Rethinking on the Definition of Carbon Accounting

Cai-Ping ZHANG\textsuperscript{a*}, Chen-Zi ZHANG\textsuperscript{b}, Min ZHOU\textsuperscript{c}

School of Economics and Management, University of South China, Hengyang, China

\textsuperscript{a}zcp2002117@163.com, \textsuperscript{b}195252440@qq.com, \textsuperscript{c}316851883@qq.com

Keywords: Carbon accounting; Carbon emission rights; Accounting standard.

Abstract. Carbon accounting has become an international dilemma because the effects of climate change are so complicated and extensive. The definition of carbon accounting is the key problem among many unsolved problems in carbon accounting field. The paper finds that there are multiply definitions because of different understandings in carbon accounting at macro and micro levels. By analyzing the inner connection between macro and micro levels, the new definition for carbon accounting means a management activity to provide carbon emission financial information with monetary and material measurement unit and by means of accounting and verification methods. It constructs the basic framework including “carbon emission rights” accounting standard from the perspective of financial accounting and “carbon emission management accounting standard from the perspective of management accounting and conforms the basic framework of accounting standard for carbon emission.

Introduction

Climate change is of wide concern among world countries. The Paris agreement signed on December 12, 2015, emphasizes the need to reduce carbon emissions and to minimize the adverse effects of climate change. Since the Intergovernmental Panel on Climate Change (IPCC) has released assessment report and signed the Kyoto Protocol, climate change and its impact on academic research has become a hot issue for scholars in all fields. Recognition, measurement and reporting of such influence contribute to the generation of carbon accounting. However, compared to hundreds of billions global carbon trading volumes (Bank World, 2014), carbon accounting research is far from mature, and has become an international problem in accounting field (IASB, 2012).Among the many unsolved problems, carbon accounting definition is undoubtedly the key issues. This paper attempts to study the definition of carbon accounting and expects this as a breakthrough in this field. The objective of this study is to develop a definition for carbon accounting. This study is organized as follows: first, literature review is presented. Second, the definition of carbon accounting is developed. Third, the basic framework of carbon emission accounting standards are built, which is followed by conclusion and recommendations.

Literature Review

For “Carbon accounting”, different scholars have different interpretations from different levels and have come to multiple definitions. Janek Ratnatunga and Stewart Jones (2008) firstly proposed the concept of “carbon accounting”, and collectively refer the carbon released, trading and forensic as carbon accounting. Bebbington and Larrinaga (2008) pointed out that carbon accounting is confirmed as the value of the assets such as carbon emission right and the liabilities due to the purchase of additional carbon emissions in order to fulfill the emission reduction obligations. Hespenheide et al. (2010) thinks that the significance of carbon accounting should include two levels. One is the behavior of accounting the amount of carbon emissions and clearance and the amount of carbon emissions generated during the continuous operation. The second is the financial impact that produce by obeying the carbon regulations or carbon trading. Bowen and Wittneben (2011) defined carbon accounting as accounting carbon emission and its data processing. Stefan Schaltegger (2012) think carbon accounting is a basic system to promote sustainable development.
of enterprises from a broad perspective and carbon accounting should account carbon emissions for the entire life cycle from procurement, production, sales and recycling, and put forward improvement measures. Francisco et al. (2013) also held a generalized carbon accounting view, which pointed out that the carbon accounting should not only confirm emission rights and liabilities under carbon trading system but also use a variety of methods, which both provide the monetary form of carbon accounting information and provide carbon strategic information on nonmonetary forms.

With the idea of low carbon economy in China and establishment and development of carbon trading market, domestic scholars began to pay close attention to the accounting problems of carbon emissions and carbon exchange, and tried to define the carbon accounting. Zhifang Zhou and Xu Xiao (2009) define carbon accounting from the perspective of traditional accounting discipline that carbon accounting is mainly related to confirmation problem of carbon sink asset and carbon source liabilities. Xiao Liu (2011) proposed carbon accounting by emphasizing the limited and rareness of carbon resources, and assign to value and price, compensating for its losses, so that extends to the social of the enterprise responsibility, forcing companies to economic benefit, social benefit and ecological benefit into account. Aiguo Wang (2011) through in-depth analysis of the development of foreign carbon accounting found that the study was not only limited to the accounting treatment of carbon emission and trading that aspect of carbon accounting and carbon accounting information disclosure and also relates to the carbon cost and carbon accounting of carbon product or service, and risk or uncertainty management, external audit. In recent years, although scholars discuss carbon accounting contents (Bo Yang, 2013) and the development prospects of carbon accounting in our country (Tingting Wang and Gang Liu, 2013), but the research progress of essence of carbon accounting is slow and there is no breakthrough in this field.

In the study, we can see that there is no recognized definition of carbon accounting in China and abroad. The main differences lie in: (1) Foreign scholars focus on defining carbon accounting from a broader perspective, the scope of the study relates to national level, project level, organization level and so on. (2) Domestic scholars more from the angle of accounting discipline attribute to discuss the definition of carbon accounting and try to put the impact that climate change on enterprise financial into the traditional accounting system. Obviously, due to the influence of carbon emissions and complexity of its formation, it is hard for scholars to fully reflect the whole picture of carbon accounting.

**Redefining of Carbon Accounting**

The complexity and breadth of the impact of climate change makes the need for a comprehensive definition from the macro and micro level. It is necessary to consider the links between the levels and cannot blur the boundaries between them. Specific relationship is as follows (see Fig. 1)

![Figure 1. Relation and difference between macro and micro carbon accounting.](image)

Accounting for a country's carbon emissions from a macro perspective, known as the national carbon budget, is an important basis for determining the state responsibility to reduce emissions. Drawing lessons from the theory and method of international carbon budget can define the “carbon accounting” of the national level as “accounting a country direct and indirect carbon emission by physical and non-monetary unit of measurement”. The purpose is to set national climate policy and
national emission reduction strategy in line with national conditions by “greenhouse gas inventory” (GHG inventory). However, we cannot simply define physical or non-monetary carbon emissions as carbon accounting. Because throughout the development history of the accounting discipline, although the accounting has been the development of the physical measurement to the money measurement. But the measurement is always just a means or tool, the financial information provided by the money measurement is the core of modern accounting. According to the essential attribute of this subject, recognition, measurement and reporting carbon emissions from the micro level and the financial impact of this are deeply reflects the essence of carbon accounting, that is, “confirming direct and indirect carbon emissions produced by the organization and use the monetary and non-monetary measurement in order to meet the need of internal carbon management decisions (carbon management accounting) and external stakeholders (carbon financial accounting). “Based on the above analysis, we can know that the macro and micro “accounting carbon” has its generality and difference. Carbon emissions accounting has its generality and the difference is the choice of the unit measurement and the content of the accounting. Since carbon accounting is a branch of accounting, it can be defined as “a management activity with the aid of material, technology and other units, using a series of accounting and confirm method to provide carbon financial information to the internal and external accounting information users”. This definition has the following notable features:

(1)The main information provided by the carbon emissions financial information, including the access, trading and delivery of carbon emission rights and settlement of carbon emission liabilities and all costs occurred in order to reduce carbon emissions; Non-financial information, such as carbon emissions accounting, authentication that is the basis and an important part of financial information. The characteristics show that we should not separate the meaning “carbon accounting” to a macro and micro level but two levels should be integrated. Macro level accounting carbon emissions proposes allocation principles, methods and standards and determines the specific allocation plan. The micro level, carbon emissions liabilities produce by fulfilling reduction obligations, cost and income of reduce emissions and so on, the recognition, measurement and reporting of them provide carbon information.

(2)Carbon accounting information users include internal and external stakeholders. Carbon financial accounting is mainly to provide carbon emission rights assets, liabilities, costs and carbon emissions benefits and other accounting information for external stakeholders. Carbon management accounting will provide internal managers with information on carbon emission cost structure, carbon emission reduction performance, carbon budget and carbon risk and other information and provide decision support for enterprise's carbon performance management.

(3)Carbon accounting has time and space limitation. The space subject should be the enterprise that produces carbon emission. Because the enterprise is an important part of modern society, also a main source of greenhouse gas (GHG) emissions, from the preparation and construction to the procurement, production, sales and waste treatment and other activities are all the root of GHG. Defining the definition of carbon accounting at the enterprise level is in line with the truth of “main source”. At the same time, carbon emissions accounting, reporting and verification also have a time limit that is consistent with the annual accounting reports and need to reflect the enterprise in a fiscal year of carbon emissions, carbon emission trading costs and benefits and other information.

Construction of the Basic Framework of Carbon Emission Accounting Standards

Compared with the rapid development of carbon trading market, carbon trading still exists some problem such as laws and regulations are not perfect, the binding is weak, the market regulation are inconsistent and so on. The diversification of accounting treatment that cause by the lack of accounting standards of carbon emission permits is one of the problems. Internationally, the International Accounting Standards Board (IASB) and the United States Financial Accounting Standards Board (FASB) cooperation for the study of the development of accounting standards for carbon emissions. From the International Accounting Standards Interpretation Committee (IFRIC) issued the “IFRIC 3: emission rights” in 2003 and continued to research the recognition and
measurement of carbon emission rights. Unfortunately, from the beginning of 2012, the study of carbon emission rights accounting standards has into a stagnant state and the same in China. Although A few scholars (Zhifang Zhou, 2011; Caiping Zhang, 2011; Aiguo Wang, 2012) try to study the issue, but this fragmented research cannot form a systematic theoretical framework. Through in-depth analysis of carbon emissions related accounting issues, we found that no clear definition of carbon accounting is the key factor restricting the development of carbon emissions accounting standards. According to the definition of carbon accounting in this article in china, we should take two steps and from two angles to set the carbon emissions accounting standards:

(1) The first step is to set “carbon emission rights” accounting standard from the view of financial accounting. The main content is to provide financial information. The specific performance is the allocation, trading, delivery of carbon emission right, the rights and obligations raised by credit and debt. Because no matter what is the situation in the carbon emissions of enterprises, ultra emission, zero emissions or emission reduction, is nothing more than the difference between the actual carbon emissions and the distribution of carbon emissions. Ultra emission will make an outflow of economic benefits because you need buy more emission rights, and emissions reduction will bring economic benefits to the enterprise. These financial performances will finally affect the financial situation and operating results of the enterprise (see Fig. 2).

![Figure 2. Framework of “carbon emission rights” accounting standard.](image)

(2) The second step is to set “carbon management” accounting standards direction from the perspective of management accounting. Carbon management activity is to develop with low carbon economy and carbon emissions trading market. About carrying on carbon management, Dunn (2002) proposed that improving energy efficiency, fuel conversion, new technology applications, emissions trading, carbon offset project investment are five effective carbon management measures. Kolk and Pinkse (2005) also believe that corporate carbon management mainly includes process improvement, product improvement, new market/product combination, internal transfer of emissions reduction, supply chain measures, the acquisition of emission quotas. Jianming Tu (2014) pointed out that developing the management tools and management system at enterprise level can guide enterprises to rationally carbon reduction activities. Therefore, corporate carbon budget is the management arrangements that enterprise rationally weigh carbon emission quotas, carbon emission reduction capacity, carbon emission reduction benefits and costs of carbon emissions. Summarize the above research results, combined with enterprise carbon management throughout the product life cycle process, the impact of carbon emissions and carbon emission reduction requirements, we can know comprehensive carbon management framework should include the carbon emissions accounting and assurance, risk identification and assessment, carbon cost analysis and control, carbon budget formulation and optimization, carbon performance evaluation and enhancing (see Fig. 3).
Figure 3. Framework of “carbon management” accounting standard indirection.

Based on the disclosure of carbon emission accounting information, we can learn from the theory and methods of environmental management and management accounting, such as cost effectiveness, risk prevention, budget control to structure a carbon management framework which is the main content of carbon emission, carbon risk, carbon cost, carbon budget and carbon performance. In a word, management and control of carbon emissions and carbon accounting and disclosure are closely related. Effective management of carbon emissions will be able to promote enterprises to improve the management level of carbon emissions, improve the performance of carbon management, prompt companies to reduce the actual carbon emissions and get the remaining carbon emissions, and improve the enterprises carbon emission reduction benefit by way of sale. The effective combination of the two will promote the improvement of corporate carbon performance and give full play to the role of accounting support for business decisions.

Conclusions and Recommendations

Throughout the development history of carbon accounting in more than 20 years, although there had some research results in carbon financial accounting, management accounting, carbon finance, investment, are far away from meeting the need of low carbon economy and carbon trading market for accounting information and carbon management. Despite the relatively complete carbon accounting system is also still to be constructed, but as a man-made economic information systems, accounting has inherent compatibility with the evolving economy and society. The economic activities, for instance, carbon trading and carbon industry would be incentive to the essence of accounting, which will contribute to amend, improve and form a new accounting system-Carbon Accounting. In the future of carbon accounting research, it can carry out the following research step by step according to the development priorities of carbon activities:

(1) Continue to intensify the carbon emissions trading accounting recognition, measurement and reporting of research. Professor Aiguo Wang (2011) has pointed out that “the current should primarily focus on corporate carbon financial accounting research, focusing on definition of carbon accounting, especially accounting recognition, measurement and accounting information disclosure”. Hence, the accounting standard-setting institutions should learn from traditional accounting theory and methods, systematic research and summary carbon recognition, measurement and research results of report, formulate the accounting standards for carbon emissions, allow accountants to deal with carbon emission right according to the law, to improve the comparability and coherence of accounting information, and the relevance of decisions.

(2) Make full use of the carbon trading market data for empirical research. In recent years, there are several factors which restrict the development of the carbon accounting, but the lack of carbon trade data must be one of the important factors. Obvious, in 2017 the establishment of a carbon trading market in China will provide a solid data base for empirical research of carbon accounting. Open and comprehensive carbon trading information will help to check the accounting theory is
implied the carbon trading, such as whether the price of carbon market could reflect the fair value of carbon transaction, whether the disclosure of carbon accounting information meets the decision relevance of requirements of the accounting information quality. These problems will be the important content of the need for empirical research in the future.

(3) Carry out the carbon management case studies of typical enterprise active. With the deeper development of low-carbon economy and the gradual promotion of national low-carbon policy, carbon asset has gradually formed a resource of theoretical concept evolved into economic resources of real impact on business cost and benefit. To carry out the carbon asset management, control the cost of carbon emission, improve the benefits of carbon reduction will become an inevitable choice that enterprises to implement low-carbon transformation.

Acknowledgements

The authors would like to thank the anonymous reviewers for helpful comments and the China National Social Science Foundation (Grant No: 13CGL029), China Postdoctoral Science Foundation (Grant No: 2014M560534) and Hunan Social Science Foundation (Grant No: 14YBA339) for providing financial support.

References