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THE CHALLENGE OF CARBON ACCOUNTABILITY IN A 'DUAL CARBON' ENVIRONMENT: AN EXTENSIVE STUDY

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Abstract: The release of The State of the Global Climate 2021 by the World Meteorological Organization in June 2022 underscored the alarming escalation of key climate change indicators, including greenhouse gas concentrations, ocean heat, sea level rise, and ocean acidification. These observations emphasize the deepening crisis of global warming. Notably, the surge in carbon dioxide concentration has garnered worldwide attention, galvanizing governments and enterprises to prioritize carbon reduction efforts.

Many nations are advancing energy-saving and emission reduction policies, mandating high-energy-consuming enterprises to proactively shoulder social responsibility and contribute to carbon emissions mitigation. China, a rapid economic developer since the 1990s, has witnessed exponential growth in carbon emissions. However, President Xi Jinping's pledge at the 75th United Nations General Assembly in September 2020 to peak carbon dioxide emissions by 2030 and achieve carbon neutrality by 2060 signifies China's resolute commitment to the "dual carbon" objectives.

In this context, there's an urgent need to establish standardized carbon audit evaluation criteria tailored to China's unique circumstances. By adopting a tripartite approach with government audit leading, supported by social third-party audit, and supplemented by internal audit, enterprises can proactively fulfill their social responsibilities, foster low-carbon sustainable development, and actualize the dual carbon objectives, driving effective growth in the green economy.

Keywords: Carbon Audit, Climate Change, Carbon Reduction, Green Economy, Carbon Neutrality

Introduction

In June 2022, the World Meteorological Organization (WMO) released The State of the Global Climate 2021, which shows that four key climate change indicators broke through to new observed values in 2021, namely greenhouse gas concentrations, ocean heat, the degree of sea level rise and the degree of ocean acidification, implying that the phenomenon of global warming is still worsening. Among them, the rise of carbon dioxide concentration has received global attention and is gradually strengthening the awareness of carbon reduction among governments and enterprises. Many countries are promoting energy-saving and emission reduction policies and initiatives, and have made it clear that high-energyconsuming enterprises should proactively assume social responsibility and actively promote the goal of mitigating carbon emissions. China has entered a period of rapid economic development since the 1990s, and carbon emissions have grown exponentially as a result. However, in September 2020, President solemnly declared at the 75th General Debate of the United Nations General Assembly that "China will increase the strength of the country's autonomous contribution, adopt more vigorous policies and measures, and strive to peak carbon dioxide emissions by 2030, and We will strive to achieve carbon neutrality by 2060", strongly demonstrating China's determination to achieve the "dual carbon" goal.

As China's development in the direction of carbon auditing started late, the lack of in-depth research and discussion of carbon auditing procedures and systems has led to the lack of carbon auditing work in China. Therefore, it is urgent to establish a set of standardized carbon audit evaluation criteria applicable to China's national conditions. With government audit as the leading role, social third-party audit as the auxiliary role and internal audit as the supplementary role, enterprises will be more proactive in fulfilling their social responsibilities, achieving low-carbon sustainable development, and realizing the dual carbon goal and the effective development of the green economy[1].

1. Theories related to carbon auditing and the necessities for its implementation

1.1. Carbon audit concept

The concept of low carbon economy first originated in the United Kingdom, and after it appeared in the white paper "Britain's Energy Future - Creating a Low Carbon Society" in 2003, the low carbon economy has caused strong repercussions around the world, and has gained the attention of many countries. 2009, the Copenhagen Conference was successfully held, and the "low carbon " theme focused on fighting climate change, causing a low-carbon boom. And the concept of carbon auditing arose from this, evolving on the basis of carbon accounting.

Carbon audit is a part of environmental audit, which is an independent environmental auditing institution entrusted by government authorization or relevant institutions, in accordance with national policies and relevant laws and regulations, following the auditing standards, based on the results of the calculation of carbon emissions and carbon footprint, the audited unit in the fulfilment of the responsibility of carbon emissions to carry out the inspection and forensics, is to make an objective and independent evaluation and supervision of its carbon emissions management activities and their results. According to the provisions of the Kyoto Protocol, there are six main greenhouse gases involved in carbon audits: Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydro fluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF_6).

1.2. Carbon audit objectives

The macro-goal of carbon auditing is to achieve the development of a low-carbon economy for the whole society and the sustainable development of mankind. In order to achieve this ultimate goal, the government needs to formulate scientific and reasonable low-carbon policies and guidelines, and the verification and authentication of carbon audits can truly reflect the implementation of government policies by enterprises. Therefore, the objectives of carbon audits can be divided into the following three main points: first, to verify whether enterprises have implemented low-carbon policies; secondly, the compliance and authenticity of the use of special funds for financial subsidies; and thirdly, the accuracy and authenticity of carbon trading data.

1.3. Necessities for carbon audits

1.3.1. Regulating corporate carbon behaviour and promoting green transformation of enterprises

Since the reform and opening up, the development needs of China's economy have led to adjustments and changes in the industrial structure. Industry, especially heavy industry, has developed very rapidly, with energy-intensive industries accounting for a considerable proportion of the total. The rapid development of high energy-consuming enterprises will lead to an increase in

energy demand, which will continue to aggravate carbon emissions in the long run. Especially if these high energy consumption and heavy pollution enterprises do not have strict control over their own production technology and manufacturing process, it will largely affect the achievement of China's "dual carbon" goal. Therefore, the state and provincial and municipal governments should formulate more perfect emission reduction regulations and policies as soon as possible, and determine the standard of carbon emission of enterprises, so as to ensure the sustainable development of the environment. Therefore, the development of carbon auditing in China has broadened the inherent ideas and methods of traditional auditing, and analyzed and externally verified the environmental information and carbon emissions of enterprises by accounting for their carbon footprints. This enhances the quality of information disclosure of carbon emission reports, helps the government and relevant departments to identify and solve problems in a timely manner, and formulate more effective policies and regulations by analyzing these problems, and positively supervise and control the carbon emissions of enterprises.

At the same time, with the monitoring of carbon audit, the government is able to understand the carbon emission situation of different enterprises in the same industry more realistically, which will encourage the government to issue special subsidies for environmental protection in a fairer and more effective way. Enterprises in the role of carbon audit can turn passive into active, a clear understanding of the green economy is the necessary trend of future development, so as to be able to proactively regulate their own carbon emissions and behavioral decision-making on carbon emission reduction, to accelerate the green transformation of their own production methods.

1.3.2. Energising the carbon trading market and promoting the effectiveness of low-cost emission reductions

The construction of a unified national carbon emissions trading market is an important institutional innovation that uses market mechanisms to control and reduce greenhouse gas emissions and promote the green and low-carbon transformation of the mode of economic development, as well as an important policy tool for strengthening the construction of an ecological civilization and the implementation of international commitments on emissions reduction, and one of the core policy tools for achieving the objectives of carbon peaking and carbon neutrality.

Since June 2013, China has gradually established carbon trading pilots in seven provinces and cities, including Shenzhen, Beijing, Shanghai, Tianjin, Guangdong, Hubei and Chongqing, which has led to the gradual establishment of a carbon emissions verification system. Although it has initially shown the effectiveness of low-cost emission reduction, there are still problems such as small trading market turnover and low overall market activity. At the same time, carbon emissions trading releases price signals that can provide economic incentives. Therefore, a reasonable and professional carbon trading audit system can ensure the truthfulness and fairness of the carbon trading process, strengthen the credibility of the carbon trading market for the participating investors and other stakeholders, and thus fully activate the activity of the carbon trading market as well as the liquidity of the carbon trading market.

1.3.3. Supporting the implementation of "dual carbon" policies to mitigate ecological degradation and achieve sustainable development of the national economy

All along, China has attached great importance to economic development, and enterprises also aim at maximizing the value of their companies. So it is often easy to neglect the protection of the environment, which has gradually led to the destruction of the ecological environment. If enterprises maximize their economic interests at the expense of ecological degradation, such economic interests are hardly sustainable. Only if the economic development of enterprises and the development of the natural environment are regarded as one and progress together, the development of enterprises will be longlasting. In order to alleviate the continuous deterioration of the ecological environment and reduce carbon emissions, governments need to formulate scientific, reasonable and effective guidelines for energy conservation and emission reduction. China's carbon-neutral "1+N" policy not only encourages enterprises to achieve green transformation and high-quality development in high-carbon areas through innovative technologies, but also strengthens the construction of relevant laws and regulations, improves the comprehensive operational efficiency of cities and green infrastructure, and promotes the construction of low-carbon cities[2].

In the white paper "China's Policies and Actions to Address Climate Change" issued by the State Council of China, it is also proposed that targets should be set according to the intensity and total amount of energy consumption in each province, and indicators should be monitored and assessed. Energy saving indicators are incorporated into the performance evaluation index system of ecological civilization and green development, so as to enhance the provinces' awareness of environmental protection and the concept of sustainable development.2021 In December 2021, the "14th Five-Year Plan" energy saving and emission reduction comprehensive programme also emphasized the importance of the evaluation and assessment of emission reduction targets, stressing that provinces and municipalities at all levels should be guided by the results obtained from completing the total emission reduction, and that energy consumption should be assessed in terms of the total amount of emission reduction. It emphasizes that provincial and municipal departments at all levels should be guided by the results of the total emission reduction, and incorporate various indicators such as the amount of energy consumed and funds invested in treatment into the scope of local performance examination, and strengthen supervision and control. Adding carbon emissions and harmful pollutant emissions as an important indicator of enterprise assessment to the audit report is undoubtedly an effective means to achieve the emission reduction target, which can strengthen the supervision of enterprises on their own carbon emissions and promote the sustainable development capability of the national economy as a whole.

2. Analysis of the current status of carbon audits in the context of "dual carbon"

Firstly, from the perspective of the auditing process itself, China's traditional auditing process is already at a relatively mature stage, but there has been no corresponding improvement in the process flow for carbon emissions. The audit process generally includes a preparation phase, an implementation phase and a reporting phase, in which the most different step between carbon emission verification and traditional financial auditing lies in the implementation phase, so how to use the audit procedures in a targeted manner is particularly important. In general, before the audit work formally begins, the audit team needs to do detailed planning, risk analysis and the selection of materiality indicators based on the understanding of the enterprise. Although carbon auditing is mainly used to authenticate the authenticity and reasonableness of carbon emission data through

the verification and calculation of carbon footprints, due to the differences in industries, the inconsistencies in the calculation of carbon footprints and the production processes involved in carbon emissions have led to difficulties in standardising the auditing procedures and methodologies, which in turn affects the quality of carbon auditing. When implementing carbon audits, it is important to collect audit evidence adequately and appropriately and, at the same time, to adopt special and creative professional procedures and methods for the multidisciplinary nature of carbon audits, in order to prevent drawbacks such as a single audit procedure and low audit quality.

Secondly, from the perspective of auditing standards, China's carbon audit evaluation standards and evaluation methods have not yet been perfected. Compared with the traditional auditing model, the auditing of carbon emissions is more complex, as it not only relies on general auditing standards and specialised auditing and financial knowledge, but also requires knowledge of environmental ecology, mathematical statistics and analyses, etc. Traditional auditing standards can no longer meet the needs of carbon auditing. Although at this stage there are already some leading enterprises and governmental organisations taking the lead to innovate and formulate some standards and systems for the implementation of carbon auditing work, and put forward instructive opinions and guidelines for China to carry out carbon auditing work. However, some problems are still encountered in concrete practice, such as the macro or non-measurable nature of the indicators assessed, which makes it difficult to assess the effectiveness of the carbon emissions of enterprises; the lack of uniform and comparable standards makes the quality and efficiency of carbon audits of enterprises low, etc. From the perspective of companies that emit pollutants and greenhouse gases, the inadequacy of the evaluation criteria for their pollutant emissions and the controversial nature of the scoring criteria. These issues can affect the development of internal corrective policies and standards by company executives, leading to poor cooperation from audited entities and disagreement with audit results, making it difficult to conduct carbon audits in China and becoming one of the main obstacles to the development of carbon audits in China.

Furthermore, from the point of view of the audited companies, the contents of annual reports and social responsibility reports of pollution-emitting enterprises in China do not strictly require the disclosure of carbon emission information. Therefore, many listed companies have the problem of insufficient disclosure of carbon information. After checking the disclosure annual reports of listed companies in China, it is found that most of the listed companies have the problem of too much textual description of carbon emissions and little data, which cannot provide comprehensive and intuitive carbon emission information for government agencies, investors and other stakeholders. At the same time, few companies actively disclose environmental, social and governance reports, and more companies prefer to selectively describe what they have done for the environment in their disclosed social responsibility reports. The main reasons for the incomplete disclosure are the following two aspects: firstly, the attention to environmental information disclosure by managers who are orientated to the economic benefits of the enterprise will be greatly reduced, thus hindering the full disclosure of carbon information; secondly, there is no unified standard and mandatory requirements for the disclosure of carbon auditing information in our country at present, which leads to the lack of disclosure of environmental information by the major enterprises.

In summary, China's current research on carbon audit is still in the primary stage, mainly from the government's point of view of the provinces and regions to carry out carbon audits, in the two perspectives of external auditing and internal auditing of enterprises in China's carbon auditing procedures are not yet perfect, the long-term mechanism is not yet sound enough; the audit content has not yet been covered by the carbon audit of all aspects of carbon auditing work has not yet been established to establish a complete process steps. The current carbon audit work is not enough to provide a solid foundation for achieving the carbon peak and carbon neutral goals, and there are still certain difficulties in achieving the "dual carbon" goal. Therefore, it is crucial to explore the joint mechanisms and roles of the various auditing parties in carbon auditing.

4. Development path for carbon audits in the context of "dual carbon"

4.1. Improvement of laws and regulations related to carbon audit and construction of carbon audit system

Having a law to follow is an important prerequisite for carrying out auditing work. However, at present, China has not yet formed a systematic system of carbon audit laws and regulations, and is still in the primary stage of carbon audit legislation. Taking the application of carbon auditing in the carbon trading market as an example, the Carbon Emission Trading Management Measures (for Trial Implementation) implemented in February 2021 only covers enterprises in the power generation industry, and there is still a large gap in the more universal carbon emission monitoring and forensic system. Overall, China's existing carbon auditing legislation is generally not of a high level, mostly government regulations and normative documents, and the implementing regulations of the CPA Law, Audit Law, and other higher-level laws involving carbon auditing are also more fragmented and generalised. The imperfection of relevant laws and regulations makes the specific carbon audit practice lack of uniformity, mandatory process norms and constraints, greatly weakening the effectiveness and comparability of carbon audit reports. Therefore, China needs to comprehensively clean up the existing laws and regulations with the carbon peak, carbon neutral work is not compatible with the content, and strengthen the articulation and coordination between laws and regulations. We should study the formulation of carbon neutral special laws, and urgently revise the Energy Conservation Law, Electricity Law, Coal Law, Renewable Energy Law, Circular Economy Promotion Law, etc., so as to enhance the pertinence and effectiveness of the relevant laws and regulations[3].

Secondly, Secondly, a complete and effective carbon audit process can greatly contribute to the quality and efficiency of carbon audits. Taking the three phases of an audit as a framework, the audit process can be roughly divided into seven steps: ①. acceptance of an engagement; ②. preparation for verification; ③. developing of an audit plan; ④. on-site verification; ⑤. calculation and analysis of data; ⑥. submission of a report; and ⑦. Provision of countermeasures and recommendations. The specific process can be referred to in Figure 1.

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Figure 1: Carbon audit process.

4.2. Strengthening audit oversight synergies and promoting linkages and synergies on carbon audits

Analysed from the existing literature, most scholars believe that there are three main subjects of carbon auditing, among which national government auditing has authority, social external auditing has universality, and internal auditing has uniqueness. According to the principal-agent principle, carbon audit arises from the existence of a principal-agent relationship of carbon emission, the environment on which human beings rely for survival needs to be improved, which prompts the government to understand the source of carbon emission and carbon emission, thus generating a series of principal-agent relationship. Contract type of principal-agent relationship exists in the transaction relationship, the two sides need to be agreed beforehand and the establishment of the contract, have their own rights and obligations, usually social external audit received commissioned to carry out carbon audits of highpollution, high-carbon emission enterprises.

Therefore, the construction of the government audit, social external audit and internal audit of the three synergistic auditing network can help to bring into play the maximum effectiveness of the three audit subjects, through the joint supervision and information sharing, to promote the penetration of carbon audits into the major fields of industry in China's society. Through the formation of vertical supervision and the establishment of horizontal linkage and synergy mechanisms, carbon audits can maximise the effectiveness of supervision and contribute to the realisation of the goal of carbon peaking and carbon neutrality. Based on the above, this paper constructs a carbon audit synergy mechanism with vertical and horizontal integration, and the specific framework is shown in the figure 2 below.

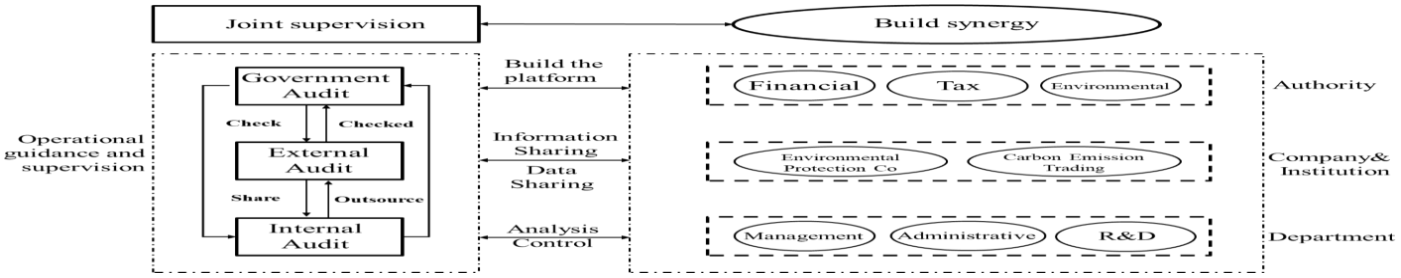

Figure 2: Multi-Audit Synergy Framework.

4.3. Improve disclosure of information on carbon audits.

Firstly, to strengthen the awareness of carbon information disclosure in enterprises. Enterprises need to raise their own ideological awareness and strengthen their knowledge and understanding of low carbon, so as to enhance their sense of social responsibility. At the same time, it should also form a working atmosphere of environmental protection and recycling development within the

enterprise, and gradually enhance the awareness of carbon information disclosure of the leadership and employees.

Secondly, improve the carbon management system. Carbon management system is launched in the context of the national dual-carbon target strategy and the launch of the national carbon market, which is of great significance. Establishing a carbon management system at the level of the whole enterprise is an important hand to deal with the national carbon trading at present. For listed enterprises, carbon management is not only an environmental issue, but enterprises should take carbon management as an opportunity to lay out the road of transformation oriented to sustainable development and to enhance the core competitiveness of the enterprise in the future. This includes the establishment of a quality monitoring system for carbon audits, scientific supervision and standardised management of production processes to achieve quality control of emission reduction.

Finally, establish a practice system for corporate carbon disclosure. The state has recently issued regulations on accounting treatment related to carbon emission rights trading, which clarify the accounting of carbon emission rights trading. Unlike the disclosure of corporate financial information, the important indicators of corporate carbon disclosure include not only the primary indicators that can be directly counted into the carbon asset accounting table, but also the secondary indicators obtained through the processing and calculation of the primary indicators. In addition, it is also necessary to clarify the linkage between the carbon asset accounting statement and the three financial statements.

5. Conclusions

Low-carbon development is a necessary path to realise China's green economy and sustainable development. Under the policy guidance of carbon peak and carbon neutral, all regions and industries in China have gradually begun to pay attention to the importance of the environment for future development, and have started to help the realization of the "dual-carbon" goal with practical actions, which will undoubtedly promote the high-speed development of China's carbon audit. Under the background of "double carbon", the development of China's carbon audit should be committed to improving the study of carbon audit system and accelerating the legislation of carbon audit; strengthening the vertical and horizontal linkage and synergy of carbon audit, and promoting the platform of information disclosure and data sharing; strengthening the awareness of carbon disclosure, and creating a good supervisory environment for the carbon audit, so as to realize the carbon peak, carbon neutrality and high quality development of the economy. The carbon audit is a good way to achieve carbon peak, carbon neutrality and high-quality development of the economy.

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