Research on the Path of Digital Empowerment for Enterprise Green Transition: a Case Study of Garzê Prefecture

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Abstract: Against the backdrop of the deep integration of the "dual carbon" goal and the digital economy, digital technology has become the core engine driving enterprise green transition. As an ecological demonstration area in northwestern Sichuan, Garzê Tibetan Autonomous Prefecture bears the core mission of ecological protection and the urgent need for industrial upgrading. Exploring the path of digital empowerment for enterprise green transition is of important demonstrative significance for the high-quality development of plateau ethnic regions. Taking enterprises in Garzê Prefecture as the research object, this paper constructs a transition path system of "technology empowerment-industrial integration-institutional guarantee" and puts forward targeted optimization countermeasures. It aims to help enterprises in Garzê Prefecture achieve the coordinated improvement of ecological and economic benefits, and provide practical references for the green transition of enterprises in similar plateau regions.

Keywords: Enterprise Green Transition; Garzê Prefecture; Dual Carbon Goals

1. Introduction

With the acceleration of global climate governance, "carbon peaking and carbon neutrality" has become the core strategic orientation of China's economic and social development, and promoting enterprise green transition is the key grip to achieve the "dual carbon" goal. Meanwhile, as the core force of the new round of scientific and technological revolution and industrial transformation, the digital economy is deeply coupled with the green economy. The application of digital technology in energy consumption control, emission and carbon reduction, resource recycling and other fields provides new paths and momentum for enterprise green transition.

Located on the southeastern edge of the Qinghai-Tibet Plateau, Garzê Tibetan Autonomous Prefecture is an important ecological barrier in the upper reaches of the Yangtze River and a core region for the development of clean energy industry in Sichuan Province, shouldering the dual mission of ecological protection and economic development. Since the 14th Five-Year Plan period, relying on the strategy of "developing the prefecture through ecology and strengthening the prefecture through industries", Garzê Prefecture has vigorously developed green industries such as clean energy, ecological agriculture and animal husbandry, and cultural tourism. The energy consumption per unit added value of large-scale industries has decreased by 56.8% cumulatively, exceeding the provincial target. However, constrained by geographical environment, economic foundation and technical level, the overall development level of enterprises in Garzê Prefecture is low, with prominent problems such as high proportion of traditional industries, insufficient driving force for green transition and lagging application of digital technology. It is urgent to use digital technology to solve transition dilemmas and explore a practical model of enterprise green transition suitable for plateau ethnic regions.

2. Practical Foundation for Digital Empowerment of Enterprise Green Transition in Garzê Prefecture

2.1 Solid Foundation for Green Transition

Garzê Prefecture is rich in natural resources and has an excellent ecological environment, providing unique resource conditions for enterprise green transition. Firstly, it is abundant in clean energy resources, with huge reserves of hydropower, solar energy and wind energy. The total scale of clean energy development reaches 56.65 million kilowatts, ranking second in the province in hydropower development and first in photovoltaic development, making it an

important national clean energy base. Secondly, it has unique ecological agricultural and animal husbandry resources, including high-quality yaks, highland barley, Chinese and Tibetan medicinal materials, etc. The annual output of under-forest wild fungi and traditional Chinese medicinal materials reaches 9,111.7 tons with an output value of nearly 2 billion yuan, supporting the green development of ecological agriculture and animal husbandry. Thirdly, it is rich in ecological and cultural resources, featuring unique Tibetan culture and plateau natural scenery, laying a foundation for the green development of cultural tourism industry.

2.2 Clear Policy Orientation

A series of national and local policies have been issued to provide strong policy support for the digital empowerment of green transition of enterprises in Garzê Prefecture. At the national level, policies such as the "dual carbon" goal, digital economy development plan, and construction plan of the northwestern Sichuan ecological demonstration area have clarified the direction of green, low-carbon and digital development for plateau regions. At the local level, Sichuan Province has issued policies to support the high-quality development of Garzê Prefecture and promote the development of clean energy and ecological industries; Garzê Prefecture has successively issued policy documents such as Action Plan for Intelligent Transformation and Digital Transformation in the Industrial Sector of Garzê Prefecture (2025-2027) and Carbon Peaking Implementation Plan in the Industrial Sector of Garzê Prefecture, clearly proposing to promote the deep integration of digital technology and green industry and foster demonstration enterprises for coordinated digital and green transition, providing policy guidance and guarantee for enterprise transition.

2.3 Gradual Improvement of Digital Infrastructure

Garzê Prefecture has accelerated the construction of digital infrastructure, laying a hardware foundation for digital empowerment of enterprise green transition. Firstly, network coverage has been continuously expanded, achieving full 5G coverage in county seats and key towns, and in-depth coverage of 5G and industrial Internet infrastructure in industrial clusters, supporting the digital transformation of enterprises. Secondly, data platform construction has started, with the completion of the Danba Yanwogou Intelligent Computing Cabin and the Lianghekou Integrated Computing and Power Demonstration Project. Relying on the "Garzê Industrial Brain", the construction of the prefecture-wide industrial carbon emission control platform has been launched to support enterprise energy consumption monitoring and carbon emission management. Thirdly, digital service capacity has been improved by fostering local digital service enterprises and introducing external professional service providers to offer digital transformation and green technology consulting services for enterprises.

3. Bottlenecks Restricting Digital Empowerment of Enterprise Green Transition in Garzê Prefecture

3.1 Insufficient Depth of Digital Technology Application

Most enterprises in Garzê Prefecture are small, medium and micro-sized, with weak digital awareness and insufficient technical investment. Digital technology applications are mostly limited to low-end scenarios such as basic office work and simple production monitoring, while high-end scenarios such as precise energy consumption control, carbon emission monitoring, intelligent production scheduling and green supply chain management are underdeveloped. Most enterprises still adopt traditional production and management models without establishing a digital and green management system, making it difficult to give full play to the empowering effect of digital technology on green transition.

In addition, local digital technology enterprises in Garzê Prefecture are small in number and scale with weak innovation capacity, lacking core technologies and solutions with independent research and development. The digital and green transformation of enterprises mostly relies on external technical service providers, resulting in high transformation costs, difficult later maintenance, and low compatibility between technical solutions and local industrial realities, failing to meet the personalized transition needs of enterprises. Meanwhile, the collaborative innovation mechanism between enterprises and universities or research institutions is imperfect, leading to low transformation efficiency of R&D

achievements in green digital technology.

3.2 Low Level of Industrial Chain Collaboration

Garzê Prefecture has a single industrial structure and short industrial chains. Most enterprises are concentrated in low-end links such as resource exploitation and primary processing, lacking deep processing and high value-added links, with low correlation among enterprises and difficulty in forming synergies. Taking the clean energy industry as an example, despite the large installed scale, supporting industries such as power equipment manufacturing, energy storage equipment production and new energy services are underdeveloped, resulting in insufficient industrial chain collaboration and difficulty for digital technology to penetrate and integrate among industrial chains.

Furthermore, although some industrial digital platforms have been built in Garzê Prefecture, there is a lack of unified standards and docking mechanisms among platforms, highlighting data barriers and making it difficult to achieve cross-industry and cross-enterprise data interconnection and resource sharing. The digital systems of leading enterprises and small and medium-sized enterprises are incompatible, and resources such as R&D design, production scheduling and energy consumption data cannot be shared, leading to fragmented application of digital technology and difficulty in exerting the scale effect and synergy effect of platform economy, restricting the overall green transition of the industrial chain.

3.3 Severe Shortage of Talents

Located in the plateau area with low economic development and limited educational resources, Garzê Prefecture has insufficient capacity for local talent training and lacks interdisciplinary talents proficient in both digital technology and green production. The low digital literacy of internal employees makes it difficult to skillfully operate digital equipment and systems, restricting the application of digital technology and the promotion of green transition. Constrained by geographical environment, working conditions, salary and other factors, Garzê Prefecture is difficult to attract outstanding external digital technical talents, green management talents and professional technical talents. The talent gap keeps widening due to low inflow and high outflow, failing to provide sufficient intellectual support for the digital empowerment of enterprise green transition.

4. Path Construction of Digital Empowerment for Enterprise Green Transition in Garzê Prefecture

Based on the dual positioning of ecological protection and industrial development in Garzê Prefecture, with digital technology innovation as the core driving force, the integration of industrial digitalization and greening as the main line, and the alleviation of talent, capital and institutional bottlenecks as the guarantee, adhering to the principle of "ecological priority, digital leadership, key breakthrough and coordinated promotion", focusing on key industries such as clean energy, ecological agriculture and animal husbandry, Chinese and Tibetan medicine, and traditional processing, strengthening the penetration and application of digital technology, this paper constructs a trinity transition path system of "technology empowerment-industrial integration-institutional guarantee". It promotes the green transformation of enterprises' production modes, management models and business models, helps enterprises in Garzê Prefecture achieve the coordinated improvement of ecological, economic and social benefits, and builds a model of digital empowerment for green transition in plateau ethnic regions.

4.1 Technology Empowerment Path

Focus on key industries and promote the in-depth application of digital technology by category. For the clean energy industry: promote technologies such as digital twinning, intelligent scheduling, energy consumption monitoring and carbon emission tracking, build intelligent hydropower and photovoltaic platforms, optimize the whole-process management of energy production, storage and consumption, improve energy utilization efficiency and reduce carbon emissions. Establish a technological innovation system of "government guidance, enterprise leadership and industry-university-research collaboration". The government should increase financial investment in R&D of green digital technology, support enterprises to build joint R&D platforms with universities and research institutions, focus on joint research and development of plateau-adapted digital technology, clean energy green technology and

ecological industry digital technology to break through core technical bottlenecks. Improve the transformation mechanism of scientific and technological achievements, build technology transfer service platforms to provide enterprises with technology docking, achievement incubation, testing and other services, promote the landing and application of advanced green digital technology in Garzê Prefecture, and enhance the independent innovation capacity of enterprises.

4.2 Industrial Integration Path

Relying on the resource advantages of Garzê Prefecture, promote the deep integration of digital technology and green industry, and foster new business forms and models.

"Digital + Clean Energy": Develop new business forms such as green computing power, integrated computing and power, and green hydrogen, build the Danba Yanwogou Intelligent Computing Cabin and Lianghekou Integrated Computing and Power Demonstration Project, and promote the coordinated development of clean energy and digital industry.

"Digital + Ecological Agriculture and Animal Husbandry": Develop new models such as intelligent breeding, precise planting and rural e-commerce, build digital ecological agriculture and animal husbandry industrial parks, and promote the intelligent production, networked operation and informationized service of agriculture and animal husbandry.

"Digital + Cultural Tourism": Develop new business forms such as smart tourism, digital cultural and creative products and immersive experience, and promote the green and intelligent upgrading of cultural tourism industry.

Take leading enterprises as the core to promote the digital coordinated development of upstream and downstream enterprises in the industrial chain. Support leading enterprises in clean energy, ecological agriculture and animal husbandry to open digital system interfaces, share resources such as R&D design, production scheduling and energy consumption data, and drive the digital transformation of small and medium-sized enterprises. Build a prefecture-wide industrial chain collaboration platform, integrate supply chain resources, carry out applications such as collaborative procurement, material traceability, capacity sharing and logistics optimization, improve the integration level of the industrial chain, and achieve overall carbon reduction and efficiency improvement of the industrial chain. Deepen "enclave" cooperation and promote the cross-regional collaborative development of digital technology and green industry relying on the national-level Ganmei Green Industrial Park.

4.3 Institutional Guarantee Path

Improve the talent introduction and training system. Relying on local colleges and universities such as Garzê Vocational and Technical College, add relevant majors such as digital technology, green production and ecological economy, deepen school-enterprise cooperation, carry out order-based talent training to cultivate local interdisciplinary talents. Conduct training on digital literacy and green skills for enterprise employees, and regularly hold special training courses and technical seminars to improve employees' operational skills and transition awareness. For external introduction: formulate preferential talent introduction policies, give inclinations in housing, children's education, salary and other aspects to attract digital technology experts, green management talents and senior technical talents to take root in Garzê. Establish a flexible talent introduction mechanism to introduce external high-end talents to provide intellectual support for enterprise transition through project cooperation, technical consulting, part-time job attachment and other ways.

Improve the standard and supervision system. Accelerate the formulation of technical standards, data standards and green evaluation standards for the digital and green transition of enterprises in Garzê Prefecture, unify norms such as enterprise energy consumption monitoring, carbon emission accounting and green product certification, and guide enterprises to standardize transition. Establish and improve the energy consumption and carbon emission monitoring and supervision system, integrate energy consumption and emission data of key enterprises relying on the "Garzê Industrial Brain" and carbon emission control platform, carry out carbon footprint accounting and dynamic monitoring to achieve precise supervision and targeted policy implementation. Strengthen green law enforcement and supervision, strictly implement environmental protection laws and regulations, force enterprises to fulfill green production responsibilities and take the initiative to promote digital and green

transition.

5. Research Conclusion

This paper systematically studies the path of digital empowerment for enterprise green transition by taking Garzê Prefecture as an example, and draws the following main conclusions: Firstly, Garzê Prefecture has a sound practical foundation for digital empowerment of enterprise green transition, with rich clean energy resources, strong policy support and gradually improved digital infrastructure. The transition of clean energy enterprises takes the lead, the transformation of traditional industries progresses steadily, the integration of ecological industries shows initial results, and the enabling effect of green finance is prominent, laying a solid foundation for the overall transition. Secondly, the digital empowerment of enterprise green transition in Garzê Prefecture still faces many bottlenecks, mainly reflected in the insufficient depth of digital technology application, low level of industrial chain collaboration and serious shortage of talents, which seriously restrict the transition process. Thirdly, to promote the digital empowerment of enterprise green transition in Garzê Prefecture, it is necessary to base on the reality of plateau ethnic regions, construct a trinity transition path system of "technology empowerment-industrial integration-institutional guarantee", and break through transition bottlenecks by strengthening the penetration and application of digital technology, promoting the integration of digital and green industries, and improving the support systems such as policies, talents, finance, standards and public services, so as to help enterprises achieve the coordinated improvement of ecological and economic benefits.

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