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Digital Transformation and Rule of Law Based on Peak CO₂ Emissions and Carbon Neutrality

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Abstract: The promotion and implementation of carbon neutrality against peaking carbon dioxide emissions urgently need the support of science and technology and the backing provided by a guarantee of rule of law. The proposition, logic, and progression of digital responses to peaking carbon dioxide levels in the search for carbon neutrality are clearly reflected in the current era, employing big data to address the problems of inadequate central–local coordination and interaction, the inadequate application of the rule of law, campaign-style “carbon reduction” promotion, and scientific and technological support in the promotion and implementation of peak carbon dioxide emissions and carbon neutrality. We need to pay attention to the coordination of digital technology, the rule of law response, and the protection of people’s rights. First, in the process of digital carbon dioxide peaking and carbon neutrality, it is necessary to improve the credibility of carbon dioxide peaking and carbon neutrality through the “whole-process trace” and storage mechanism techniques that are made possible by blockchain technology. Second, it is necessary to refine the management of peak carbon dioxide emissions and carbon neutrality through “decentralization” and consensus mechanisms. Third, it is necessary to improve the effectiveness of governance in the management of peak carbon dioxide emissions and carbon neutrality through “non-falsifiability” and collaboration mechanisms. Fourth and finally, the conclusions of this paper are offered. First, from the aspect of smart city construction, it is necessary to promote the coordinated construction of a low-carbon city and smart city and explore the legal ramifications of low-carbon development in urban governance. Second, in corporate governance, we need to build a low-carbon-development digital platform to promote the integration of digital technology and corporate compliance. Third, in terms of global governance, we need to promote the rule of law in cyberspace to address global climate change, the low-carbon development of digital technology, and the low-carbon construction of a cyber society. Fourth, we need to emphasize the rights and obligations of different parties in the implementation mechanism of the rule of law on digital carbon peaks and carbon neutrality.

Keywords: carbon peak; carbon neutral; digitization; rule of law; big data law

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1. Introduction

China has put forward a national environmental strategy of carbon-peak and carbon-neutral resolution, with the aim of addressing global climate change and promoting amelioration implementation in key regions and enterprises, to promote the overall reform and sustainable development of economic production and life [1]. At present, the theoretical policy is paying more attention to how to achieve the double carbon goal within traditional industries [2], urban governance [3], companies and private citizens [4], and how emerging big data technologies can enable carbon-neutral peaking, especially when studies of the implementation of its safeguards in the rule of law [5] are rare.

From the global perspective (See Table 1), the background of the carbon peak and carbon neutrality is closely related to the complex and changeable international and domestic environment. In the late 1980s, the United Nations organization established its

Intergovernmental Panel on climate change, which began to study the issue of climate change, noting that since the industrial revolution, the climate has warmed globally because of the emission of greenhouse gases such as carbon dioxide and that this type of change will endanger the human survival circulation system. The world's major countries have put forward a carbon-neutral time point and have committed to taking the relevant measures to promote carbon emission reduction.

Table 1. Peak times for carbon emissions in major countries and their commitment to a carbon-neutral time.

Countries	Carbon Peak Time	Carbon Neutral Time
Britain	After Britain reached its peak in the early 1970s, it has been in a plateau period for a long time, with emissions now falling about 40% relative to peak levels.	2050
Germany	After reaching a peak in Germany in the late 1970s, a long-term plateau has occurred; current emissions relative to peak levels are about 35%.	2050
The United States	The United States reached its peak in 2007, after a slow decline in current emissions relative to peak levels of about 20%.	2050
Japan	Japan's 2013 emissions level is the highest on record; future trends remain to be seen.	2050
Korea	Korea has not yet reached a peak in emissions.	2050
China	China has not yet reached a peak in emissions; it is anticipated by 2030 (projected).	2060

In December 2015, following the mitigation efforts of China, the United States, France, and the European Union, the Paris Agreement was signed in Paris, France, calling for a cap to the global temperature rise of less than 2 degrees Celsius by the end of the 21st century compared with that before industrialization, and to control it within 1.5 degrees Celsius by the second half of the 21st century to achieve global carbon-neutral requirements. In October 2018, the United Nations Intergovernmental Panel on Climate Change reported that to avoid extreme harm, the world must limit its global warming to 1.5 degrees Celsius; if global temperatures do not rise by more than 1.5 degrees Celsius, by 2050, then, the world will be carbon neutral; by 2070, it needs to have risen by less than 2 degrees Celsius. The current grim situation has prompted countries to join forces to take major action to tackle climate change, with 121 countries now offering a carbon-neutral target or vision by 2050.

How can China, the world's second-largest economy, push for carbon peaking and carbon neutrality in the big data era? Reviewing China's low-carbon strategy and development process, "carbon peak carbon neutralization" represents the inevitable evolution of China's low-carbon development strategy. China's implementation of the National Strategy for low-carbon development, following the "11th Five-year Plan", has established binding targets for energy conservation and carbon reduction, as in each five-year plan. Based on an analysis of the evolution process and the internal logic of China's low-carbon development strategy, the evolution of China's low-carbon strategic goals has three characteristics, as follows: first, the objectives are constantly being strengthened, the current strategic dimension is extremely high, and the pace of promotion is extremely fast. That is, with the continuous application of China's low-carbon development process and the changes in the world's response to climate change, China's low-carbon strategic objectives have become more and more active; the height, breadth, intensity, and speed of deployment at both central and national levels have all increased rapidly. Second, the objectives have moved from the recessive target to the dominant target. That is, in terms of energy-saving, the indirect and recessive carbon emission reduction targets have gradually transitioned to the direct carbon intensity emission reduction target, then evolved into carbon peak, carbon-neutral, and other total carbon control targets. Third, these objectives are gradually being diversified and structured. That is, in the process of the low-carbon targets evolving from recessive to

dominant, both recessive and dominant targets are retained; thus, a diversified and structured target system, including energy saving, energy structure optimization, total energy consumption control, carbon intensity reduction, and total carbon control has been formed.

Therefore, in the current big data era, in order to achieve the goals of the carbon peak and carbon neutrality, we need to emphasize “digital decarbonization”, and then explore the basic study topic of “digital carbon peaking and carbon neutrality”, from smart grids to clean energy, from the industrial internet to a future low-carbon factory, to a digital low-carbon economy, and from a smart city to a low-carbon city. This exploration covers ecological and environmental management and green development; through digital reform and the green integration of resources, we can promote the realization of the dual carbon goal [6]. In a fundamental sense, it is necessary to emphasize the basic path of digital reform in terms of traditional industries and the basic requirements of legal protection of the market’s main body, as well as to promote the fundamental integration of digital technology, peak carbon dioxide emissions, and carbon neutrality through legal means. In this paper, we propose the technical principles of digital carbon neutrality, in the context of the integration of new technologies and carbon neutrality, and propose specific legal responses through the value leadership of the rule of law, the construction of key institutions, and the collaborative development of various actors, so as to form a synergy between the digitalization of carbon neutrality, the greening of carbon, and the rule of law. This article is intended to encourage further discussion of this issue.

2. Levels and Problems: Analysis of the Current Situation of Peak Carbon Dioxide Emissions and Carbon Neutrality

2.1. The Incongruity between the Central and Local Authorities

The ecosystem is an open complex giant system. To solve the “double carbon” problem, we need to use system thinking, adopt a central and local overall perspective and create the height of ecological civilization. China’s industrialization, energy structure, carbon-neutral starting-point strength, and so on, are at the development stage; to realize the double-carbon target, the government must face multiple obstacles and formidable challenges. For this reason, we use political, economic, scientific, technological, legal, and other means to comprehensively consider the two ways of reducing emissions and increasing foreign exchange, starting with energy efficiency, energy structure, industrial structure, and so on, taking key issues as guidance for the emerging technology and legal system and multi-dimensional efforts to promote the economic and social system to achieve a comprehensive green low-carbon transformation on a step-by-step basis [7]. Since the “double carbon” target was set at the central government level, “doing a good job of carbon peak and carbon neutrality” has been included as a key task in the 14th five-year plan. Local authorities are also actively planning to reach the peak as a primary target in the schedule and strive for early neutralization. However, the overall coordination and interaction between central and local governments are still insufficient; the carbon market lacks a legislative basis at the national level, as well as uniform rules at the national level [8]. For example, the energy supply systems of Yancheng and Zhangjiakou, the national renewable energy demonstration areas, still face many difficulties in the process of implementation, mainly including the lack of national standards, which results in regional and focus areas of carbon emissions. In addition, carbon sink capacity measurement is not accurate; the energy consumption growth of provincial and even national key projects leads to the problem of carbon peaks, as well as uncertainty regarding the carbon-neutral year [9].

2.2. The Lack of the Rule of Law

In terms of the implementation of a carbon-neutral peak, this clearly reflects the implication of policy-driven legislation, mainly, the need for centralized top-level design to promote it. In the action plans of the government, enterprises, and network platforms, the legal support and legal framework are relatively lacking. Although the central government has issued a series of policy documents on carbon neutrality, legislation on carbon neutrality

needs to be accelerated, relying only on policy documents and not on the legal system; there are many institutional and mechanism problems that must be addressed in the process of carbon-neutral propulsion. However, there is a lack of a legal guarantee mechanism for emerging technologies, in terms of a technical guarantee of carbon-neutral compliance. On the other hand, the lack of specific national legislation regarding climate change may lead to a lack of rigidity in the implementation of double-carbon targets. For example, the construction of a national carbon market should encourage the promulgation of interim regulations on carbon emissions trading management as soon as possible, and establish a legal rights guarantee mechanism and a legal accountability mechanism to promote the implementation of a dual-carbon strategy by using the rule of law [10]. In terms of pollution reduction and carbon reduction of the main bodies, such as governments and enterprises, there is also the lack of a legal incentive mechanism and an applicable normative basis for the application of legal big data, blockchain, and artificial intelligence, which makes it difficult to achieve the goal of technology synergy. These problems collectively reflect the critical absence of a legal framework for carbon neutrality in terms of China's carbon peak [11].

2.3. The Problem of Technical Support

Peak carbon dioxide emissions and carbon neutrality depend on a systematic and complex technical system and need all-around scientific and technological support. At present, many technologies in the relevant key areas are not mature, so it is necessary to increase efforts toward tackling key problems in scientific research and to speed up the promotion of a network to support science and technology. In the global arena, climate change and the destruction of our ecological environment is a threat to the entirety of human life and environment quality is being brought lower and lower; the implementation of peak carbon dioxide emissions and carbon neutrality need to go further, in terms of technical development, to overcome the major challenges of the harsh climate change environment via better technical support [12]. For example, the official launch of the national carbon emissions trading market on 16 July 2021 marks another step toward the carbon peak and carbon neutrality; at the same time, we need to further promote the "two-carbon" blueprint to lead the way to 5G, IDC high-quality development, and new, green infrastructure construction [13].

2.4. Campaigning for Carbon Reduction

In China's peak carbon dioxide emissions and carbon neutrality implementation process, movement of the "carbon reduction" problem must be prevented. The so-called campaign-style "carbon reduction" means that in the process of carbon neutralization, the relevant entities use unconventional, non-standardized, and non-continuous methods to promote energy-saving and emissions reduction, blindly pushing forward. For example, although some regions and departments are actively promoting carbon-neutral production, there are some places, industries, and enterprises where the focus has been on catchphrases such as "off track" and "race to the top", and carbon-neutral "hats" fly everywhere [14]. Therefore, it is necessary to enact a guarantee of the rule of law, encourage the standardization of carbon peak and carbon-neutral issues, and promote the digital operation of carbon peak and carbon-neutral concepts by using new technology. For example, in some countries and regions, research on emerging technologies has been actively pursued to provide digital support for carbon neutrality and, in the process of digitization, to consolidate reforms and provide legal safeguards in the form of legislation or legislative amendments [15].

3. Value and Logic: Relationship Compatibility in Carbon Peak, Carbon Neutrality, Digital Technology, and the Rule of Law

3.1. At the Macro Level, Attention Should Be Paid to the Role of Numbers and the Rule of Law in the Sound Development of an Economic Society, along with the National Governance System and Production Capacity

First, dealing with the relationship between a market economy, the green economy, and a rule-of-law economy in the process of realizing a "double carbon" target necessitates

digital technology and the guarantee given by a rule-of-law norm. For example, Zhejiang fully integrated all functions and actively built a dual-carbon intelligent platform, in accordance with the “cross-domain, scenario-based” and “big scene, small cuts” requirements. The aim is to improve the use of various data, co-processing data, and algorithm models to establish assessment standards and a legal system, to provide an advanced governance platform for achieving the carbon peak and carbon neutral targets, and to monitor, manage and forecast the whole process visually [16].

Second, solving the problems of social development and natural environment protection, in the process of realizing the “double carbon” target, needs coordination and the governance function of the central and local rule of law departments, as well as the coordination of foreign-related and domestic rule of law systems in service of international rule of law. Looking at the outline of China’s 14th five-year plan, it is necessary to solidify the targets of “carbon intensity” and “carbon emissions” by means of the rule of law, through communication and coordination among different departments under the rule of law, and in central and local coordination under the promotion of target assessment and system evaluation. At the same time, in the process of international cooperation and exchange, it is necessary to explore the international application path of low-carbon technology in the international rule of law system and to stimulate and promote the innovation and upgrading of the green transformation of the relevant domestic industries through the market service mechanism. Furthermore, it provides a long-term mechanism through the path of the rule of law, in terms of its international and domestic aspects [17], for example, in the implementation of fiscal law, via the subsidy mechanism to guide industrial restructuring and improve the competitiveness of the renewable energy industry. In terms of international cooperation policy, this initiative will promote Sino-British climate cooperation, “South–South cooperation”, and the “Belt and Road” initiative by establishing an international treaty mechanism with legal safeguards and services, and we will promote the “Introduction” and “Going global” initiatives of energy technologies and industries [18].

Third, in the process of “double carbon” initiatives, promoting the modernization of a national governance system and governance capacity, along with the iterative development of emerging technologies, needs the support of a technical, procedural, and coordinated network rule of law and its governance. Through the construction of the digital carbon peak, the carbon-neutral information platform, and the overall construction of a green digital infrastructure, funds, finance, and other compliance incentives make it possible to guide emerging enterprises to carry out the relevant green low-carbon business. We need to work together to innovate and develop the PPP model under the supervision of the rule of law on the network platform, to form a good cooperative relationship among the government, enterprises, and social capital actors, and, through network technology platforms and online compliance mechanisms, to build a high-quality legal system for low-carbon environmental protection industries, and to promote and ensure a novel digital infrastructure for new energy use [19].

3.2. At the Micro-Level, We Need to Pay Attention to the Protection of People’s Legitimate Rights and Interests, As Well As the Key Links in the Construction of the Rule of Law and a Digital and Green Government

In the process of working toward the “double carbon” goal, realizing and promoting the population’s sense of happiness and security in the field of digitalization needs the rule of law to guarantee people’s livelihoods. We need to improve the green legal administration structure as well as the supporting system and mechanism. In the process of low-carbon and law-based government administration, we should adhere to the ideal of shared development of the whole society, standardize the right to serve the people in the construction of a government under the rule of law, and improve the handling of emergency situations. During natural disasters in China, people report disaster information through Weibo, express their most urgent needs, and seek help. As a result, Weibo data have become an important source of information for disaster management. Text, images,

and geographic location data can be used to learn more about natural disasters and to provide a database for natural disaster management.

People's sense of participation and gain is vital for garnering support. By sharing the fruits of low-carbon development throughout society, low-carbon and environmentally friendly behavior patterns are gradually incorporated into the actions of the people, promoting the construction of a mass base for digital carbon peaking and carbon neutrality [20]. However, in the process of achieving the "double carbon" goal, the digitalization needed to meet the growing needs of the people for a better life requires the timely updating of digital technology and the careful implementation of the environmental rule of law. By promoting the development of a sharing economy model and the construction of legal norms for the relevant emerging technologies, by promoting a low-carbon lifestyle under the leadership of the state, and with the participation of the "Whole Society in Cyberspace", as well as via the rule of law and the consciousness of the people, the end goals of saving energy and reducing carbon, the digital carbon peak, carbon neutrality, and network efficiency will be achieved.

4. Mode and Application: The Digital Mode Transformation of the Carbon Peak and Carbon Neutralization, and the Technical Principles

In the context of promoting carbon neutrality using science and technology, information technologies such as big data and blockchains should be brought into full play, to support the work and achieve the realization of the double carbon target. The application of blockchain can force enterprises to achieve green transformation, which is characterized by increased efficiency, and, thus, promote the deep integration of blockchain technology and dual carbon implementation to achieve the goal of "digital carbon peaking and carbon neutrality" [21]. This can be enabled by promoting "blockchain technology + double carbon propulsion" and "Big data + double carbon propulsion", in order to gradually achieve carbon peak carbon neutral status and enable intelligent construction.

4.1. To Enhance the Credibility of Digital Carbon Peak Goals and Carbon Neutrality through the "Whole-Process Trace" Theory and Certification Mechanism, via Blockchain Technology

When promoting the digital double-carbon target, the data and documents of the double-carbon target can be preserved throughout the production and distribution process; the whole paper trail can be recorded using the "distributed accounting" blockchain inventory mechanism; through the consensus mechanism and trusted rules of the blockchain, tamper-proof and traceable data units are formed. Furthermore, blockchain technology can achieve good interaction between society and the network in the process of digital carbon peaks and carbon neutralization, and ensure the authenticity and reliability of data and information content [22]. This will result in the updating of models and the preservation of data for the enforcement of dual carbon management by collaboration with the dual carbon production sector and the legal addressing of dual carbon violations. For example, in specific areas, such as carbon reduction services, dual-carbon product anti-counterfeiting, and low-carbon material applications, blockchain technology can enable relevant data, commodify anti-counterfeiting information, and use information to create links, make service data, circulate low-carbon product information and make the use of each donation traceable in the blockchain, to enhance the transparency and credibility of the management of dual carbon goals. For example, in the specific applications of blockchain technology, information can be stored at multiple points for low-carbon products, and specific links such as distribution, logistics, and distribution can be recorded on the blockchain. In consequence, the whole process can be open and subject to public supervision, we will effectively increase the efficiency of resource allocation for low-carbon goods and enhance mutual trust among the government, society, and citizens [23].

4.2. Realizing the Refinement of the Digital Carbon Peak Goal and Carbon-Neutral Management through the “Decentralization” and Consensus Mechanism of Blockchain Technology

On the one hand, the core advantage of blockchain technology is the possibility of “decentralization”. This distributed block structure, in terms of the digital carbon peak and carbon neutrality’s developing management process, will create a trust relationship between the various actors, making it possible to build a synchronized, convenient, open, and refined platform system. On the basis of this platform, the digital carbon peak and carbon-neutral blockchain system can achieve relative equality between the main supervisory bodies of the upper chain, while the participants form a relatively fixed and mutually supervised relationship. “Working together to achieve double carbon”, to benefit from convenience and service to achieve carbon peak carbon-neutral management information sharing and fine participation.

On the other hand, the consensus mechanism of blockchain technology is that with digital carbon peaks, carbon-neutral information is linked up in the form of blocks, and an intelligent algorithm is used to form a decentralized super-ledger. This allows the digital carbon peak and carbon-neutral entities to be stored in a stable, sequential database over a period of time so that the digital carbon peak and carbon-neutral blockchain can be recorded; there are strong trust endorsements based on consensus in terms of collection, interaction, computation, and so on. Carbon peak and carbon-neutral managers can identify violations in chronological order using the “Alliance Chain” [24], for the purposes of scientific research, prediction, and a summary of the development trend, and to provide visualization mapping and information technology support to make subsequent research and judgments more accurate.

4.3. To Enhance the Effectiveness of Governance in Digital Carbon Peak and Carbon-Neutral Management, through the “Unforgeable” and Collaborative Mechanisms of Blockchain Technology

Firstly, blockchain technology can be used in the fields of evidence review and fact-finding for carbon-neutral enforcement. The core factors of the digital carbon peak, carbon-neutral management, and legal compliance, are data and evidence, forming so-called big data evidence [25]. The digital carbon peak, carbon neutralization, and the formation of “unforgeable” traces left by the entire process are tracked through electronic evidence and other online materials. For example, the authenticity of evidence in the process of enforcement of peak carbon dioxide emissions and carbon neutrality has always been one of the issues troubling governments, along with public security, enterprises, and social organizations at all levels. Blockchain technology’s “no forgery” verification mechanism can help to solve the problem of authenticity when obtaining, preserving, and transmitting evidence in the process of application [26].

Secondly, the cooperation mechanism of blockchain technology can promote high-efficient and stable multi-cooperation under the requirement of “Setting up a national whole consciousness” to achieve the digital carbon peak and carbon neutrality. According to Swan, a leading American scholar, “Blockchain technology can fundamentally become a new paradigm for reducing friction and increasing efficiency in organizational activity patterns, greatly facilitating the coordination and validation that used to be done by humans and operating through collaborative consensus to achieve greater qualitative freedom, fairness, and efficiency” [27]. In other words, blockchain technology is conducive to carbon peak and carbon-neutral management, according to the central line of multi-party collaboration and precision implementation. Blockchain technology can achieve the multi-trust status of the carbon peak and the rules of carbon-neutral technology among its factors. Blockchain technology is also conducive to the construction of different carbon peak and carbon-neutral collaborative tasks, government agencies, departments at all levels and organizations, with clear mission objectives and detailed specific operations. Blockchain technology also facilitates the recording and evaluation of carbon peak and carbon-neutral management collaboration, thus providing data analysis support for improvement measures and efficiency.

Thirdly, blockchain technology can promote the construction of an intelligent national digital carbon peak and carbon-neutral early warning system, thereby improving the carbon peak and carbon neutral governance capability. For example, through the construction of a “double carbon alliance chain” involving different sectors, the government, social organizations, private enterprises, the public, and other entities can be certified online, can fast-track carbon peak and carbon-neutral issues, and optimize the resumption of production and the related government activities [28]. At the same time, for carbon peaking and carbon-neutral cases and the related data, cross-agent interaction, research, and diagnosis can be achieved through the verification and trust mechanisms of the blockchain platform, can ensure the authenticity of information exchange on carbon peaks and carbon neutrality, and enable point-to-point analysis via correlation, thereby improving the governance level and promoting efficient governance, thus achieving synergistic governance effectiveness. It is favorable for better, faster, and more effective propulsion and monitoring of carbon peaking and carbon neutralization.

5. System and Approach: Legal Guarantee Path of Digital Carbon Peaking and Carbon Neutrality

As mentioned above, digital carbon peaking and carbon neutrality have need of emerging technology support and the rule of law to ensure the establishment of effective mechanisms. On the one hand, digital carbon peaking and carbon neutrality require universal mobilization and participation, and this can only be achieved through global and nationwide technical support and policy and legal safeguards [29]. On the other hand, in key areas and key industries, we need to carry out the construction of a digital carbon peak and a carbon-neutral rule of law with focus, commitment, and purpose [30].

The V1.0 guidelines for the application of peak carbon neutrality in a digital technology-enabled industry clearly state that digital technology can promote the greening of industrial production, improve carbon management in secondary industry, and facilitate the development of carbon trading and carbon finance in the global market. Digital technology plays an important role in carbon peaking and carbon neutralization. According to China’s 2030 carbon peak study, China’s total net carbon dioxide emissions in 2019 were about 10.5 billion tonnes. Digital technology could reduce global carbon emissions by 20% over the next decade by empowering other industries, according to research by the Global Electronic Sustainability Initiative (GeSI).

For example, as one of the first pilot provinces and cities in China to carry out carbon trading, the Beijing carbon market is actively exploring the relevant green financial product innovations, gradually building and improving the region of the capital with a characteristic, multi-level, digital carbon emissions trading market (See Table 2). By the end of 2020, through the analysis of big data, 843 key carbon emission units have been incorporated into the management of the Beijing pilot carbon market, covering eight industries including electric power, thermal power, and aviation, and 100 percent of the key carbon emission units involved in the implementation of this convention have achieved compliance; nearly 68 million tons of carbon products were sold in the Beijing carbon market, with the turnover exceeding CNY 1.94 billion.

5.1. In the Construction of Smart Cities, It Is Necessary to Complete the Legal Proposition of Urban Governance in the Coordinated Construction of a Low-Carbon City or Smart City

In the process of carbon peaking and carbon neutralization regarding urban governance, it is necessary to analyze, monitor, and forecast the relevant elements of urban governance using big data artificial intelligence, and other emerging digital technologies. In the analysis mechanism, it is necessary to create the correct data foundation for big data and artificial intelligence algorithms. In the monitoring mechanism, there is a need to emphasize the protection of the whole process of data production security, in terms of 24/7 and all-around data monitoring in the process. This involves the production, storage, transmission, and use of energy [31] to achieve the overall goal of carbon peaking and carbon neutrality, by means of administrative rule-of-law monitoring, such as testing,

reporting, and pre-plan processing. For example, Chengdu, the capital city of Sichuan Province, has made great progress in its early explorations of building a low-carbon city and a park city, in terms of its base, industrial structure, and energy use (See Table 3).

Table 2. Progress of digital transformation of the Beijing carbon market.

Concrete Progress	Content Representation
First, the system is completed.	In addition to the Beijing measures for the administration of carbon emission trading, the relevant competent authorities have also formulated and issued supporting policies and technical documents, such as the big data method for quota approval, the administrative measures for verification agencies, and the detailed implementation rules for over-the-counter transactions. Beijing is the first and so far the only market to introduce open-market operation management measures.
Second, the carbon price is stable and reasonable.	Since the creation of the Beijing Carbon Market, the average annual transaction price of carbon emission quotas has always been CNY 50–70/ton, the overall year-by-year upward trend. Compared with other domestic regional carbon markets, the Beijing Carbon Market has higher carbon prices and less trend fluctuation.
Third, the way of trading is flexible.	Each transaction participant may choose either an online public transaction or an offline agreement assignment, according to their own circumstances.
Fourth, the trading subjects are diverse.	At the initial stages of operation, the carbon market in Beijing mainly controlled the direct and indirect emissions of more than 10,000 tons of carbon dioxide per year from fixed facilities, in industries such as thermal power production and supply, thermal power generation, cement manufacturing, and petrochemicals production. Since 2016, the target has been lowered to more than 5000 tons, and the number of key platoon units covered has increased from more than 400 in the initial period to more than 900. By the end of 2020, more than 1000 enterprises, institutions, and investment institutions had participated in carbon market activities in Beijing.
Fifth, the digital practice of carbon neutrality is lucrative.	The Beijing carbon market has been committed to promoting voluntary emission reduction and carbon-neutral behavior of enterprises and individuals, through big data, artificial intelligence, and other emerging technologies, to promote the sustainable creation of the carbon-inclusive market.

Table 3. Integration of low carbon development and big data technologies in Chengdu.

Time	Initiatives and National Pilot Name	Organization (Grant)	Meaning
March 2012	Chengdu was listed as a “Sustainable and livable city” project between China and the United States.	National Development and Reform Commission	This kicked off Chengdu’s efforts to combat climate change and promote low-carbon development.
June 2014	Chengdu was included in the national ecological civilization demonstration zone.	National Development and Reform Commission, the Ministry of Finance, and other departments	This is marking the city’s efforts to promote ecological construction by the state.
April 2016	The Chengdu project of “Low-carbon City in Switzerland, China” was launched, and the “China–Switzerland International Seminar on low-carbon City Construction and Industrial Development” was successfully held.	The Swiss Agency for Development Cooperation works closely with the Chengdu municipal government of Sichuan Province	It combines international cooperation with low-carbon demonstration projects.

Table 3. Cont.

Time	Initiatives and National Pilot Name	Organization (Grant)	Meaning
March 2017	Chengdu was designated as part of the third group of national low-carbon pilot cities and has been compiling the “Chengdu Green Low-carbon Development Report” blue skin for several years.	The National Development and Reform Commission	It has set new requirements for a green, low-carbon city in Chengdu.
September 2018	Chengdu won the 2018 Global Green low-carbon Pioneer City Blue Sky Award.	Global Green low-carbon Field Blue Sky Award Organizing Committee	Chengdu implementation of green low-carbon achievements by the international community.
December 2019	“Green Rong” green financial supermarket officially launched.	Sichuan United Environment Exchange	It plays the role of a financial service entity economy and provides more diversified financial tools and services for green industries.
September 2020	Chengdu issued guidance on the construction of the “Carbon Huitanfu” mechanism implementation.	The Government of Chengdu	It has set up a positive guidance mechanism that combines policy incentives, business incentives, and carbon emissions trading.

In the prediction mechanism, we need to sort out the integrated rule of law implementation system of “Digital foundation + Energy revolution + The rule of law mechanism”, through the digital Internet, tools from the Internet of Things, integrating digital technologies and legal big data with emerging legal mechanisms regarding rights and providing fair, open, decentralized, and widely voluntary carbon-neutral early warning systems for a wide range of carbon-neutral subjects in cities, to prevent problems before they arise. For example, the Shanghai Center for Energy Conservation and Emission Reduction is currently carrying out local explorations of “digital intelligence” to control carbon emissions, while in the context of building a smart city, the digital dynamic accounting and future prediction of urban carbon emissions are accomplished through a carbon emissions data management and monitoring platform.

5.2. In the Area of Corporate Governance, the Establishment of a Compliance Mechanism for Digital Platforms Is Needed

On the basis of giving full play to the government’s regulatory role, it is also necessary to fully mobilize the market mechanisms of digital companies and carbon enterprises, so as to achieve compliance through the digital “carbon enterprise chain” mechanism, the standardized and efficient implementation of digital carbon peaking, and carbon-neutral financial needs. To achieve the goal of “double carbon”, it is necessary to establish a capital operation system and mechanisms to adapt to the new development pattern and the big data era and to encourage green investment and financing through preferential policies. We must establish an incentive and restraint mechanism that links executive compensation with green performance in financial institutions, increase guidance on the direction of green capital investment, strengthen the supervision and management of monopoly capital, and continue to improve the legal system that guides the orderly flow of capital [32]. In the digital “Carbon enterprise chain” platform, using big data analysis and intelligent algorithm models to serve the market, gaining synergy advantage in the main body and standardizing financing channels, etc., helps to achieve platform-based compliance on the basis of “Financing” and “Financial intelligence” as needed for carbon peaking and carbon-neutral behavior by providing a standardized and digital program. For example, recently, the Wuxi high-tech zone signed a formal contract with a vision technology group

to jointly build an Ark “Double carbon and double control” management platform, to help local governments achieve high-quality economic development under carbon constraints, offering regional carbon management in the digital, carbon-neutral era. For example, the Ant Group uses the non-tamperable and traceable features of blockchain technology to make the processes of carbon emission, carbon reduction and clearing transparent, and the relevant records can be traced and verified at any time, thus realizing the deep integration of blockchain technology with carbon peaking and carbon-neutral goals.

5.3. In Global Governance, the Establishment of a Rule of Law Mechanism in Cyberspace Regarding Global Climate Change Needs to Be Promoted, in the Context of a Community for the Shared Future of Mankind

In this era of frequent extreme weather events and natural disasters, a digital “double carbon” strategy is needed to deal with global climate change. To enhance the self-governance of all kinds of subjects at the global level through the legitimate demands and initiatives of network participants and other actors, to promote the global environment through the network of Global Environmental Protection Conventions, to encourage the government, citizens, third-party organizations and other entities as a whole to coordinate the development of environmental protection countermeasures, and to overcome the systematic risks inherent in the destruction of the natural and ecological environment through the global network, the concept of “Carbon emission reduction and global human development are closely linked” has been disseminated. The digital carbon peak and carbon neutrality cannot be achieved without the participation of people from all over the world, thus promoting a more sustainable transformation of the global community. For example, carbon peaking and carbon neutral are by no means a step backward. Relatively well-off and well-established industries or regions must take a step forward and treat the goals as an opportunity but not a burden. The human carbon footprint network database can be established on a pilot basis in key cities and industries, then individual, industry, national, and even global carbon emission accounting can be carried out; the goal of carbon neutrality, in the sense of an information resource, is achieved by means of technical and legal data collection advances.

5.4. In the Specific Rule of Law of Mechanism Construction, There Is a Need to Emphasize the Customization of the Conventional Rule of Law Response Program

First, the mechanism emphasizes the importance of the road to digital carbon peaking and carbon-neutral goals that the rule of law guarantees. We should learn from the Chinese cultural tradition of the rule of law and traditional ecological values, to promote the coordinated development of a domestic rule of law and foreign-oriented rule of law in the process of carbon peaking and carbon neutralization, and to realize the Chinese character and characteristics of ecological construction and rule of law construction. As a consequence of China’s national character, through absorbing the excellent achievements of the rule of law outside the country, promoting the construction of a domestic legal system of ecological protection via the reform of the current system, absorbing the paramount virtues of thrift and diligence, and refining the spirit of the principle of green development, we firmly believe that China is fully capable and confident of achieving the goals of carbon peaking and carbon neutrality.

Second, the formation of the digital carbon peak, carbon-neutral rule of law is to ensure the basis of the people’s broadest consensus. In the process of building a digital carbon peak, carbon-neutral rule of law, it is necessary to always uphold the people as the main agency, form a responsive rule of law based on the well-being of the people, improve the relevant legislative system from the people’s standpoint and needs, and optimize the administrative law enforcement system to achieve justice, to comply with the law, and to protect the spirit of the law through the pursuit of a substantive rule of law. It is even more necessary to reach the broadest consensus possible in the whole of society and in the whole field, to unite as one, and to promote the rule of law through coordination between the central and local governments, to abstract and agglomerate the goal, path,

system and action consensus in the rule of law reform, thereby enhancing the whole of society's sense of the rule of law and their recognition of the rules. For example, through the "public interest incentive model" of the online platform, the establishment of a personal carbon credit system can encourage socially responsible individuals, enterprises, and social organizations to promote green and low-carbon living in a digital way, thus achieving universal participation and behavioral consensus in the "dual carbon" process [33].

Third, it is necessary to improve the digital carbon peak and carbon-neutral legal protection of the conventional system. On the one hand, this should speed up the construction of a digital carbon-neutral rule of law demonstration zone and a public professional team. The construction and improvement of digital carbon-neutral demonstration areas of the rule of law will enable greater freedom, fairness, and efficiency in terms of the quality of the rule of law, and will be conducive to the construction of regional platforms of synergy and mutual trust, to set out and accomplish different tasks of environmental protection and cooperation under the rule of law, and to promote government agencies, departments at all levels, and organizations when defining the objectives of the tasks and specific operations in the process of building a government under the rule of law. At the same time, in the process of carbon peaking and carbon neutralization, we need to actively promote a strong political, legal, and other public office construction. Through ideological education and legal education, we can improve the basic quality, environmental protection quality, and professional ethics of the political and legal team, enhance the consciousness of problems, and improve their ability to solve problems. For example, the majority of political and legal officials are the main force for promoting carbon neutrality and need to actively practice low-carbon social behavior and lifestyles under the leadership of local government committees and central governments at all levels; to prevent carbon peaking and carbon neutralization is an unfortunate tendency of departments in the government concerning the ecological environment [34].

Fourth, such an emphasis promotes neutral environmental publicity and education to the majority of citizens for the carbon peak and carbon-neutral agenda. In the process of digital carbon peaking and carbon neutralization, citizens should know and understand the value and significance of green development for themselves personally, so as to discover the citizens' demand for the rule of law and to satisfy their individual "sense of gain" [35]. Furthermore, we adopt the diversified methods of "big data", "blockchain" and "artificial intelligence" to improve the methods of rule of law education. In addition, virtual reality technology represents a new field of information technology in this era of artificial intelligence. It has the characteristics of a large application space and a strong actual effect on the education of carbon peaking and the rule of law. The White Paper on the application of virtual reality in China (2018) points out that virtual reality technology can solve the problems of user experience, technological innovation, and the integration of content. In the rule of law regarding education on carbon-neutrality, we lay stress on the application innovation of virtual reality technology, which can enrich the application of virtual reality in the application of carbon-neutral law practice and help the technology transformation and intelligence upgrade of rule of law education.

Citizens in the big data system should be subject to platform and blockchain technology governance, under the mechanism of co-governance and integration, in order to promote digital carbon peaking and carbon-neutral agendas, to establish real-time and personalized interactive learning. In the big data field, cloud computing and artificial intelligence, as the core of information technology, gradually infiltrated people's social lives in all aspects of carbon peak and carbon-neutral technology solutions, but they also need innovation and improvement. In the era of big data, citizens should carry out interdisciplinary and integrated technology education and rule of law education in the process of carbon neutralization, and gradually develop the abilities of fair judgment and calculation of the rule of law information. It is an indisputable fact that big data technology and its application can inject vigor into the carbon neutralization of carbon peaking. Citizens, corporations, social organizations, government agencies, and other entities need to be

integrated into carbon peak and carbon-neutral big data systems in the virtual construction of legal issues related to legal advice, to analyze the problem and provide solutions and methods to solve the problem, from the collation of practice and experience accumulation of carbon peak carbon-neutral legal knowledge and improve the logic behind the rule of law. In the carbon-neutral push of the big data era, ethical norms need to be reconstructed for individual learning by citizens, enterprises, social organizations, government agencies, and other agents; that is, to promote the quality of “human-computer interaction” in big data systems in the process, and to promote common sense on the basis of assuring understanding.

In addition, through the Internet, big data, artificial intelligence, and other emerging technological governance, it is possible to accelerate the national ecological environment governance system of the rule of law guarantee mechanism. By constructing a system platform involving the different sectors related to “double carbon”, the government, social organizations, enterprises, and the general public can carry out rule of law activities on the Internet, which is helpful for realizing the synergetic governance efficiency of digital carbon-neutral construction. Through “Smart justice”, based on big data, we can solve the lack of digital carbon-neutral judicial practice, including the problem typified by “The case is difficult, difficult to win, difficult to implement” and other basic issues. To strengthen the professional assessment and third-party assessment of China’s rule of law construction by establishing a complete digital carbon-neutral rule of law assessment system, it is necessary to develop a scientific understanding of the various conflicts, major problems, and changing trends in the construction of the “double carbon” reform, and to encourage the promotion of the people’s sense of gain, happiness, and security, green behavior, and high-quality development of the implementation system of the rule of law with specific Chinese characteristics.

Finally, we should sum up our experiences and work together, upholding the self-confidence given to China by the rule of law and the principal role of the people, giving full play to the leading role played by digital carbon-neutral demonstration zones [36] for the rule of law, and strengthening the building of a cadre of competent political and legal personnel. We will give full play to the support of science and technology [37], including big data and artificial intelligence, and establish a comprehensive system for assessing the rule of law index for building a “double carbon” economy [38].

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