

Review of Supply Chain Emissions in Asymmetric Information

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Abstract: Low carbon economy environment, the enterprise and the supply chain are facing pressure from government and market of low carbon emissions under Low carbon economy environment. And in the process of implementation of emission reduction, the information is often not completely symmetrical, leading to a lower supply chain efficiency. What's more, the theory of asymmetric information about supply chain emissions is still imperfect, lack of innovation cooperation mechanism or mitigation strategies to achieve the purpose of the supply chain to reduce emissions. Therefore, this paper analyzed the development background of supply chain emissions under asymmetric information, reviewed related research results at home and abroad and discussed future research. It provides the certain reference value for upstream and downstream supply chain enterprises to formulate cooperative strategies and manage mental practices of low-carbon development.

Keywords: Asymmetric information; Supply chain emissions; Low-carbon economy

1. Introduction

1.1. Adapting to the need for a low-carbon economy

In its fourth assessment report, the IPCC said that the most important contributor to global warming is the greenhouse gases emitted by human industrialization[1]. In order to deal with the relationship between people and nature, and to protect human health, governments, enterprises and societies around the world have begun to pay great attention to greenhouse gas emission. Our government has made it clear at the Copenhagen conference that China's carbon dioxide emissions per unit of GDP will fall by 40-45% from 2005 levels by 2020. 2030 peak emission peak, with a 60% to 65% reduction in carbon intensity; Carbon reduction by 2050 [2]. In addition, consumers' own low carbon awareness has gradually increased, willing to buy green and low-carbon products and pay extra for it[3]. For example, the market research analysis report shows that more than 60 percent of auto consumers have the incentive to purchase energy-saving and environmentally friendly cars. Therefore, low carbon emission reduction and sustainable development are the general trend, and it is the responsibility and obligation of the state, enterprises and consumers.

1.2. The need for asymmetric information research

Asymmetric information is also information asymmetry. At present, the research on two layers of supply chain under symmetric information situation has been paid attention to by many scholars. But in real economy activity, because of knowledge monopoly, industry barrier and concealing or falsely reporting private information to

pursue their own best interests, supply chain cannot realize complete information sharing. That is, information asymmetry exists between them. Information asymmetry can lead to serious consequences such as increased transaction cost, difficulty in performance monitoring and reduced supply chain efficiency. Therefore, it can be seen that the urgency and necessity under asymmetric information to study emission reduction and coordination.

2. Research Significance

Influenced by the era of low-carbon economy, energy conservation and environmental protection, reducing carbon emission has been the topic of our daily life. But our country enterprise generally has the characteristics of high energy consumption, high emission, resulting in the cost of converting ordinary products into low-carbon products is very high, at the same time, because of the existence of double limit effect of supply chain, the retail price is much higher than ordinary low carbon products. For example, the average price of a low-carb variable frequency air conditioner is nearly three times that of a normal air conditioner. Therefore, the demand of consumer market has been low, thus restricting the promotion of low-carbon products and discouraging the production of green environmental products by enterprises, and affecting the process of sustainable economic development in China.

In the case of information symmetry, research on supply chain emission reduction has received the attention of scholars. In the actual situation of life, the information cannot be fully equivalent due to the factors such as technology, monopoly and conflict of interest. In this

constantly updated and rapidly changing society, information, as an important resource, greatly influences the coordination of supply chain and efficiency of emission reduction. Establish a reasonable and efficient mechanism to reduce emissions, can share the part of the cost in the upstream manufacturers to promote supply chain companies to realize the pareto improvement, so as to reduce low carbon product price, expand market demand for low carbon products. It also contributes to the low carbonized road in China.

2.1. Theoretical significance

First of all, the issue of supply chain emission reduction is one of the most popular issues. Carbon emission also affects the process of sustainable economic development in China. Therefore, it is necessary to study the theory and practice of supply chain emission reduction.

Secondly, many scholars have done a lot of research on the symmetry of information, and the information asymmetry has been considered less. The research on the emission reduction of supply chain under asymmetric information will help enrich the current theoretical system, and think about the innovative emission reduction mechanism or policy of realizing pareto improvement by the members of the supply chain.

Finally, in-depth and systematic study on the related issues of supply chain emission reduction under information asymmetry can provide some reference value for research in this field.

2.2. The practical significance

First of all, under the low carbon economy era, the whole society from all walks of life are in response to the call of national low-carbon economy, the government have issued a series of policies to promote the enterprise have to put the low carbon is introduced into the corresponding decisions.

Second, low carbon prices are high and consumption demand is low. Research on current supply chain emission reduction can help to improve the existing situation by thing about new coordination mechanisms or policies based on the summary of existing research results.

Finally, with the rapid development of economy, the importance of information continuously emerging, more and more enterprises use information as a private resources for protection, are not willing to make voluntary disclosure and sharing. Under asymmetric information, the study of emission reduction of supply chain enterprises can not only raise the attention of the whole society to low-carbon emission reduction, but also provide important practical reference significance for the emission reduction of supply chain enterprises.

3. Domestic and Foreign Research Overview

The problem of supply chain emission reduction is not long, but the research is very rich. This paper firstly summarizes the domestic and international situation of the research field, including the research of asymmetric information and the research on supply chain emission reduction.

3.1. Research on asymmetric information

Study of asymmetrical information supply chain, some scholars choose to downstream companies owned by private information as a system of asymmetric information, such as price, market demand information, seller information and cost of sales information, etc. DanBin et al[4],studied the problem of fresh supply chain coordination under the asymmetry of price information, found that wholesalers share purchase price information, not only can improve the expected profit of wholesale market operators, more help bring fresh agricultural product price fluctuations. Babich et al[5],studied the incentive contract design of suppliers with asymmetric demand information, and the results show that the contract can realize any distribution of profits between suppliers and retailers.

Some scholars also explore the cost information asymmetry of upstream suppliers and manufacturers. Such as Cakanyildirim and other people[6] explore the contract design problem of the retailer when the supplier produces cost information asymmetrically and retains the profit related to the production cost. The research shows that the asymmetric information does not necessarily affect the performance of the system. When the cost efficiency of the low-cost supplier is within a certain scope, the contract can effectively coordinate the supply chain.

3.2. Research on emission reduction of supply chain

Currently, about low carbon under the environment of supply chain emissions problem research is more, mainly from the environmental policy, low carbon supply chain decision-making, coordination optimization, consumers' low carbon behavior several aspects.

3.2.1. Research on government environmental policy and reduction decision of enterprises

The idea of using market mechanisms to deal with the externalities of pollution has a long history. More research in the supply chain is the emissions trading mechanism, taxation and subsidies.

In terms of emissions trading mechanism, the research is mostly on the macro level. As a result of the global carbon emission restriction and the establishment of emission and trading mechanism, carbon emission factors are bound to have an impact on the production and operation of enterprises. As a result of the global carbon emission restriction and the establishment of emission and trading mechanism, carbon emission factors are bound to have

an impact on the production and operation of enterprises. Benjaafar et al[7], took the lead in incorporating the carbon emission factors into the enterprise decision model, and came up with many management implications, which was groundbreaking on the issue of carbon emission. Konur and Schaefer[8], by analyzing the inventory control and transport strategy under four different carbon emission policies, found the carrier transport costs and transport emissions will impact on customer's decision. Scholars have conducted detailed studies on the use of taxes and subsidies to address externalities and promote the overall social welfare increase. As Xia Liangjie[9] study found that the transfer payment can effectively motivate suppliers to improve emissions reductions, no matter whether the joint to reduce emissions, manufacturers can improve their emissions to push supplier to improve the emission reductions.

3.2.2. Research on coordination optimization and cost-sharing of low-carbon emission reduction in supply chain

Supply chain emissions is government supervision and random demand, followed by high cost, high price and low market demand, restricts the positive development of the supply chain to reduce emissions. At present, many scholars in view of the supply chain to reduce emissions has carried on the detailed, comprehensive and in-depth research, mainly focused on the study of optimal decision of supply chain enterprise to reduce emissions and coordination optimization, supply chain upstream and downstream of the innovation investment cost allocation, etc.

In the research on optimal decision-making and coordination optimization of supply chain enterprises under the existing carbon emission constraints, typical representatives are: Mr. Wang and others[10] have designed the revenue-sharing contract to coordinate the relationship among supply chain members, assuming that consumers have a preference for low-carbon products and that companies voluntarily reduce their emissions. On the basis of considering consumer behavior, Luo Ruiling et al[11], analyzed the influence of consumers' carbon footprint sensitivity coefficient and carbon emission reduction cost coefficient on optimal decision making and carbon emission reduction of supply chain members.

In the study of the cost-sharing of innovation input in the upstream and downstream of the supply chain, the cost-sharing (subsidy) is mainly concentrated in the vertical supply chain in order to motivate the other party. Including the manufacturer's contribution to the retailer's promotional costs, retailers share and subsidize manufacturers' input costs, manufacturer's cost-sharing and subsidy for supplier innovation costs, supplier's cost-sharing and subsidy to manufacturers' innovation input costs.

With the advent of the era of low-carbon economy, the supply chain enterprises are constantly seeking better

development mode, and now they are more competitive in information, market and service. The emission reduction input is a key part of the supply chain emission reduction. The strategy of sustainable development must be explored to reduce the price of low-carbon products and increase market demand from the bottom. The research on the emission reduction of supply chain is limited to cost-sharing problem, which can not meet the demand and improve the quality efficiency of supply chain. Therefore, seeking innovation cooperation mode to reduce emissions, breaking the constraints of current cost sharing and revenue sharing, introducing new mechanisms or methods to make the benefits unchanged or make the environment better, which is the top priority and the research direction in the future.

3.2.3. Research on the low carbon behavior of consumers

Research on the low carbon behavior of consumers is at the stage of exploration and development, so there are relatively few researches on this aspect. Most studies at home and abroad are mainly based on the impact of consumers' low carbon preference or low carbon sentiment on order quantity and emission reduction. Plambeck[12] pointed out that the manufacturers' disclosure of their product emission reduction and other related information will increase the consumers' trust and increase the market share of the product market. In addition, Liu, etc[13], The results also indicated that the downstream retailers, through the low carbon means of promotion and publicity to enhance the environmental protection consciousness of consumers, can inspire more consumers to environmental protection. Recently, domestic scholars have also paid attention to the issue of reducing the demand for emissions reduction in low-carbon environment. Zhao Daozhi [14] discuss the dynamic game of competition manufacturers in the case of carbon emission trading and carbon cap.

Most of the above research assumes that the sales price is exogenous variables and ignores the correlation between demand and sales price. More importantly, the research on the coordination mechanism of the combination of voluntary energy conservation and emission reduction manufacturing enterprises and low carbon publicity in retail enterprises is also lacking.

4. Review

Supply chain emissions is in the traditional supply chain into low carbon concept. It is required to minimize environmental damage and improve resource utilization, realize the overall benefit maximization of supply chain and minimize carbon emission, and realize coordinated development of economy and environment. In the context of China's energy conservation and emission reduction and sustainable development, through literature review, it

can provide theoretical reference for the emission reduction of supply chain, and also make useful Suggestions for enterprises to carry out low-carbon activities.

Through literature, it is not hard to find, and supply chain emissions involved a lot of problems, and related research has been very mature, but there are still lots of problems are not resolved or still need further discussion. For example, the carbon tax will reduce the profits of the fossil energy sector, there is the "green paradox", subsidies will increase short-term carbon emissions, carbon trading is complicated to implement, and the trading market also has defects in price fluctuation, transaction cost, mechanism design, and carbon leakage. In the face of existing theories and practices that cannot provide the only policy solutions that promote the most effective low-carbon development, is there a more appropriate policy to apply to the supply chain emission reduction? In addition, most studies are in the context of information symmetry, in reality, information is more and more important, often asymmetric. How does a party of unknown information design a contract or contract to reveal the information that the other party has in the asymmetric information? How do you deal with the cost of disclosure in this process? Previous studies on supply chain emission reduction have adopted cost-sharing to reduce the price of low-carbon products and increase market demand. However, the cost-sharing in the research process is limited to certain conditions, and the actual situation is complicated and changeable. For example, the price of carbon trading fluctuates with the market situation. So is there a more appropriate mechanism for reducing emissions in the supply chain so that all businesses have better returns when the overall benefit is not so bad? So the research is still being done. And how much carbon is the supply chain in the process? How do you measure it? In what way? This is also the future research direction. In addition, with the rapid development of the Internet, e-commerce has penetrated into people's life, greatly changing the operation mode of logistics, information flow and capital flow. How to combine the emission reduction of supply chain with e-commerce is also the trend of future development. However, the existing research on the emission reduction of supply chain has implications for the development of low carbon supply chain, which lays a theoretical foundation for later research and provides direction and clues.

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