

# An Evolutionary Game Analysis of Green Development of Logistics Enterprises

Yan Xiaoxia<sup>1,a</sup>

<sup>1</sup>Department of Business Administration, Shanxi University of Finance and Economics, Taiyuan, Shanxi, China

<sup>a</sup> Corresponding author. Email: yanxx0330@163.com

## ABSTRACT

The development of China's economy has promoted the rapid development of logistics industry, and in this process of development so that China's environment has been seriously persecuted, on this basis, the implementation of green logistics has become the inevitable trend of China's logistics industry development. In this paper, logistics enterprises in our country, on the basis of current situation of the development of green logistics, build an evolutionary game model of the government and logistics enterprise, both in the government and logistics enterprise development of low carbon logistics all the selection of the optimal strategy, portfolio strategy can be found according to the analysis, the enterprise after the implementation of low carbon logistics comprehensive benefit is improved obviously, and reduces the cost, the government implement inspection strategies after low carbon subsidies and fine comprehensive measures to build a good enterprise low carbon development environment. Finally, based on the analysis of the game model, the author puts forward some Suggestions to promote the development of China's low-carbon logistics, such as improving the management ability of China's logistics enterprises and the government building a good low-carbon logistics environment.

**Keywords:** Low-carbon logistics, Evolutionary game model, The optimal strategy

## 1. INTRODUCTION

According to the data of relevant scholars, it can be concluded that the logistics industry plays an indispensable and important role in China's economic development. But there is no denying that the development of the logistics industry during the burning of high pollution energy emissions of harmful gases have seriously polluted our country's environment. The development of green logistics is crucial as it is an important measure to ensure that China can achieve its 2020 carbon reduction targets. Green logistics is to make full use of the logistics resources, and prevent the pollution to the environment in the logistics work, a series of measures to effectively improve the existing logistics environment, green logistics from the perspective of the environment, to protect the environment as the first goal, to improve the logistics industry, thus forming a new logistics system, it will protect the environment, the concept of green development deeply melting into the logistics system, emphasizes the efficiency of the logistics industry development, to achieve the coordination and balance of the logistics industry and the environment development, promote the utilization of logistics resources. Green logistics not only effectively improves the economic benefits of our country, but also brings long-term benefits to the logistics enterprises themselves.

Low carbon logistics is the most basic prerequisite to achieve green logistics, to achieve green logistics, the primary goal is to implement low carbon logistics. The concept of sustainable development will be integrated into

the existing logistics activities and logistics technology, and advanced environmental protection technology and economic means will be adopted to achieve the highest utilization rate of existing logistics resources and the lowest rate of environmental pollution. The logistics industry has promoted the development of China's economy, and with the characteristics of high energy consumption, high emissions and high pollution, it is in urgent need to change from the previous extensive and inefficient to intensive and efficient, to conform to the economic low-carbon development. In addition, the developed countries in low carbon development clairvoyance, using its technology advantages and industry advantages to build up international standards and low carbon low carbon green trade barriers, do not meet the market demand of the product or service further compressed space, the logistics industry development in our country is also a big challenge, brought huge challenges to the logistics industry development in our country.

### 1.1. Literature Review

The development of low-carbon logistics has become one of the effective ways to cope with climate warming at home and abroad. Relevant scholars have combined interdisciplinary theories to provide new methods, ideas and theoretical support for the development of low-carbon logistics. Xing Husong et al. used evolutionary game method to construct the evolutionary game of logistics enterprise cooperation, analyzed the adaptability and

selection strategy of logistics enterprises in the case that the government chose to support or not to support the two strategies, and finally determined the impact of the government's choice of support strategy on logistics enterprises [13]. Wang Zhenzhen et al. constructed two evolutionary game models, one is the evolutionary game model between logistics enterprises and manufacturing enterprises when the government chooses to support them, the other is the evolutionary game model between the government and logistics enterprises during the linkage development of logistics enterprises and manufacturing enterprises. It is proposed that policy support from the government can promote the joint development of manufacturing enterprises and logistics enterprises [14]. Li Youdong and Zhao Daozhi et al [3] used evolutionary game model to build a game model of mutual cooperation between the government and logistics enterprises. The game analysis results showed that the evolution of the system was characterized by "path dependence", and the evolution result of the system was closely related to the income of the government and enterprises.

The application of game theory to the development of low-carbon logistics has achieved important theoretical results, whether in the green supply chain upstream and downstream enterprises in the optimal strategy to achieve carbon emission reduction, while maintaining economic benefits, or the analysis of game behavior between enterprises and the government to study the development path of low-carbon logistics. Based on the previous research results, this paper focuses on the game strategy in two states. One is the situation where the government chooses the inspection strategy and the logistics enterprise makes the selection strategy; the other is the situation where the government chooses not to inspect the strategy and the logistics enterprise makes the selection strategy. Finally, the optimal strategy is obtained through the analysis of the main enterprise selection strategy, and then the countermeasures for the low-carbon development of logistics enterprises are put forward according to the analysis results of the game model.

**1.2. Hypothesis of Game Model**

In the game model of government and enterprise studied in this paper, enterprise participants generally refer to the decision-making group of logistics enterprises in China, hereinafter referred to as enterprises; Government participants do not distinguish between central and local governments and represent social and public interests, hereinafter referred to as the government. Enterprises choose to implement low carbon logistics strategies in the game needs to your money in the aspects of technology and implementation cost  $C_L$ , at the same time in the long term business through the implementation of the low carbon logistics strategy because leads to low carbon strategy and direct benefits, referred to as enterprises implement the direct income  $BL$ , enterprises implement low-carbon logistics strategy will bring good social evaluation and credibility of  $R_L$ [1]. Corresponding game on the other side of

the government can choose to check whether logistics enterprises implement low-carbon strategy, at this time to check the cost need to be paid, or the government inspection cost  $C_G$ , after checking strategy, the government chooses according to enterprise strategy choice has two kind of situations: first, check to the implementation of the low carbon logistics strategy of enterprise, the enterprise needs to be properly subsidies to alleviate the pressure of the development of low carbon logistics cost, incentive enterprises implement the strategy of low carbon behavior, hereinafter referred to as government subsidies  $A$ ; Second, if the detected enterprises fail to implement low-carbon logistics strategy, they need to be punished accordingly. In other words, it is also the revenue of the government, which is referred to as government fine  $P$ . Meanwhile, the punishment imposed by the government will bring some negative effects to the enterprises, which is referred to as enterprise loss  $D$ . Finally, due to the environmental problems caused by enterprises' failure to implement low-carbon logistics strategy, the government needs to improve the environmental problems whether it implements inspection strategy or not, which is referred to as government treatment cost  $C$ .

Table 1 Symbolic meanings

symbol	meaning
$C_L$	Enterprise implementation cost
$B_L$	Enterprises implement direct income
$R_L$	Social evaluation and credibility
$C_G$	Government inspection cost
$A$	The government subsidies
$P$	The government fines
$C$	Government processing cost
$D$	Loss of business

**1.3. Game Strategy Matrix**

In the game model of low-carbon policy, both decision-making parties make rational strategies based on their own interest demands and the learning of each other's behaviors. On the one hand, the government's inspection on the low-carbon development of logistics enterprises has a direct impact on the low-carbon development strategy selection of logistics enterprises, and logistics enterprises make different low-carbon logistics strategy responses according to different measures taken by the government. On the other hand, different strategic choices of enterprises will in turn urge the government to formulate different policies and regulations [2].

This paper simulates whether the government checks the low-carbon behavior of logistics enterprises, and whether the logistics enterprises implement low-carbon logistics strategy in the face of the selective behavior of the government to construct the strategic matrix of the game between government and enterprise. Behavior choice of both parties: government (check, do not check), enterprise

(implement, do not implement). As shown in Table 2. There are four combined strategies:

(1) The first combination strategy is (check, implement). Which stands for the social and public interests of the government's low carbon practice of logistics enterprises implement the inspection strategy, including the establishment of a perfect incentive regulation mechanism, giving play to the role of Banks, investment institutions such as the financial system in a variety of ways, such as subsidies to alleviate enterprise low carbon logistics practice or regulation did not practice low carbon logistics strategy of enterprises, and impose a fine. As the decision-making party of enterprises, we choose to implement low-carbon logistics strategy, including the introduction and purchase of low-carbon logistics facilities and equipment, and improve the level of logistics information.

(2) The second combination strategy is (check, do not implement). Which stands for the social and public interests of the government's low carbon practice of logistics enterprises implement the inspection strategy, including the establishment of a perfect incentive regulation mechanism, giving play to the role of Banks, investment institutions such as the financial system in a variety of ways, such as subsidies to alleviate enterprise low carbon logistics practice or regulation did not practice low carbon logistics strategy of enterprises, and impose a fine. However, as the decision makers of enterprises who choose not to implement low-carbon logistics strategy, they will be punished due to

the violation of government regulation requirements.

(3) The third combination strategy is (do not check, implement). In other words, the government representing the social and public interests will not check the low-carbon practice activities of logistics enterprises, and there will be no corresponding policy subsidies or penalties for logistics enterprises to implement low-carbon logistics strategies. Since low-carbon products are public goods, the government will be responsible for the treatment costs of the polluted environment. As the decision-making party of enterprises, we choose to implement low-carbon logistics strategy, including the introduction and purchase of low-carbon logistics facilities and equipment, and improve the level of logistics information.

(4) The fourth combination strategy is (do not check, do not implement). In other words, the government representing the social and public interests will not check the low-carbon practice activities of logistics enterprises, and there will be no corresponding policy subsidies or penalties for logistics enterprises to implement low-carbon logistics strategies. Since low-carbon products are public goods, the government will be responsible for the treatment costs of the polluted environment. However, as the decision-maker of enterprises, if they choose not to implement the low-carbon logistics strategy, there is no corresponding penalty because the government adopts the non-inspection strategy.

Table 2 Game strategy matrix between government and logistics enterprises

		Enterprise	
		Implement	Do not implement
The government	Check	(check, implement)	(check, Do not implement)
	Do not check	(Do not check, implement)	(Do not check, Do not implement)

As the representative of social and public interests, the government should correctly and effectively guide logistics enterprises to take a low-carbon development path to make up for the shortage of market regulation. The government undertakes various tasks in this link. First of all, strengthen the supervision on the low-carbon practice of logistics enterprises. Through formulating laws and regulations, force logistics enterprises to change the original production mode with high energy consumption, high pollution and high emissions, encourage enterprises to produce low-carbon products and consume low-carbon products, and reduce the impact on the environment. Second, at the beginning of the enterprises are difficult to bear the development of low carbon logistics cost and under the condition of low carbon yield little, the government on the basis of the original regulation to strengthen incentives, through subsidies, taxation and financial policy support, so as to reduce and alleviate enterprise implementation of low carbon logistics cost and financial pressure, for the logistics enterprise change "energy-consuming, high pollution and high emissions" of the original mode of production, development of low carbon logistics create a good policy environment.

Finally, the initial development of logistics enterprises pays little attention to the adverse impact on the environment and is not willing to make extra efforts for environmental problems. There are still many uncertainties in low-carbon development, which requires the government to deal with and encourage logistics enterprises to take the initiative to practice low-carbon logistics, protect the ecology and assume social responsibility.

Game model of government and enterprises based on the above, the assumption of costs and benefits both sides, make the following refinements: enterprise implementation cost  $C_L$ , including low carbon logistics technology are introduced to the increase of investment, the low carbon transformation of original logistics facilities and update the increase of operating costs, purchase low carbon logistics equipment cost money, and for low carbon logistics operation management cost increase, etc.; Enterprises implement income  $B_L$ , which specifically includes the extra income from low-carbon market gained by enterprises through the implementation of low-carbon logistics strategy and the production cost

savings brought by energy consumption and resource recycling, etc. Social evaluation and reputation RL of enterprises mainly refers to the good social evaluation and reputation of enterprises in implementing low-carbon logistics policies by the public. Losses of enterprises. Specifically, when enterprises fail to implement low-carbon logistics policies, the government will punish them to a certain extent. In this case, bad reputation will bring losses to enterprises. The government inspects the cost of  $C_G$ , specifically, the people, goods and financial resources spent by the government in the process of supervising the implementation of low-carbon logistics strategy; Government subsidy A, including government financial discount interest, tax preference, policy-based subsidy, etc.; Government fine P refers to administrative penalty imposed on enterprises that fail to implement low-carbon logistics strategy; C, the environment has the attribute of public goods. The government needs to pay for the treatment of the polluted and damaged environment in terms of people, goods and financial resources.

Through the combination strategy of the government-enterprise game model, four different combination returns of the two sides can be obtained, as shown in Table 3.

(1) the first combination strategy :(check, implement)

Government:  $-C_G-A$ , which means that the government will pay the inspection cost for the implementation of the inspection strategy and give corresponding incentive subsidies to the enterprises implementing the low-carbon logistics strategy.

Enterprise:  $-C_L + B_L + R_L + A$ , refers to the special cost paid by the enterprise in the low-carbon practice after the implementation of the low-carbon logistics strategy, the

low-carbon performance gained after the implementation of the low-carbon logistics strategy, the good social evaluation and reputation given by the public and the incentive subsidy from the government for this strategy.

(2) the second combination strategy :(check, do not implement)

The government:  $-C_G + P - C$ , that is, the government pays the inspection cost for the implementation of the inspection strategy, the regulatory penalty for the profits of enterprises that do not implement the low-carbon logistics strategy, and the cost of the treatment of the damaged ecological environment.

Enterprise:  $-P - D$ , the regulatory penalty paid by the government after the enterprise chooses not to implement low-carbon logistics strategy and the loss caused by the government punishment.

(3) the third combination strategy :(do not check, implement)

Government: 0, that is, the government has no income or expenditure under this combination strategy.

Enterprise:  $-C_L + B_L + R_L$ , refers to the special cost paid by the enterprise in the low-carbon practice after the implementation of the low-carbon logistics strategy, and the low-carbon performance and the public's good social evaluation and reputation after the implementation of the low-carbon logistics strategy.

(4) the fourth combination strategy :(do not check, do not implement)

Government:  $-c$ , that is, the government pays the treatment cost of the damaged ecological environment.

Enterprise: 0, that is, the enterprise does not have any income or expenditure under this combination strategy.

Table 3 Income matrix of government and logistics enterprises

		Enterprise	
		Implement y	Do not implement 1-y
The government	Check x	$(-C_G - A, -C_L + B_L + R_L + A)$	$(-C_G + P - C, -P - D)$
	Do not check 1-x	$(0, -C_L + B_L + R_L)$	$(-C, 0)$

**1.4. GAME EQUILIBRIUM ANALYSIS**

The scribing method is adopted to solve the Nash equilibrium of the return matrix, and the analysis is as follows:

If  $-C_L + B_L + R_L > 0$ , that is, the benefits and public's good social evaluation and reputation of the enterprise after the implementation of the strategy are greater than the cost of the implementation of the strategy. There is a unique Nash equilibrium (not checked, Implement). Combined with the analysis of the actual situation, some leading low-carbon logistics enterprises will practice low-carbon logistics with a positive attitude, and the actual income they get is higher than the cost they pay for it, which is more in line with the developed countries with high awareness of low-carbon environmental protection.

If  $-C_L + B_L + R_L < 0$ , that is, the profit after the implementation of the strategy and the good social evaluation and reputation

of the public are less than the cost of the implementation of the strategy. At this point, the size of  $-C_G + P - C$  and  $-C$  should be analyzed:

(1) if  $-C_G + P - C < -C$ , that is,  $C_G > P$ , that is, the cost of government inspection is greater than the regulatory penalty imposed on enterprises that fail to implement low-carbon strategies. There is a unique Nash equilibrium

(Do not check, Do not implement) under the condition that the enterprise's implementation revenue is less than the enterprise's implementation cost and the government's implementation cost is greater than the penalty for the enterprise's failure to implement the strategy. After the reform and opening up in China, the state and local government's policy towards local economic construction, and local officials in the GDP weights of evaluation indexes is higher, make the enterprise in the development of the excessive pursuit of economic benefits and neglected the environmental elements, even in the face of high pollution, high emissions, energy-intensive

enterprises have serious consequences for the environment is usually a small amount of symbolic fine by the government, the government departments to concentrate on production and construction, the regulation pay cost and for the practice of enterprise low carbon subsidies also is very low. It can be seen that under this environment, the game between government and enterprise will reach (Do not check, Do not implement) equilibrium.

(2) if  $-C_G + P - C > -C$ , that is,  $C_G < P$ , that is, the cost of government inspection is less than the regulatory penalty imposed on enterprises that fail to implement low-carbon strategies. At this point, the size of  $-P - D$  and  $-C_L + B_L + R_L + A$  needs to be solved by analyzing:

① If the  $-p - d > -c_l + B_L + R_L + A$ , that is, the government has not implemented the low-carbon strategy of the enterprise imposed fines and losses of the enterprise is less than the cost of the implementation of the low-carbon strategy of the logistics enterprise minus the benefits of the implementation of the low-carbon strategy of the logistics enterprise and the public's good social evaluation and reputation of the enterprise as well as the government to the enterprise development of low-carbon logistics subsidies sum.

② If  $-P - D < -C_L + B_L + R_L + A$ , that is, the fines and losses imposed by the government on enterprises that have not implemented low-carbon strategies are greater than the costs of logistics enterprises implementing low-carbon strategies minus the benefits of logistics enterprises implementing low-carbon strategies and the good social evaluation and reputation of the enterprises as well as the government subsidies for enterprises to develop low-carbon logistics. There is no stable solution to the pure strategic Nash equilibrium. Governments and businesses should consider a hybrid approach.

Suppose the probability of the government choosing inspection strategy, non-inspection strategy, implementing low carbon logistics strategy, and not implementing low carbon logistics strategy is  $X$ ,  $1 - x$ ,  $Y$ , and  $1 - y$  respectively. Then the expected utility functions of the government and the enterprise are respectively.

Expected utility function of the government:

$$U(X, 1 - X) = X * [Y * (-C_L - A) + (1 - Y) * (-C_G + P - C)] + (1 - X) * [(1 - Y) * (-C)]$$

if  $\frac{\partial U(X, 1 - X)}{\partial X} = 0$ , so  $Y = 1 - \frac{C_L + A}{A + P}$  (1)

Expected utility function of an enterprise:

$$U(Y, 1 - Y) = Y * [X * (-C_L + B_L + R_L + A) + (1 - X) * (-C_G + B_L + R_L)] + (1 - Y) * [(1 - X) * (-P - D)]$$

if  $\frac{\partial U(Y, 1 - Y)}{\partial Y} = 0$ , so  $X = \frac{C_L - B_L}{A + P}$  (2)

As can be seen from Equation (2),

① Because  $C_L - B_L > 0$ , so  $X$  is the minus function of  $B_L - C_L$ . In other words, with the reduction of comprehensive effects obtained after the implementation of low-carbon strategies by logistics enterprises, the probability of government implementing inspection strategies will increase.

② Because  $A + P$  times  $b$  times  $b$  zero, so  $X$  is  $A + P$

minus. In other words, with the increase of government subsidies after the implementation of low-carbon strategies by logistics enterprises, the increase of environmental penalties imposed by the government on logistics enterprises that have not implemented low-carbon strategies, the probability of the implementation of inspection strategies by the government will decrease. With the reduction of government subsidies after the implementation of low-carbon strategies by logistics enterprises, the reduction of environmental penalties imposed by the government on logistics enterprises that have not implemented low-carbon strategies, the probability of the implementation of inspection strategies by the government will increase.

As can be seen from Equation (1),

① When  $A$  is fixed,  $Y$  is positively correlated with  $P$ , and  $Y$  is inversely correlated with  $C_L$ . As the government imposes less penalties on enterprises that do not implement low-carbon logistics, the higher the cost for enterprises to implement low-carbon logistics, the lower the probability of enterprises implementing low-carbon logistics strategy will be.

② When  $P$  is fixed, there is an inverse relationship between  $Y$  and  $C_L$ , and an inverse relationship between  $Y$  and  $A$ . This is because when the government increases subsidies for low-carbon logistics strategy selection, enterprises tend to give up high subsidies instead of implementing them. Companies as a rational decision makers, mastered when choosing check whether enterprise implementation of low-carbon strategy, inevitably need to pay the government inspection costs and in the face of low carbon logistics enterprise high subsidies, while the fine information remains the same, this situation more firms prefer to believe the government after the measure of revenue expenditure do not check strategy of probability, so enterprise implementation of low-carbon strategy introduction to not also on the rise.

## 2. CONCLUSIONS AND RECOMMENDATIONS

### 2.1 Conclusions

From the analysis of the above part of the content, there are three equilibrium results (Do not check, Implement), (Do not check, Do not implement), (Check, Do not implement), and there are also mixed strategies between the government and logistics enterprises. (Do not check, implement) Applicable to the equilibrium state of the government-enterprise game in developed countries and regions; (Do not check, do not implement) Applicable to the state of overly pursuing economic growth while ignoring environmental factors. The game between government and enterprise in the early stage of China's reform and opening up basically reached this Balanced; (Check, Do not implement) suitable for the pursuit of

economic growth while beginning to pay attention to environmental factors, but the corresponding supervision and incentive mechanism is still in its infancy. Since China's reform and opening up, with the increasing environmental problems, the government has paid a lot of environmental governance. After the cost began to gradually pay attention to environmental factors and incorporate them into the environmental assessment of enterprises, fines were imposed on enterprises that did not meet environmental protection requirements, but the amount did not attract the attention of enterprises. The game between government and enterprises at this stage basically reached the equilibrium.

In the mixed strategy of the government and logistics enterprises, it is found that based on the conditions that logistics enterprises cannot complete the realization of low-carbon logistics through self-integration (the implementation cost of low-carbon logistics is greater than the benefits after implementation), the government adopts low-carbon logistics policies and regulations. Intervene and guide the low-carbon logistics development of logistics enterprises. However, the government exists as an actor, and it will inevitably have choices in the degree of intervention and guidance, mainly in terms of subsidies to low-carbon logistics companies and fines for non-low-carbon logistics companies. At this time, the government and logistics companies. The probability of inspection and implementation will be affected by the actions of both parties.

Through the analysis and comparison of the three equilibrium results, it is easy to find that (Do not check, Implement) is the equilibrium result of the government-enterprise game that best meets the requirements of sustainable development. Since my country's reform and opening up in 1978, the economic development of the past 40 years has gradually changed from focusing on volume and scale to focusing on quality. The transition from (Check, Implement) to (Do not check, Implement) of low-carbon development of government and enterprise strategies is an inevitable development direction. Increasing the probability of logistics companies implementing low-carbon logistics and government non-inspection strategies is the main content of the future development of low-carbon logistics.

## **2.2 Countermeasures**

Under the conditions of reducing X and increasing Y: After the enterprise implements low-carbon logistics, the overall benefits increase, and X becomes smaller; after the enterprise implements low-carbon logistics, government subsidies and fines also increase, and X becomes smaller; subsidies are fixed and government fines increase, enterprise implementation costs will decrease, Y will increase; fines will be fixed, enterprise implementation costs will decrease, Y will increase. A comprehensive analysis can find that the improvement of comprehensive benefits and the reduction of implementation costs after the implementation of low-carbon logistics by enterprises is a reflection of the low-carbon management capabilities of logistics enterprises. The government has created a low-carbon development

environment through comprehensive measures of low-carbon subsidies and fines. This article will study my country's low-carbon logistics development strategies from the logistics companies and governments analyzed above.

### *2.2.1. Logistics companies improve their low-carbon management capabilities*

Through comprehensive analysis, it can be found that the comprehensive benefit improvement and implementation cost reduction after enterprises implement low-carbon logistics reflect the low-carbon management ability of logistics enterprises, and the government creates low-carbon development environment through comprehensive measures of low-carbon subsidies and fines. This paper will from the above analysis of logistics enterprises and the government to study China's low-carbon logistics development countermeasures.

#### 2.2.1.1. Introduce talents and strengthen the training of logistics professionals

Effective low carbon management capability is designed from the strategic level of enterprises, rather than based on the rise and fall of immediate costs. Long-term vision to treat and practice low carbon logistics meets the requirements of green and sustainable development. This paper will comprehensively analyze the low-carbon consciousness, low-carbon equipment and low-carbon innovation ability to improve the low-carbon management ability of logistics enterprises and promote the efficient development of low-carbon logistics.

#### 2.2.1.2 Strengthen the strategic cooperation between logistics enterprises and manufacturing enterprises<sup>[9]</sup>

To strengthen the cooperation between logistics industry and manufacturing industry and promote the harmonious development of logistics industry and manufacturing industry is the primary goal of realizing green logistics. The common development of logistics industry and manufacturing industry can effectively reduce costs and save resources. Meanwhile, logistics industry can bring better services to the manufacturing industry and promote the development of the manufacturing industry. Logistics is a producer service industry, which cannot exist independently without manufacturing industry. Logistics industry and manufacturing industry complement each other. Effective cooperation between logistics enterprises and manufacturing enterprises can provide effective guarantee for manufacturing enterprises in transportation.

### *2.2.2. The government will create a low-carbon logistics development environment*

The development of low-carbon logistics cannot be achieved without the support and guidance of the government, and the policy support of the government promotes the development of low-carbon logistics in China's logistics enterprises. First of all, the government should formulate some effective laws and regulations to restrain some illegal ACTS in China's logistics industry, such as the harm to the environment, on the basis of understanding the development of logistics in China. In addition, the government should give certain subsidies to enterprises implementing low-carbon logistics, mobilize the enthusiasm of national logistics enterprises in the development of low-carbon logistics, and promote the implementation of low-carbon logistics in the whole country as soon as possible.

#### 2.2.2.1. Formulate relevant laws and regulations

The government's primary goal at this stage is to make China's logistics enterprises to achieve the development of low-carbon logistics. As China's logistics industry is relatively backward compared with developed countries, coupled with the lack of funds, it is difficult for some logistics enterprises to implement low-carbon logistics, so it is difficult to achieve the nationwide promotion of low-carbon logistics, at this time, it needs the macro-allocation of the government. In the context of understanding the development of China's logistics, relevant government departments have formulated relevant laws and regulations to give certain subsidies to the development of low-carbon logistics enterprises, and encourage more enterprises to join the ranks of low-carbon logistics development.

#### 2.2.2.2. Improve the service system in the transportation process

The government should supervise the service of logistics enterprises and make corresponding evaluation on their service regularly, so as to effectively improve the service quality of logistics enterprises. To improve the service system in the process of transportation, the government should establish a supply chain in line with the development of low-carbon logistics of logistics enterprises in China, realize market-oriented operation and trading of logistics enterprises' carbon emissions, and then promote the carbon emission to logistics enterprises nationwide after reaching the standard.

## **REFERENCES**

- [1] Qin,L.G., Zhu,K.K.(2016) Research on the Behavior of Logistics Enterprises from the perspective of Carbon emission Regulation -- A Game Analysis based on each participant. *Logistics Technology*, 41(09) : 40-43.
- [2] Ju,J.X. (2018) Countermeasures for the Development of Low-carbon Logistics in China from the Perspective of response . East China Jiaotong University.
- [3] Li,Y.D., Zhao,D.Z., Xia,L.J. (2013) An Evolutionary Game Model between Government and Core Enterprises in the context of low-carbon supply chain. *Statistics and Decision-making*,20 : 38-41.
- [4] Zhu,Q.H.,Dou,Y.J. (2007) Evolutionary game model between government and core enterprises in green supply chain. *Systems engineering theory and practice*,18(12) : 95-96.
- [5] Yang,H.X., Li,Y. (2009) Research on the Motivation of Enterprises implementing Green Logistics based on Game Theory . *Logistics Technology*, 34(6) : 30-32.
- [6] Li,S.H., Wang,X.J. (2014) Research on obstacles to the Green Development of Enterprise Logistics and countermeasures -- Analysis from the perspective of green participants of enterprise logistics. *Chinese management science*,22 (S1) : 788-793.
- [7] Li,C. (2008) Research on the Development Status and Countermeasures of Low-carbon Logistics in China. *Logistics Engineering and Management*, 40(02) : 1-3.
- [8] Li,C., Xie,F. (2016) China's low-carbon logistics development bottleneck and countermeasures. *Logistics engineering and management*, 38 (10) : 1-4.
- [9] Chen,Y. (2013) Research on low-carbon logistics strategy selection from the perspective of game play. *Railway transportation and economy*, 35 (06) : 89-92.
- [10] Qi,G. (2006) Social Transformation, Social Governance, and Social Response Mechanism Chain. *Journal of Southwest Normal University*, 20 (6) : 109-115.
- [11] Yao,G.X., Zhang,D.M., Xu,J., Dai,P.Q. (2016) Analysis on the evolution of low-carbon strategy development in logistics industry. *Jiangsu agricultural science*,44 (10):515-519.
- [12] Xing,H.S., Liu,K., Deng,Y.H.(2013) Research on the influence of government support on regional logistics enterprise cooperation. *Journal of Beijing jiaotong university: social science edition*, 12 (3) : 14-20.

- [13] Wang,Z.Z., Chen,G.Y. (2012) An Evolutionary Game Analysis of the Linkage Development between manufacturing and logistic. *China's Economic Problems*, 23(2) : 86-97.