

Problems and Countermeasures in Environmental Cost Accounting: A Case Study of China's Coal Industry

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Abstract. In recent years, many scholars have carried out research on improving the environmental cost accounting of coal enterprises. Through the research, the traditional product cost accounting and environmental cost accounting are standardized. But the current cost accounting system still exists problems like wrong calculation of the cost of environmental damage and fraudulent accounting problems. In order to enhance the enterprise's environmental protection consciousness and improve the level of cost control management for the enterprise to provide scientific decision basis, this paper aims to find out the main composition of coal enterprise environment cost, analysis of the problems existing in coal enterprise environment cost accounting and puts forward corresponding solutions.

1 Introduction

In the process of coal mining, coal enterprises not only cause serious pollution to the environment of the mining area, but also cause pollution to the environment outside the mining area. While having a tangible impact on the environment, the pollution also affects the growth of plants, which then exerts influence on the ecological environment. Compared with other industries, coal enterprises have more prominent problems in sustainable development, suffer from more damages in resource and environment destruction and have to pay more to protect resources and environment. Therefore, it is of great theoretical value and practical significance for the development of coal enterprises to correctly understand and study the environmental costs and to strengthen the control of environmental costs.

The Outline of the *13th Five-Year Plan* for National Economic and Social Development, promulgated and implemented by China in 2015, sets specific requirements for enterprises to assume social responsibility and control environmental pollution. The 19th CPC National Congress has put forward new goals and new requirements for building ecological civilization and protecting ecological environment. In recent years, in order to give full play to the role of ecological environmental protection in promoting supply-side structural reform and speeding up the upgrading of the industrial structure, many scholars have carried out studies on how to improve coal enterprises' environmental cost accounting and

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coal cost accounting methods. Through the research, the traditional product cost accounting and environmental cost accounting are standardized. However, there are still some problems in the current cost accounting system, such as incomplete and false calculation of environmental damage costs that enterprises should bear. In order to enhance enterprises' awareness of environmental protection, improve the level of cost management, truly reflect the coal cost, provide scientific basis for companies' management departments to improve cost controlling level, and offer references for macroeconomic management departments to approve the environment protection costs that enterprises should bear, studies on perfecting environmental cost accounting based on the traditional product cost accounting system have been conducted and it has become one of the most important research topics in recent years.

2 Literature review

The environmental cost is a part of social costs. It is a historical category and the product of a certain social and historical period under a certain industrial structure. In the face of the worsening ecological environment, since the 1960s, the academic circles have focused on "the road of environmental economy" to realize environmental return, and they have set up the theory of "light green" and "deep green". Both of the theories try to solve ecological environment problems. The studies on environmental cost accounting began in the 1970s, marked by *The Study of the Social Cost Transformation of Pollution Control* written by Beamons in 1971 and Ma Lin's article *Accounting Problems of Pollution* written in 1973. The United Nations intergovernmental working group of experts on International Standards of Accounting and Reporting (ISAR) (1998) defines environmental costs as the costs which are incurred when an enterprise takes its social responsibility to repair, actively or passively, the environmental damages caused by its production, also including other relative costs for reaching environmental goals. These costs include environmental maintenance costs, environmental treatment costs, environmental pollution compensation costs, environmental development costs and environmental loss costs. Germany adopts the ecological accounting model for environmental cost accounting, that is, measuring the influence degree of various environmental loads by physical and chemical units using the principle of flow balance between the material and energy input into the enterprise and the product and waste output into the environment, and on this basis calculating environmental costs and analyzing the input-output effects. Environmental costs mandated by the United States Environmental Protection Agency in 2000 include: (a) traditional costs: the portion of traditional costs that relates to environmental protection; (b) potential hidden costs: costs incurred prior to the commencement of production and business operations, costs paid for complying with environmental laws and regulations, and costs incurred after enterprises cease production and operation activities; (c) contingent costs: expenses that may need to be paid in the future; (d) image-associated costs: the costs for fulfilling enterprise social responsibility.

The studies on environmental reports in Japan began in the 1990s. At the end of the 20th century, Japan proposed the concept of "Circular Economy Society". Enterprises began to pay more and more attention to environmental costs. The Ministry of Environment (formerly The Environment Department) successively published the Environmental Report and explained in detail. In 2005, the Australian practice field divided the costs of coal enterprises into raw coal production costs, construction costs of underground mines, environmental protection costs, and taxes and fees. In summary, it can be seen that the developed countries such as the United States, Japan, Germany and Australia have studied the definition, classification, measurement and information disclosure of enterprise environmental costs to varying degrees, and have achieved certain results. Foreign experts believe that enterprise environmental costs should be included in the accounting system.

However, since experts and scholars in various countries carry out studies based on their own countries' conditions, the focuses and research directions are different. Each one has its own merits, and the research results also differ. This is why a more unified theoretical system has not yet formed.

3 The main composition of environmental cost of coal enterprises

(a) Costs of coal consumption. Coal is a non-renewable resource that nature gives to human beings. The consumption of coal resources is irreversible. Human beings cannot re-create coal in their own way. Coal mining and processing by coal enterprises leads to the continuous shrink of this resource. Coal resources are valuable, and the resources themselves do not belong to coal enterprises at the very beginning. Therefore, coal enterprises should pay a certain amount of money to get coal resources for mining. This expenditure is the cost of coal resource consumption. This cost should be included into the environmental cost accounting of coal enterprises. This cost is paid mainly through the form of taxes and fees, such as mineral resources compensation fees and resource taxes.

(b) Exploration costs of coal resources. This cost is caused when coal enterprises conduct exploration activities at the target spots, estimate coal resource reserves and economic value before the coal mining. It mainly includes geological survey fees, mining rights fees and reserves estimation fees.

(c) Environmental prevention costs. Environmental prevention costs are paid by coal enterprises before they cause pollution and damage to the environment, or to reduce the costs of pollution and emissions, including costs from purchasing advanced air and water purification equipment, raising the processing level, and engineering fees of preventing surface subsidence and solid waste discharge, etc. The cost of emission testing is included as well.

(d) Environmental governance costs. Coal enterprises will cause damages of various degrees to nature during coal mining and processing, such as water pollution, air pollution, solid waste discharge and accumulation, surface subsidence and vegetation destruction. Coal enterprises need to pay a certain price to compensate for the environmental problems caused by themselves and restore the original appearance of nature as much as possible.

(e) Environmental impact costs. The coal mining process may cause surface subsidence, and the surrounding topography and soil quality will be affected to varying degrees. Coal enterprises need to bear the relocation costs of the nearby residents, the compensation fees for the damages caused to crops, the costs of filling the subsidence area, etc.

(f) Costs of ecological environment damage. While consuming various natural resources, coal enterprises are also destroying the ecological environment and the balance of ecosystems. They are disturbing the water cycle system, the forest system and other minerals. These damages should be compensated for by the coal enterprises, rather than other social entities.

(g) Environmental management and education costs. The environmental management costs mainly include the expenses incurred by the environmental protection department's daily environmental monitoring, certification and inspection. The environmental education costs

are caused by environmental knowledge lectures and trainings that coal enterprises organize to mobilize all employees to participate in environmental protection activities.

4 Problems in environmental cost accounting of Chinese coal enterprises

(a) Environmental cost measurement is unscientific. The measurement of environmental costs is a process of quantifying the confirmed result of environmental costs. It is a process which identifies and calculates the amount, quantity, and unit price through certain analysis and using certain measurement units and attributes. For some environmental costs that cannot be measured by currency, enterprises have not found a suitable, closely related and matching measurement method, and the same measurement method has been adopted for environmental costs of different nature. All these will inevitably lead to the inaccuracy of the measurement of enterprises' environmental costs. The environmental cost forecast is unscientific and incomplete, and some environmental damages that should be included in the product costs are excluded from enterprises' confirmed lists of environmental costs. Therefore, the final environmental costs can not fully reflect the real degree of environmental damages. As a result, it is not conducive for enterprises to do cost control and reduction in the later stage of work; managers can not correctly estimate the influence of environmental costs on the business operation according to the accounting results; governments can not make correct evaluations of the environmental damages caused by coal enterprises.

(b) The accounting mechanism of enterprise environmental costs has flaws. The vast majority of coal enterprises have not conducted complete and meticulous analysis and studies on environmental factors, and have not fully incorporated financial accounting into environmental costs accounting. The environmental costs thus can not be separated from the product costs generated in the normal production process. Enterprises can not effectively control the environmental costs, so it is difficult to avoid the corresponding risks. False accounting may happen in the existing cost accounting of coal enterprises due to the absence of a sound environmental cost accounting mechanism.

(c) Information disclosure is an important procedure of the environmental accounting information system. Only through disclosure procedure can enterprises transfer environmental cost information to information users. Environmental cost reports are of great significance for information users to correctly understand environmental cost information. However, the current environmental disclosure of coal enterprises can not meet the requirements of enterprise decision makers, and thus enterprises' internal and external decision-making is affected. The disclosed content is mainly about monetary information measured by historical cost, while in environmental accounting it is the non-monetary information that accounts for a majority. In addition, some items that can not be measured by historical cost are not disclosed in the accounting report either. In fact, the non-monetary information is an important supplement to environmental cost accounting, such as the measurement of pollutant emissions and waste disposal, explanations on enterprises' environmental policy and objectives, impacts of environment damaging or improving on enterprises' financial situations, operating results and cash flow, and the performance of enterprises in environmental fiduciary responsibilities. This kind of information can more comprehensively reflect the attitude of coal enterprises towards environmental issues, as well as their efforts and achievements in environmental protection and resource conservation.

(d) Accounting laws and regulations in environmental cost accounting is absent. In Accounting Law, Accounting Standards for Enterprises and other relevant accounting laws and regulations, there are no detailed provisions on enterprise environmental costs accounting. No unified requirements are made for the objects, measurement, principles and information disclosure of environmental cost accounting. Unified guidelines and standards are also absent. Enterprises can only follow the environmental protection requirements in relevant national policies, which is the reason why different enterprises have different treatment, reports and analysis. Due to the late start of environmental accounting in China, though in recent years many scholars have devoted themselves to the studies on the confirmation, measurement and record of environmental costs, the studies still stay at the theoretical level, and the empirical research on environmental costs is still insufficient. As a result, the confirmation and measurement of environmental costs and the setting of environmental cost accounting subjects are quite random, which affects accounting accuracy, integrity and scientificity.

(e) The management layer of coal enterprises fails to pay enough attention to the accounting and management of environmental costs, but put their emphasis on the pursuit of coal production and maximization of economic benefits. Sound environmental cost rules and regulations have not been established inside enterprises, and finance departments in enterprises have not set up special environmental cost accounting posts to carry out environmental cost control, so a well-founded environmental cost accounting and management system has yet to be formed. The consequence is that enterprises can not achieve coordination between profit growth and environmental benefits, which is contrary to sustainable development. The main goal of coal environmental cost accounting is to offer useful environmental cost information to the outside and to optimize the internal cost control. The environmental cost has little influence on the stock price of coal enterprises. The empirical research shows that the environmental cost has no direct impact on the stock prices of listed companies and the coal industry because China's capital market has not been mature enough. The environmental cost and environmental responsibility index have a weak positive correlation with the changes of stock prices. Therefore, the financial staff hold slack attitude towards environmental cost accounting and its improvement, and coal enterprises also ignore it correspondingly.

5 Countermeasures to strengthen environmental cost control of coal enterprises

(a) Optimizing the measurement of environmental costs.

The measurement of environmental cost in coal enterprises mainly has defects in measurement units, measurement attributes and metrological methods, so coal enterprises must optimize the measurement system. First of all, optimize the choice of measurement units and attributes. Generally, accounting measurement is based on currency, but due to the particularity of the environment, it is difficult to accurately respond to the problems in environmental costs with the currency-based measurement alone. Therefore, apart from the major currency-based measurement, coal enterprises also need labor indicators and physical indicators as supplement to measure environmental costs. At the same time, more measurement methods of environmental costs should be adopted, such as the application of historical costs, replacement costs and opportunity costs. Moreover, reasonable accounting subjects should be set up. According to the requirements of environmental cost accounting in coal enterprises, the accounting subjects include: environmental assets account, environmental debt account, environmental equity account, environmental cost account etc.

(b) Formulating the overall strategic plan of environmental governance by using value chain analysis .

The value chain analysis regards enterprises as a place where different activities interconnect with each other. The analysis factors in the environmental costs incurred in the process of production and operation. By analyzing the costs of various activities, the analysis links the costs and their related activities together. The value chain analysis includes: (i) the internal value chain analysis, which means equal attention should be paid to production and processes before and after production in order to find out the relationship between them and ultimately reduce the cost of coal products. (ii) the external value chain analysis, that is, the analysis of the relationship between suppliers and customers. Suppliers not only produce products or services used in the value chain, but also affects enterprises in other aspects. For example, the frequent delivery of goods from suppliers can reduce the inventory demand of enterprises. Customers also have their own value chains. The costs brought by the customers with small, uncertain orders are higher than those from the customers with large, pre-determined orders.

(c) Carrying out environmental pre-assessment of coal enterprises.

Environmental pre-assessment is an important part of environmental quality assessment. The implementation of environmental pre-assessment in coal enterprises plays an important role in the pre-control of environmental costs. The pre-evaluation takes the whole production process into consideration, allocates the possible environmental expenditures in the future and brings it into the product cost budget system. It puts forward various possible production schemes, and then evaluates them. In order to control the environmental cost, the scheme with the least environmental expenditure is selected from all the feasible programs to be implemented.

(d) Implementing the whole-process control.

Coal enterprises should carry out whole-process control of the environmental costs, which consists of ex-ante planning, interim control and ex-post control.

In ex-ante planning, the entire production process is factored in, possible environmental costs in the future are brought into the product cost budget system, a variety of feasible schemes are put forward, and then the value of each scheme is estimated and the best one is picked out to control environmental costs. The interim control is to control the process in which environment costs are generated. The main task of this stage is to track the production process, supervise and control the incurrence of environmental costs, collect and sort out the first-hand cost data, analyze the process of environmental cost incurrence, and coordinate the cost responsibility centers. Ex-post control refers to enterprises' remedy and compensation for pollution. Compared with ex-ante planning, ex-post control is a passive way of management.

(e) Strengthening the tracking and monitoring of the factors affecting the environment in coal enterprises' various production stages.

Coal enterprises should track and monitor the factors that affect the environment in all production stages, especially the quality of the discharged wastes. Enterprises should do their best to meet the discharge standard to avoid unnecessary accidents, losses, or fines.

(f) Establishing an accountability system for environmental protection.

Under the guidance of the scientific outlook on development, a long-term environmental protection accountability system should be established, and environment indicators should be incorporated into the assessment system for leaders. These measures can raise the awareness of enterprises and government leaders on environmental benefits, promote the

renewal and progress of environmental technology and achieve a win-win result of economic and environmental benefits.

(g) Adopting multiple channels to control the cost of environmental governance.

This measure includes the operation of environmental protection facilities, the operation of environmental projects, environmental pollution control and the management of environmental protection affairs. The waste gas, water and residue generated in production, if treated properly, may be changed into treasure, so as to reduce enterprises' costs and increase efficiency; otherwise they will increase the treatment cost. In addition, attention should be paid to environmental regional governance. Centralized sewage disposal should be used to reduce the environmental costs of the various enterprises in certain region.

(h) Strengthening the evaluation and assessment of environmental cost control.

The function of environmental cost control system is to evaluate the effect of environmental factors in enterprise operation. Enterprises cover the environmental costs for obtaining the corresponding environmental benefits, and this is also the motive for enterprises to control environmental costs. The investment of environmental costs can lead to two results: (i) environmental effects. The incurrance of enterprise environmental costs can reduce the emission of wasted pollutants; environmental accidents and potential environmental risks will decrease; staff awareness on environmental protection will be raised and a good corporate image can be established. (ii) Environmental benefits. These include: the reduction of environmental risks, the drop of the level of environmental resource consumption, the benefits from waste reuse, the reduction of expenses on emissions and fines, the rise in sales revenue due to the popularity of environmental protection products, reduction of interest costs thanks to preferential loans, tax reduction and exemption brought by environmental protection products and reuse of "the three kinds of wastes", more vitality in enterprises owing to rising stock prices in the capital market, brisk trade of products in the international market, the increase of trade efficiency and so on.

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