basis

2.1 Connotation

2.1.1 Ecological Civilization

Given extensive damage being brought to the global environment, it is crucial to contemplate the organization of a genuinely ecological civilization—one that coexists harmoniously with nature—rather than attempting to subdue and dominate nature.[1] "Ecological civilization is a major theoretical innovation achievement in the process of human exploration of sustainable development" (Foster 2022).[2] Meanwhile, ecological civilization is a new stage of the development of human civilization, and a new civilization beyond modern industrial civilization[3], he believes that ecological civilization is a civilization built under the guidance of ecology, a civilization aiming at the pursuit of harmonious coexistence between man and nature, and a great innovation in the history of human thought.

Based on this, this study believed that ecological civilization refers to the environment management practice of human to persuit harmonious coexistence and sustainable development between humans and nature, which is a transcendence of industrial civilization.

2.1.2 Digital Ecological Civilization

Over the past few years, the rapid advancement of digital technology has attained significant attention from scholars for its potential to enhance ecological environment management(Böttcher et al. 2024)[4]. Existing research generally regards digital technology as the application of various advanced technologies—such as artificial intelligence (AI), big data, cloud computing, the Internet of Things (LoT), blockchain, quantum computing, and 5G communication—to build digital industries on a foundation of digital infrastructure (Böttcher et al., 2024; Fareed et al., 2024; Mohamed et al., 2024)[5].

For digital ecological civilization, scholars argue that digital ecological civilization is the integration of digitalization and greening, which mutually promote and integrate each other, embodying the basic principle that digitalization empowers green development[6], which

can be regarded as an organic unity of "greening" and "digitalization," which mutually coordinate and promote each other. Digital technology, characterized by precision, efficiency, and sustainability, is highly compatible with the core values of ecological civilization construction and has become a powerful method to break through the bottlenecks and obstacles that constrain China's ecological civilization development in the new era.

2.2 Theory basis

2.2.1 The Ecological View of western Marxism

Over a century ago in 1876, Frederick Engels once described: We should not be overly complacent about our human triumphs over nature. For every such victory, nature exacts its revenge. It's true, so at every step we are reminded that we by no means rule over nature like a conqueror over a foreign people, like someone standing outside nature—but that we, with flesh, blood and brain, belong to nature, and exist in its midst, and that all our mastery of it consists in the fact that we have the advantage over all other creatures of being able to learn its laws and apply them correctly.[7]

Karl Marx and Engels analyzed the dialectical relationship between humans and nature, emphasizing that nature is essential for human survival and humans are an integral part of nature. Engels also proposed: "The most essential and immediate basis of human thought is precisely the changes that humans have caused in nature, not nature itself; the extent to which humans learn to change nature is the extent to which human intelligence develops."[8]. Engels further noted that human intelligence develops through transformation of nature, highlighting that humans need to understand and respect this relationship in production and daily life. Marx held that only by scientific and proper utilization and transformation, nature and human society could be on an efficient development path, humans urgently need to change their existing production and lifestyle, act in accordance with the inherent "laws" of nature, and respect natural "laws" to achieve harmonious coexistence between humans and nature, thereby getting free from the shackles of this predicament.

2.2.2 Ecological wisdom in Chinese traditional culture

Chinese traditional culture in every dynasty contains rich ecological wisdom, including the ideas of harmony between human and nature, the generation of things through harmony.

The "unity of heaven and humanity" of Confucianism not only regards human and nature as an integrated whole but also exemplifies the ecological wisdom of traditional Chinese culture. The "benevolence" is reflected in the idea of unity between heaven and humanity, and advocates treating all things in the world with benevolence and integrating this philosophy into the relationship between humans and nature. Mencius wrote, *"If we do not use fine-meshed nets in the ponds, there will be more fish and turtles than we can eat. If we enter the forests with axes at the right time, there will be more timber than we can use."*[9] China's Taoism believes that "heaven and earth coexist with me, and all things are one with me." This means all living beings are equal and humankind should respect and protect nature, the same ideas as seen in the classic I Ching *(Book of Changes)*. All of these ideas embedded in rich ecological wisdom of traditional Chinese culture emphasizes harmony between human and nature.

3. Multiple challenges in digital eco-civilization construction in counties

3.1 Quality and efficiency of digital empowerment in ecological governance need to be further improved

Environment governance models currently in China include government-led, market-oriented, and community-based approaches. However, these models face challenges such as inadequate policy implementation, regional differences, and inadequet social capital participation, leading to unsatisfactory governance outcomes. Additionally, the complexity of pollution issues and insufficient supervision make it difficult to address environmental problems effectively with human resources alone. The application of digital and intelligent technologies has brought transformative opportunities for environment governance. Digital technologies can not only clearly define the scope of duties but also quantify assessment criteria, thereby improving work efficiency and capabilities of ecological governance officers. This will help address the existing issues of low zoning control levels and an incomplete governance system in China's ecological environment governance[10].

3.2 Data security and privacy protection need to be enhanced

The analysis and application of big data are indispensable in digital eco-civilization construction. However, challenges related to data security and privacy protection have also emerged. In today's big data era, vast amounts of personal and corporate information are collected and analyzed. The risk of leakage and malicious exploitation becomes significantly elevated, if these data are not effectively protected. This not only infringes on citizens' privacy rights but also poses serious negative impacts on social stability and economic order. Therefore, ensuring privacy and data security has become an essential task[11]. To ensure privacy and data security, it's necessary to improve relevant laws and regulations and develop supporting technical measures to strengthen data privacy protection and security defense mechanisms. At the same time,

continuous attention to latest development in this field is required to ensure that regulations and technical means keep pace with the times to jointly address the ever-changing data security threats.

3.3 Innovation capacity of digital technologies needs to be enhanced

Digital transformation still faces many challenges. Especially, lacking of independent technological innovation capacity is particularly prominent and has become the primary obstacle. First, key technologies have not been deeply integrated into a systematic development framework, limiting their full potential in ecological industries and production safety governance and resulting in limited support effectiveness. Second, the shortcomings in independent innovation capacity have become a major constraint on high-quality development. With the rapid development of digitalization and intelligence, the weakness of internal key technology research and development has gradually become apparent. This not only creates a bottleneck for technological advancement but also increases dependence on external technologies.

Establishing a comprehensive and efficient technical system that covers data collection, processing, analysis, ecological warning, and emergency response is useless without independent core technologies. Although theoretically, these technologies offer many benefits such as improving industrial efficiency, reducing environmental pollution, and optimizing resource allocation, in practice, problems such as low technological maturity and high application costs remain prominent. This makes it difficult for enterprises to achieve digital transformation, and they may even find themselves in a dilemma.

4. Paths for advancing digital ecological civilization construction in counties

4.1 Enhancing digital and intelligent empowerment to improve ecological governance

First, building a digital platform for ecological environment governance can promote the digital transformation of data resources, government services, and environmental protection. This would create a systematic and intelligent governance system, overcoming barriers in cross-regional, cross-departmental, and cross-level data transmission.

Second, establishing an smart perception system for ecological governance needs to be strengthened. So as to prevent and warn against ecological risks, an integrated and intelligent monitoring and perception network that combines space, air, land, and sea should be established. We should advance the coordinated development of new digital infrastructure and ecological governance. Digital technologies should be used to enhance the construction of ecological environment monitoring networks and satellite remote sensing networks, ensuring the authenticity, accuracy, and comprehensiveness of monitoring data.

4.2 Establishing and improving the legal framework for data privacy protection

In response to new challenges and opportunities brought by digital technologies to ECC and ecological security, relevant laws and regulations should be formulated or revised in time. Establishing a comprehensive legal framework for data collection, processing, sharing, and privacy protection is neccessary to balance the relationship between technological innovation and personal privacy protection, clarify responsible entities, and improve accountability mechanisms, truly implementing the principles of "having laws to follow, enforcing laws strictly, and investigating violations rigorously." Digital eco-civilization construction involves multiple fields and levels, and a single law cannot comprehensively cover all issues. Therefore, legal provisions must be logically consistent and operationally feasible. For example, the effective connection and complementarity among relevant laws such as the *Environmental Protection Law*, *Cybersecurity Law*, and *Data Protection Law* should be ensured to provide comprehensive and multi-level legal support for the construction of digital ecological civilization. At the same time, cross-departmental and cross-sectoral legal coordination and cooperation should ensure the effective enforcement of laws and regulations.

4.3 Promoting Digital Technology Innovation to Bridge the Digital Divide

To thrive in digital era, enterprises and governments must collaborate to drive digital transformation. First, they should actively participate in digital technology Research and Development(R&D), focusing on emerging fields like AI, big data, and IoT. By integrating resources and increasing investment, they can overcome technical challenges, accelerate innovation, and bring cutting-edge technologies from labs to the market, boosting the penetration and application levels of digital technologies. Second, building a collaborative innovation system among industry, academia, and research institutions is crucial. Innovative enterprises and research institutions should be supported with policies and funding to accelerate the transformation of research results into productive forces, fueling the digital economy. Third, the government should lead digital infrastructure construction in collaboration with enterprises to ensure smooth and efficient deployment of digital technologies. Comprehensive planning and high-standard construction are essential, from laying communication base stations to building data centers and cloud computing platforms. In sum, the extensive use of information access facilities and the low barriers to using information technology have significantly reduced the digital divide. This has facilitated the emergence of an informal environmental regulation model led by the online public, thereby transforming the landscape of environmental governance[12].

5. Conclusion

The digitization of eco-civilization construction is an important development direction of eco-civilization today and in the future. For the realistic dilemma of digital eco-civilization construction, it also needs joint efforts of multi-agents such as government, society, enterprises and the public. In the globalization and digitalization era, the construction of a green and intelligent digital ecological civilization has become a key proposition for the development of the times, which not only requires us to base ourselves on the domestic front, comprehensively deepen the practical soil of ecological environmental protection and digital integrated development, but also actively participate in international arena of global ecological governance with an open and inclusive attitude, and continuously improve the comprehensive capacity and modern level of China's ecological governance in the process of extensive exchanges and mutual learning. Digital ecological civilization has added digital wings for ECC, and protects the ecological background of green mountains and rivers with digital technology. More importantly, it builds a solid bridge between high-quality economic and social development and high-level protection of the ecological environment, becoming the core driving force for creating a win-win pattern, deeply reshaping the framework of China's ecological governance system, improving the level of governance capacity in an all-round way, and making it accurately meet the stringent requirements of modern development. Striving to build a green and intelligent digital ecological civilization is like a solid footprint on the way to the modernization goal of harmonious co-existence between man and nature, leading us to open a new chapter of harmonious coexistence between man and nature.

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