

Analysis on the Connotation of Green Logistics

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Abstract. Green logistics which based on ecological environmental protection and sustainable development changed the unilaterally influencing relations between development and logistics, life of consumption and logistics, and it represented the future development direction and trend of logistics. Based on existing definitions of green logistics, this paper analyzed the connotation and related concepts of green logistics both in China and abroad and dissected the connotation of green logistics in aspects of objective, function, content, actors, etc. And the insufficiency of existing research results and future development direction were given on the basis of existing research results.

1. Introduction

In the current society, with the rapid development of economy, modern logistics activity has become increasingly frequent. At the same time, development of these two just affects each other. It is undeniable that development of modern logistics will promote economic development; meanwhile, rapid development of economy can also increase the logistics quantity. Therefore, they just supplement each other. With continuous development of economy, the demand for logistics increases continuously. Under the condition of high demand, many problems occur, such as urban traffic congestion, waste of resources and fuel consumption. Under such situations, the influence of logistics development on social environment is quite severe and it goes against sustainable development of economy in a new period. At present, people's environmental awareness increases gradually, and they begin to explore new logistics systems which can not only satisfy the demand of social development but also restrain the influence of logistics activity on environment. Thereby, "green logistics" emerges as the times require. "Green logistics" not only effectively improves the environment pollution problems of traditional logistics but also accords with the general trend of the current environmental protection. Therefore, it is the direction of future logistics development. As for study on "green logistics", a definition is proposed for green logistics in *Logistics Terms (GB/T 18354-2001)* published in 2001. However, the extensive logistics professionals lack a comprehensive understanding about green logistics and its characteristics. As a result, they cannot fully understand and even misunderstand green logistics, or some unnecessary faults might be caused. Therefore, it can provide reference for practical work of green logistics to strengthen cognition about green logistics and accurately comprehend the connotation of green logistics.

2. Existing Definitions of Green Logistics in China

"Green logistics" is a new concept proposed by some scholars in recent years. At present, no mature definition is formed for green logistics, and it is an environmental symbiotic logistics management system established from the angle of environment and sustainable development. Now China's national standards and some scholars have 5 definitions for green logistics (the latest literatures in the past three years are selected, and the results are given by summarizing and comparing the concepts, definitions and connotations of green logistics in the literatures).

1) Definition 1. According to *Logistics Terms (GB/T 18354-2001)* published in 2001, green logistics means to restrain environmental damage caused by logistics and to realize purification for logistics environment during the logistics process, so as to fully utilize the logistics resources.

However, in the latest *Logistics Terms (GB/T 18354-2006)* published in 2006, no definition of green logistics is given.

2) Definition 2. Rui-yan PAN and Fang LI (2014) [1] pointed out that green logistics referred to the logistics activity aiming to reduce environment pollution and resource consumption and to plan and implement logistics activities of transportation, storage, loading and unloading, distribution processing, distribution and packaging via advanced logistics technology.

3) Definition 3. Fu-jun LIU (2014) [2] indicated that logistics system responsible for the environment could be called green logistics, including greening of reverse logistics (waste disposal and recycling) and forward logistics (production, packaging, storage and transportation links). During the logistics process, we should try to avoid or restrain environmental damage in the logistics process, protect the environment, purify the logistics space, and take full advantage of logistics resources. All in all, green logistics means to save resources, protect the environment and enhance resource utilization rate. Its purpose is to realize unification for the interests of environment, society and economy, and to reach the goal of sustainable development.

4) Definition 4. Qi LI and Xiang-lin LI (2014) [3] pointed out that green logistics, also known as environmental protection logistics, meant to reduce environmental damage caused by logistics, enhance effective utilization of logistics resources, and realize greening of the entire supply chain as well as harmony between logistics and the human society & environment in all links of logistics operation and the whole process of logistics management.

5) Definition 5. Wei XIA (2014) [4] indicated that green logistics referred to the planning, control, management and implementation process for logistics system via advanced logistics technology and environmental management concept, trying to reduce resource consumption and pollutant discharge, to protect the environment, and to realize sustainable development. From the angle of management, green logistics means to connect the subject of demand for commodities with the supply subject for the interests of customers, and to realize effective and rapid transfer of commodity and service. On the one hand, it values suppression against the environmental damage caused by logistics in the logistics process; on the other hand, it tries to fully utilize logistics resources by continuously purifying the logistics environment, so as to realize the purpose of energy conservation and emission reduction.

Chinese scholars' definitions about green logistics include the following elements:

- ① Essence: Green logistics is an efficient logistics pattern of sustainable development;
- ② Core: To reduce resource consumption and pollutant discharge;
- ③ Purpose: To realize sustainable development;
- ④ Scope: All links of the entire logistics operation and the whole process of logistics management.

3. Foreign Related Concepts of Green Logistics

The foreign definitions of green logistics are as follows.

1) Definition 1. The Reverse Logistics Executive Council (1999) [5] defined green logistics as "attempts to measure and minimize the ecological impact of logistics activities".

2) Definition 2. J. P. Rodrigue et al. (2001) [6] divided the words and explained them separately and then put them together: "'Logistics' are at the heart of modern transport systems. As has been demonstrated earlier, the term implies a degree organization and control over freight movements that only modern technology could have brought into being. It has become one of the most important developments in the transportation industry. 'Greenness' has become a code-word for a range of environmental concerns, and is usually considered positively. It is employed to suggest compatibility with the environment, and thus, like 'logistics' is something that is beneficial. When put together the two words suggest an environmentally-friendly and efficient transport and distribution system."

3) Definition 3. A. Sbihi and R. W. Eglese (2007) [7] defined green logistics as “Green Logistics is concerned with producing and distributing goods in a sustainable way, taking account of environmental and social factors”.

4) Definition 4. Larsen et al. (2009) [8] defined green logistics as “efforts to measure and minimize the environmental impact of logistics activities, these activities include a proactive design for disassembly”. Activities that are dealt with in green logistics is measuring the environmental impact of different distribution strategies, reducing the energy usage in logistics activities, and reducing waste and managing its treatment.

5) Definition 5. M. Thiell et al. (2011) [9] defined green logistics as “green logistics consists of all activities related to the eco-efficient management of the forward and reverse flows of products and information between the point of origin and the point of consumption whose purpose is to meet or exceed customer demand”.

Different explanations are provided for Definition 1 to 5 according to the time sequence. According to different foreign scholars’ definitions, green logistics is actually a concept with rich connotation and wide extension. The expressions are different, but one point is the same: green logistics is a logistics pattern that meets the principle of sustainable development.

4. The Common Characters Analysis of the Green Logistics Concepts

By analyzing the concepts of green logistics at home and abroad, 6 indexes can be extracted to reflect the common part of green logistics concept: reduction of environment pollution, reduction of resource consumption, utilization of advanced logistics technology, closed loop, sustainability, and unification of economic benefit and environmental benefit.

Therefore, the concept of green logistics can be interpreted from the following five levels:

1) The core of green logistics is to reduce resource consumption and pollutant discharge. Abundant energy sources will be consumed in links of transportation, storage, packaging, loading and unloading, distribution processing, and information activity during the logistics activity. Thus energy shortage will be aggravated, logistics cost increased, and hazardous waste discharge increased. Except pursuing efficient logistics, green logistics also tries to enhance resource utilization rate, reduce the negative effects on environment, strengthen the purification effect of environment, and realize harmonious development between logistics activity and natural environment by adopting advanced technology and equipment.

2) The ultimate goal of green logistics is to realize sustainable development and cyclic utilization of resources. Different from the mode of traditional logistics, green logistics is based on the idea of sustainable development. Therefore, establishment of green logistics has dual attributes: social attribute and economic attribute. Establishment of green logistics mode is not only to satisfy the demands of contemporary logistics quantity as well as customers and enterprises, but also to realize the ultimate aim of environmental protection and resource conservation. Finally, it tries to realize harmony and unity between social benefit and economic benefit.

3) The activity range of green logistics covers the entire life cycle of product. The entire process of product life cycle, from raw material acquisition to production, circulation, consumption and abandonment, will cause influence on the environment. During green logistics system construction, environmental protection should be conducted in the logistics transportation process, so as to reduce the effect on environment to the largest extent in the product transportation and distribution process. On the other hand, during the product manufacturing, selling and recycling process, the green principle should also be followed. Green production technology should be adopted and scientific selling and recycling method must be applied, to realize the greening purpose in the whole process.

4) The behavior subject of green logistics includes government, enterprise and the public. Due to the trans-regional, cross-enterprise and multi-industry characters of logistics, realization of green logistics cannot do without supervision and management of the government. Implementation of green logistics requires support of government policy and restraint of laws and regulations. Therefore, government plays a decisive role in promoting development of green logistics, and it is one of the

behavior subjects of green logistics. The influence of logistics activity on environment runs through the entire life cycle, so all enterprises in the logistics process, including supplier, manufacturer, retailer and logistics companies, should be contained in the category of behavior subjects. Greening of logistics cannot be realized by simply relying on logistics companies. In addition, selection of the terminal public for green commodity and service will promote development of green logistics. If consumers have no green concept, green logistics will have no support, so the public is also an indispensable behavior subject of green logistics.

5) The construction principle of green logistics system is a sustainable, environmental and circular system. Green concept should run through the process of establishing green logistics, covering product manufacturing, transportation and waste recycling stage. Green logistics system is a circular logistics system centering on sustainable development that can promote harmonious development of economy, consumption life and ecological environment on the basis of meeting social and life demands.

At present, there is no universal definition for the meaning of green logistics in China and abroad, but there is a common part. In another word, green logistics has multi-layered connotations. It came into being for environmental protection and sustainable utilization of resources of the next generation on the basis of contemporary resource development and utilization. It refers to both green logistics activity of economic subjects (enterprises) and management of government and society for green logistics. At the same time, it also covers consumption activity that guides the consumers with green logistics concept. In another word, green logistics means to realize scientific management for logistics activity by applying green logistics management philosophy and advanced logistics technology means. Besides, environmental management is introduced into various systems of logistics industry, so as to strengthen environmental management and supervision in various links of custody, transportation, packaging, loading and unloading, and distribution processing during logistics. In this way, environmental pollution and energy waste caused by logistics development can be effectively checked, and high-quality logistics service will be provided for customers.

By combining with analysis about related concepts at home and abroad, this paper makes a definition for green logistics. Green logistics is the generic term of all logistics activities, from product manufacturing to abandonment, which can enhance resource utilization rate and reduce pollutant discharge via logistics technology progress and innovation by centering on harmonious development of economy, society and ecology on the basis of sustainable development concept.

5. Comparative Analysis of the Connotations of Traditional Logistics and Green Logistics

To better understand the connotation of green logistics, the comparison between traditional logistics and green logistics was given in aspects of functional elements, ultimate objective, actors and logistics system, as shown in Table 1.

Table 1 Comparison between Traditional Logistics and Green Logistics

	Traditional Logistics	Green Logistics
Functional Elements	Transportation, storage, packaging, loading and unloading, etc.	Resources intensiveness, green transportation, green storage, green packaging, waste recycling, etc.
Ultimate Objective	To achieve efficient logistics.	To achieve efficient and low-cost logistics to realize sustainable development.
Actors	Only the logistics enterprises	The government, enterprises (including logistics, manufacturing and distribution enterprises) and the public.
Logistics System	Forward logistics system	Green forward and reverse logistics systems

According to comparison between green logistics and traditional logistics:

1) In functional elements, traditional logistics only aims to realize simple transfer of commodities and meanwhile it has resulted in large consumption of resources and environment pollution. Green logistics not only has to realize greening of commodity storage and circulation process, but also needs to green the reverse logistics process of wastes.

2) In ultimate objective, traditional logistics sets realization of efficient logistics as the ultimate objective, and meanwhile it has caused environmental degradation. However, green logistics is based on logistics technology progress and innovation and aims to realize the ultimate objective of sustainable development. When pursuing efficient logistics, it can also gradually eliminate the influence of logistics process on the environment.

3) In actors, traditional logistics only has logistics enterprises as actors, so it is hard to realize integration and optimal configuration of resources. The actors of green logistics not only includes logistics enterprises but also covers upstream and downstream production and distribution enterprises in the supply chain. In this way, effective collaboration and resource integration can be realized, resource waste will be reduced, and resource utilization rate can be enhanced. At the same time, development of green logistics has to express the regulation and policy incentives of the government, and the public should also participate in it positively.

4) In logistics system, traditional logistics only considers forward logistics of resource exploitation, production and consumption, and neglects reverse logistics of cyclic utilization of wastes and renewable resources. However, with circulation characteristic, green logistics not only considers greening of forward logistics but also thinks about green reverse logistics system in the supply chain, including recycling of resource wastes, recycling of wastes, and collection of resource wastes.

6. Practical Applications and Relative Theories of Green Logistics

According to the connotation of green logistics, green logistics is a multi-layered concept. It not only includes green logistics activities of enterprises but also covers management, regulation and control of the society for green logistics activities. The research achievements about green logistics enterprises and government practice in China are as follows:

Cheng-xue YU and Xue-ting YANG (2008) [14] pointed out the flaws and risks of industrial symbiosis mode in the eco-industry park and constructed integrated management model of green logistics with composite entities of industrial enterprises. Its purpose is to overcome the flaws and risks of industrial symbiosis mode and enhance economic benefit and ecological benefit of enterprises. Ding-ding XIAO and Wen-feng ZHANG (2010) [15] made a quantitative analysis for key influence factors of green logistics covering three aspects which are enterprise, government and environment. They pointed out the core role of government in restraint and advocacy at the preliminary stage of green logistics development; enterprise was the key pivot for development of green logistics cause. Yi-ling ZHAO (2010) [16] analyzed the reasons why China's green logistics development lagged behind from the angle of economics: 3PL had no endogenous preference of supplying green logistics. By starting from externality theory, an institutional arrangement for 3PL to consciously realize green logistics was established. Yi-jun LIU and Pin PENG (2013) [17] considered that for green logistics development in China, institutional constraint green logistics could be set as the promotion mode, management improvement type could be set as the basis, and technology innovation type could be set as the development strategy. Besides, they proposed three major implementation approaches of green logistics system: legal institution and administrative means of the government as the dominant role, relevant economic means as specific execution, and producer responsibility extension system as the auxiliary.

In the process of logistics greening, internal and external subjects of logistics system have a series of games, including games between enterprises and enterprises, between government and enterprises, and in the aspect of customer perspective. Major research achievements about this aspect in China mainly cover the following ones. Qi-lei ZHOU et al. (2007) [18] analyzed game among various subjects of green logistics by applying game theory methods. Meanwhile, they proposed that the

government should strengthen the publicity force for green logistics, formulate evaluation criterion of green logistics, provide necessary fiscal subsidies for green logistics, and guide enterprises to participate in development for green logistics technology. Hao-xiong YANG and Yi LI (2009) [19] studied the motivation of enterprises to implement green logistics via game theory methods and analyzed the game behaviors between enterprises and enterprises as well as between enterprises and government. They gained that development of green logistics relied on stimulation of external factors like government supervision to a large extent. Liang DENG and Yan-xin SHI (2011) [20] proposed cooperative innovation game model of green logistics. They obtained that construction of “entrustment – agency” mechanism of green logistics enterprises should be strengthened in the cooperative process, and the industrial value chain must be established and perfected. Besides, the government should provide public service like information support and implement “green subsidy” policies.

7. The Insufficiency and Prospect of the Research

In conclusion, according to the connotation requirements of green logistics, by combining with the existing research achievements, research conclusions and existing problems of domestic and overseas scholars are mainly as follows:

1) According to the connotation of green logistics, green logistics refers to all logistics activities from product manufacturing to abandonment, including reverse logistics activity. Meanwhile, green logistics is an important part of green supply chain. Therefore, theories of reverse logistics and green supply chain are closely related to green logistics. However, scholars do not make an in-depth study and systematic organization for these aspects, and the theoretical basis of green logistics is not profound enough. Meanwhile, the existing green logistics research literatures often adopt qualitative research methods, and there are few quantitative research methods and methods of combining quantitative and qualitative researches. Moreover, there is a lack of relevant statistical data.

2) The ultimate objective of green logistics is to realize unification of interests in three aspects covering environment, society and economy, so as to realize sustainable development. At present, China’s green logistics studies mainly focus on issues in logistics and environment, while there are few studies about logistics, resource consumption and social development. No systematic study is made by unifying logistics, resource, environment and economic development.

3) According to the connotation of green logistics, government, enterprise and the public constitute behavior subjects of green logistics system in the operation process. They are driving forces for implementation and development of green logistics strategy. For different countries, regions and enterprises, there are different characteristics. However, most existing research achievements of green logistics are macroscopic analyses, and they have not carried out specific discussions for the uniqueness of green logistics. Therefore, there is a lack of comparison and analysis on differences. Only study based on differences can point out targeted and operable countermeasures. In analysis for existing problems of green logistics development, there are few studies and there is a lack of depth. Most studies stay on the following issues: green logistics technology lags behind, and green logistics idea enjoys popular support. In terms of the driving role of government in green logistics, the academic circle only makes a general analysis and the study is not deep enough.

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