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On the Functional Orientation and Optimization of Accounting in Carbon Emission Management

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Abstract: With the growing attention to climate change, carbon emission reduction has become an important issue facing countries around the world. As a key means of recording and analyzing economic activity information, accounting plays an increasingly critical role in carbon emission management. This paper deeply analyzes the functional orientation of accounting in carbon emission management from multiple dimensions. It is found that accurate carbon accounting can provide reliable carbon information to support the formulation of scientific and reasonable carbon emission reduction decisions; effective carbon cost management helps optimize resource allocation and reduce carbon emission reduction costs; accounting standards need to be further improved to more clearly guide accounting and improve information quality. Efforts should be made to cultivate accounting talents to promote the comprehensive improvement of accounting personnel's quality and support the level of carbon emission management. By giving full play to these functions of accounting, we can effectively promote the realization of carbon emission reduction goals of enterprises and even China, and promote the sustainable development of economy and environment. This paper provides a useful reference for further improving accounting theories and practices related to carbon emission reduction, and has important guiding significance for promoting the in-depth development of carbon emission reduction work.

Keywords: Accounting; Carbon emission; Management

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1. Introduction

The continuous accumulation of carbon emissions from human activities has brought tremendous pressure to the global climate system [1]. Faced with severe challenges such as global warming, glacier melting, and frequent extreme weather, carbon emission reduction has become an urgent common task for all mankind [2]. The international community has clarified emission reduction goals and paths through documents such as the Paris Agreement, requiring countries to take effective measures to control greenhouse gas emissions. In this context, as the main body of economic activities, enterprises bear an unshirkable responsibility in the process of carbon emission reduction [3]. Carbon emission management is not only related to the performance of enterprises'

environmental responsibilities but also directly affects their economic interests and long-term development. Enterprises should set reasonable carbon emission reduction goals, formulate implementation plans, and integrate them into long-term development strategies to ensure carbon emission reduction while economic development.

Accounting plays a key role in carbon emission reduction [4]. By extending the measurement object from currency flow to carbon element flow, accounting can effectively solve the problems of unreliable carbon information, opaque carbon costs, and lack of basis for carbon decisions. At the same time, with the help of tools such as cost management and performance evaluation, enterprises can better plan carbon emission reduction strategies, optimize resource allocation, evaluate emission reduction effects and risks, and achieve a win-win situation of economic and environmental benefits [5]. Therefore, in-depth research on the role of carbon accounting is of great practical significance for enterprises to implement carbon emission reduction tasks and promote global sustainable development.

2. Functional orientation of accounting in carbon emission management

2.1. Collection and accounting of carbon emission data

In the enterprise carbon emission management system, the primary function of accounting lies in the collection, analysis, and accounting of carbon emission-related data [6]. The core value of this orientation is to provide reliable carbon emission-related accounting information for internal and external information users, forming the information foundation for carbon emission management decisions. The accounting objects include core data such as enterprise energy consumption and direct emissions, as well as indirect carbon emission data generated in links such as the supply chain and production processes. Relying on professional accounting methods and tools, accounting accurately quantifies enterprise carbon emissions, providing key data support for the formulation and implementation of carbon emission reduction strategies, and forming the basic link of carbon emission management. Essentially, accounting is a systematic recorder of enterprises' carbon emission economic behaviors. In accordance with the principles of comprehensiveness, continuity, and systematicness of accounting, accounting needs to conduct complete and standardized records of all economic transactions related to enterprise carbon emissions to ensure traceability of business trajectories.

2.2. Reporter of carbon emission information

As a key role in enterprise carbon emission management, accounting needs to systematically quantify, record, and publicly disclose the relevant situation of enterprise carbon emission activities. Carbon information reporting is not only related to enterprises' social image but also directly affects their financing costs, market competitiveness, and long-term sustainable development capabilities. Accounting needs to sort out enterprises' carbon emission data into carbon reports or Environmental, Social, and Governance (ESG) reports, thereby converting them into standardized and structured information and disclosing it to internal management and external stakeholders [7]. In the process of carbon footprint accounting and reporting, accounting assumes the core responsibility of data collection, collation, and analysis to ensure the accuracy and completeness of information, thus becoming a bridge for information transmission and communication between enterprises and external stakeholders.

2.3. Supervisor of carbon emission management

Under the macro background of the continuous advancement of the dual carbon goals, China will gradually establish a carbon emission control system covering more industries, and the restrictive standards for enterprise

carbon emissions show a stepwise improvement trend [8]. In the process of this policy evolution, enterprises need to gradually adjust to adapt to the increasingly higher emission standards and requirements. The core role of accounting supervision is to ensure that enterprise carbon emission accounting, information disclosure, etc. comply with policy requirements through low-cost normalized supervision, so as to help enterprises avoid unnecessary troubles. The inherent check and balance mechanism of accounting runs through the entire process of carbon emission management. From the collection and accounting of carbon emission data to economic analysis, decision support, and performance evaluation and information reporting, accounting ensures high-quality data to the greatest extent through professional verification methods such as voucher sampling, account-voucher reconciliation, and account-account reconciliation.

2.4. Important force promoting enterprises' sustainable development

With the growing global attention to climate change, low-carbon transformation has become an inevitable choice for enterprises to cope with environmental constraints and maintain market competitiveness [9]. In this trend, enterprises' sustainable development capabilities have gradually become an important factor measuring their competitiveness. Carbon emission management is a key link in enterprises' sustainable development. By participating in carbon emission management, accounting helps enterprises solve the coordination problem between economic and environmental benefit goals. The achievement of this goal requires building a value measurement system that can connect environmental and economic goal constraints. From basic carbon emission recording, measurement, and accounting to carbon emission reduction cost accounting, information disclosure, decision support, and risk control, a complete accounting support system has been formed. In the linkage between carbon emission management and enterprises' sustainable development, the value of accounting lies in converting intangible carbon emissions into measurable, accountable, and manageable value indicators, realizing the accurate connection between environmental responsibilities and economic interests.

3. Current problems of accounting in carbon emission management

3.1. Ununified and imperfect accounting standards

In recent years, some pioneering countries in the world have formulated and implemented guidelines on carbon emission accounting and reporting [10]. However, countries have inconsistent understandings of this behavior, and there are still significant differences in specific operations. Different enterprises can decide whether to recognize carbon emission rights as assets and under what circumstances to recognize them based on their own understanding and judgment, leading to the lack of comparability of accounting information. For example, according to the standards, free carbon emission rights are not recognized as assets, but gains are recognized when they are sold later. This will lead to an increase in profits during the sale period, and carbon emission rights are not accurately reflected in the balance sheet, which is not conducive to information processing and disclosure. If an enterprise has both free and paid carbon emission rights, it is necessary to strictly distinguish between the free and paid parts when using carbon emission quotas. However, in actual operation, it is difficult for enterprises to make a strict distinction, which instead leaves room for profit manipulation. As part of assets, the value of carbon emission rights will change with time, market, and other factors. How to handle the amortization and impairment of carbon emission rights is also a question worthy of future consideration.

3.2. Professional capabilities and awareness

The first time countries around the world reached an agreement on limiting carbon emissions was on December 12, 2015, nearly ten years ago. Internationally, accounting for carbon emission behaviors is still an emerging business. For accounting personnel who have received traditional education, they have little understanding of carbon emission policies and regulations, measurement technologies, etc., and are relatively unfamiliar with the basic concepts, standards, and processes of carbon accounting, so there will inevitably be large deviations in cognition and understanding [11]. In addition, the interdisciplinary nature of carbon accounting requires accounting personnel to have the ability to integrate multidisciplinary knowledge. They must not only base themselves on accounting but also be familiar with multidisciplinary professional knowledge such as environmental science, environmental economics, policy science, and management. At present, there are relatively few professional talents with such interdisciplinary knowledge in China. The lack of professional knowledge and skills determines that accounting personnel are difficult to think from a strategic perspective, understand the impact of carbon emissions on enterprises' long-term development, and cannot provide effective decision support for enterprises' carbon emission reduction decisions and carbon asset management.

3.3. Low quality of information disclosure

The quality of carbon accounting information disclosed by enterprises directly affects the effectiveness of carbon emission policies and emission reduction effect evaluation. High-quality carbon accounting information needs to meet at least the principles of reliability, relevance, and comparability [12]. At present, there is no mandatory requirement for all domestic enterprises to disclose carbon information, and only some key enterprises are involved. Moreover, some basic data in the process of carbon emission management are estimated data, not real data. Information that cannot be traced back does not meet the requirements of the reliability principle, which fundamentally impacts the quality requirement of truthfulness and reliability.

4. Improvement measures and suggestions

4.1. Improve accounting standards and systems

The unification and improvement of accounting standards are essentially a systematic project that adapts to economic development, coordinates the interests of various parties, and balances international convergence and local practices [13]. From the current development status of carbon accounting, its evolution process is relatively short, involving limited industries, and has not undergone sufficient practical testing in diverse business scenarios of different industries and types of enterprises. One-sided experience is not enough to promote the improvement of accounting standards and systems. Based on this, at this stage, it is urgent for relevant national regulatory authorities or industry self-regulatory organizations to play a leading role, fully learn from international advanced experience, combine China's national conditions, and formulate a universally applicable carbon emission accounting standard framework.

Relevant government departments and accounting standard-setting institutions should accelerate the research and issuance of unified and clear carbon accounting and reporting standards, detail the recognition, measurement, and reporting methods of core accounting elements such as carbon assets, carbon liabilities, and carbon costs, and ensure the comparability and consistency of accounting information among different enterprises. At the level of accounting scope and measurement methods, we can try to gradually break through the limitations of traditional carbon emission rights trading accounting, and include R&D investment, purchase and maintenance expenses of

emission reduction equipment incurred by enterprises to achieve emission reduction goals, as well as hidden costs such as environmental restoration liabilities and potential fines that may arise from carbon emission behaviors into the accounting system, so as to fully reflect the economic impact of carbon emission activities on enterprises' financial status and operating results.

4.2. Strengthen the cultivation of professional talents

Within the higher education system, we can targeted expand the knowledge and skills of accounting students. Promote the integration of interdisciplinary content such as basic theories of environmental science, climate change policy systems, and carbon emission accounting methods into the elective course system of accounting, break disciplinary barriers, reconstruct curriculum knowledge modules, and cultivate compound accounting professionals with "accounting professional skills + interdisciplinary knowledge + policy and regulation sensitivity" to meet the demand for interdisciplinary talents in practice [14]. At the same time, actively promote in-depth industry-university-research cooperation mechanisms between universities and enterprises, build practical teaching platforms, provide students with real carbon emission management scenarios and practical cases, help them transform theoretical knowledge into practical capabilities, and improve their literacy in solving practical carbon accounting problems.

At the level of vocational education and continuing education, we should encourage the opening of special carbon accounting courses, incorporate core content such as environmental science principles, carbon trading market rules, carbon accounting processing methods, and carbon information disclosure norms into the teaching system, and cultivate professional carbon accounting talents with interdisciplinary knowledge reserves. Encourage relevant institutions to organize special training, seminars, and other diversified forms to indirectly promote the updating and skill improvement of carbon-related knowledge. In addition, efforts should be made to promote collaborative cooperation between the academic and practical circles, carry out systematic and in-depth research on key and difficult issues in the field of carbon accounting, and provide scientific theoretical support for practical carbon accounting operations.

4.3. Improve the quality of information disclosure

In the construction of the carbon information disclosure system, on the basis of fully learning from the experience of international pioneering regions, such as the TCFD framework and ISSB climate-related financial information disclosure standards, normative documents should be issued to clarify the content and boundaries of enterprise carbon accounting, strictly standardize the disclosure format and frequency, and ensure the reliability, completeness, systematicness, and comparability of disclosed information. In addition, combined with the actual situation of China's carbon market, actively guide carbon information disclosure behaviors, and gradually improve the supervision and management mechanism to promote enterprises to shift from passive compliance to active comprehensive disclosure. In terms of content, enterprises should not only disclose basic information such as the holding status, acquisition channels, and transaction data of carbon emission rights but also detailed disclose decision-making valuable information such as total carbon emissions, emission intensity, carbon accounting results, cost-benefit analysis, carbon strategic goals, and implementation paths.

In terms of form, a special module can be set up in the annual financial report, detailing elements such as disclosure format and content, and enterprises are required to disclose in a specific format [15]. At the same time, enterprises are encouraged to independently issue independent carbon information reports to reduce the

information acquisition costs of stakeholders. Through this dual-track information disclosure model, it not only solves the financial relevance and authority of carbon information but also enables enterprises to immersively display key information with the help of digital tools, improving the comprehensibility and perceptibility of carbon information. It provides a sufficient basis for investors, regulatory authorities, the public, and other stakeholders to comprehensively evaluate enterprises' carbon emission management capabilities and the performance of environmental responsibilities.

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