

DPSIR Analysis for China's Logistics Industry

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Abstract: With the development of social economy, the logistics activities which derived from commodity exchange have developed into a huge industry under increasing demand. At the same time, the expansion of logistics industry has also deepened the deterioration of environmental resources and posed a serious threat to society. In the background of the initial stage of rapid development, this paper takes China's logistics industry as the object of analysis, carries out an overall analysis of the environment for sustainable development of China's logistics industry, highlights the current situation and problems of environmental sustainable development of China's logistics industry, and provides decision-making basis for the future development of green logistics based on DPSIR model.

1. Introduction

Since last century, frequent commodity exchange in human society has motivated the booming of logistics activities. With the development of social economy and traffic technology, its systematicness and timeliness have been gradually improved.

On the one hand, with the rapid economic growth, demand for logistics service is increasing and the scale of the industry is expanding. Logistics has become an important role of global economic development. Data from China Industry Network shows that the volume of domestic express delivery has increased rapidly in recent years, from 9.19 billion in 2013 to 3.28 billion in 2016, with an increase of 340.4% [1]. On the other hand, the continuous progress of society has brought about the deterioration of environmental resources, seriously threatening the survival and development of mankind, making people pay more and more attention to the use and protection of the environmental resources. Liu (2015) pointed out that the carbon emissions of China's logistics industry increased from 5932.84 million tons in 1996 to 136.05 million tons in 2009, by a percentage of 129.2%. There is a close relationship between economic growth, logistics development and carbon emissions. From the negative impact of traditional logistics activities on the environment, it can be seen that the logistics industry without sound management can no longer meet the requirements of sustainable development, it has become top priority to develop green logistics which considers the performance of environment. However, China's logistics industry is still in the rapid development stage which the economic benefits is most important, and the impact of logistics activities on environmental benefits has not been paid enough attention by the industry, due to the fact that China's research on the green development of the industry is still in its infancy,

lacking an analysis of the overall logistics environment development and strategy. Based on DPSIR framework, this paper makes an overall analysis of the environmental sustainable development of China's logistics industry, providing a methodological reference and decision-making basis for the future green development of logistics.

2. Green Logistics

The concept of green logistics originated in the 1970s, which is quite new. It derived from the related research of developed countries on improving the transportation efficiency and reducing the transportation cost of highway transportation [2]. Wang (2004) put forward that green logistics is to pursue economic benefits while taking into account social benefits and apply advanced logistics technology to the control and implementation of logistics activities [3]; Zhang (2007) stated that green logistics is circular, symbiotic and resource-saving logistics [4]; Xie and Wang (2010) pointed out that green logistics is a kind of logistics that can promote consumption and economic health as well as Sustainable development of logistics system [5]. In summary, this paper holds that green logistics can be understood as planning and implementing logistics activities such as transportation, warehousing, handling, circulation, processing, distribution and packaging with advanced logistics technology, aiming at reducing environmental pollution and resource consumption, and restraining all links from harming the environment in a series of processes, so as to purify the environment and to make logistics resources available. It is a new logistics system that can make the best use of it.

As one of the sunrise industries that profoundly affect the economic development of the 21st century, logistics industry plays a key role in all commodity exchanges and economic growth. Meanwhile, the negative effects can not be underestimated. For example, in the process of logistics, transportation cannot avoid producing harmful gases and noise and causes serious environmental pollution to human life. The packaging material has become the main component of municipal solid waste. On the one hand, its recycling consumes a large amount of social manpower and material resources. On the other hand, there are also soil and air pollution caused by difficult degradation or incineration in the treatment of overloaded waste. According to statistics, China's business volume of logistics in 2017 totaled 40.6 billion pieces, consuming 19.2 billion packaging boxes, 5.8 billion woven bags, 15 billion plastic bags and 30 billion meters of tape. It is roughly estimated that if 0.1 kg packaging material is used for each express, China will produce 4 billion kg of express packaging garbage every year. Therefore, we need to design a circular logistics pattern, from the perspective of overall and long-term interests, requiring enterprises to spontaneously reduce energy consumption, reduce pollution, rationally deal with waste, as well as improve efficiency and product recycling efficiency in the whole process of logistics. Compared with the traditional logistics, the environmentally-friendly protection, low entropy and recyclability of green logistics improve the efficiency of enterprises and society, reduce logistics costs, expand profit space, and implement the strategy of sustainable social and economic development, which better adapts to the trend of world economic and social development.

3. The analysis of DPSIR in China's Logistics Industry

With the trend of economic globalization, the competition among enterprises is becoming more and more fierce. The competition between enterprises has come to the competitions of supply chains, resulting in the "economic logistics" oriented solely by economic interests. While the logistics industry plays an important role in the supply chain, the scale expansion of the third-party industry is accompanied by many environmental problems, and the development of green logistics is imperative. This paper will analyze the environmental sustainability in logistics industry by using

the DPSIR framework, and explore feasibility and practical application of DPSIR framework in logistics industry.

4. Theoretical Overview of the DPSIR

4.1 Definition of DPSIR framework

DPSIR framework is recommended by the European Environment Agency (EEA) for the analysis and evaluation of integrated environmental strategies. DPSIR framework, as an indicator system to measure the environment and sustainable development, focuses the interaction between human and environmental systems from the perspective of system analysis. It divides the evaluation indicators that characterize a natural system into five types: driving force, pressure, state, impact and response, and divides them into several indicators in each type, as shown in Figure-1 [6]. Driving force refers to the pursuit of a certain kind of material or service by human beings, which will lead to changes in the ecosystem in the process of pursuing such material or service. Pressure is an activity with negative impact produced by human beings driven by driving force. State is the result of human exerting pressure on the environment. Influence is the current state of the environment on human health, welfare and economic conditions, etc. Impact is usually negative, and the response refers to the feedback of action taken when human beings are affected.

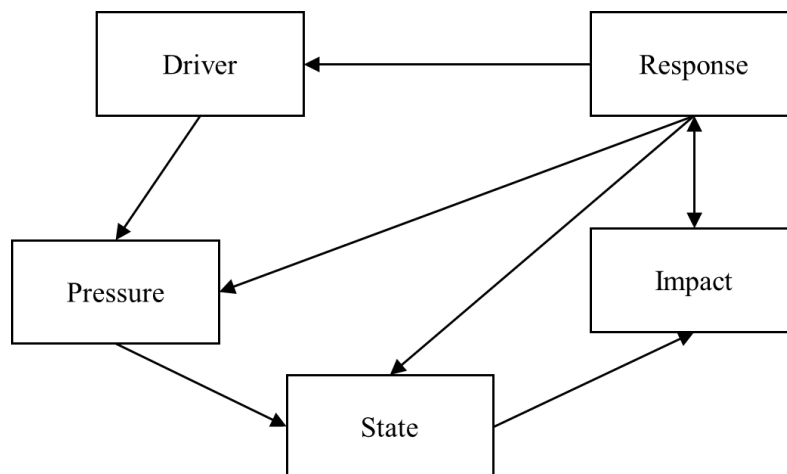


Figure 1: DPSIR framework

4.2 Application of DPSIR framework

DPSIR model is clear and concise, and has been widely used since it was proposed. A large number of theoretical and empirical studies show that DPSIR model has good quantitative analysis ability, especially in the real estate development zone land strength evaluation, natural resources performance evaluation and other aspects, being considered an undeniable industry benchmark. Xiong (2015) applied the DPSIR environmental management model of the European Environment Agency to the evaluation of new urbanization, described the relationship between ecological civilization and the coordinated development of new urban construction, and improved the scientific and operable planning recommendations [7]. Hou (2017) used DPSIR model to analyze the dynamic change of land ecological security pattern in cold mountainous areas under the background of the policy of returning farmland to forestry. He proposed that the slow-rising land ecological security level in the Mudanjiang Valley Basin in central China should be taken as a new key regulation area. In the same year, Wang and Shao (2017) also analyzed the factors of water

resources carrying capacity based on DPSIR framework to build a multi-factor basic index system of water resources carrying capacity in view of the fact that water resources in Fukang City of Xinjiang Autonomous Region are becoming increasingly scarce and the ecological environment is deteriorating. According to the analysis above, there are few studies applied the DPSIR framework into the logistics industry. In the next section, this paper will put DPSIR into the context of logistics industry in China, and analysis the whole scenario of environmental development of logistics.

5. Environmental Development of China's Logistics Industry

5.1 Driving forces

The motivation of green development of logistics industry arises not only from government policy and public attention, but also from within the industry. First of all, with the rapid pace of economic development, China's ecological problems have become increasingly serious since the opening up of international market, and the survival of mankind is also threatened. It is urgent to improve the ecological environment. Because logistics activities are closely related to people's production and life, and play an important role in human life, so solving the environmental problems in logistics plays an important role in ecological protection. At the same time, with the increase of population, the change of human life and production mode, the rapid development of economy and e-commerce have promoted the rapid development of logistics industry in China. Economic development and the growth of business pieces are the main driving forces for the development of express industry. Green logistics is an important mode to coordinate the logistics efficiency and ecology development, which is developed from a long-term and overall perspective.

Secondly, building a green logistics system is not just the superficial demand of low-carbon social development. In fact, it is the key to achieve "win-win" between enterprises and society, and it is also an inevitable choice for enterprises in future development. For a long time, Chinese enterprises have a wrong view that solving environmental problems will increase the operating costs of enterprises, increase the burden of enterprises, and affect enterprises to maximize profits. In fact, there is no essential contradiction between the solution of environmental problems and the development of enterprises themselves. Under appropriate conditions, the two will play a mutually reinforcing role. Under the green logistics mode, the "green" investment of enterprises will be rewarded from the social value (such as corporate image) and economic value (such as long-term high returns) of enterprises. In short, green logistics plays a supporting and promoting role in the sustainable development of natural resources and ecological environment, economy and society, and it is a necessary guarantee for human beings to embark on the road of sustainable development.

5.2 Pressures

Driven by economic development and social consumption demand, the logistics industry is facing increasing pressure on the scale of enterprises, and increasing environmental pressure in all aspects. In all aspects of closed-loop logistics, including transportation, warehousing, packaging, handling, distribution, circulation processing, logistics information and waste disposal, the links that have a greater impact on the environment are transportation, warehousing, packaging and waste disposal. The new transportation network and the extensive use of transportation tools undoubtedly greatly enhance the logistics capability of enterprises and speed up the logistics of the whole society. However, as one of the most important links in the logistics system, transportation has noise pollution (such as long-term linear noise sources along highways, railways, waterways and areas around airports) and air and water pollution (such as vehicle exhaust gas). Light and smoke, waste oil and diesel oil seeping into soil and water, etc. Chemical methods (such as spraying insecticides, smoking, etc.) and some special commodities (such as flammable, explosive and dangerous

chemicals) used in the maintenance of goods storage cause pollution and damage to the surrounding ecological environment due to improper storage explosion or leakage. In addition, packaging pollution and waste disposal pollution usually involve the over-exploitation and utilization of environmental resources and land resources respectively, which ultimately leads to a vicious circle.

5.3 States

Under the dual effects of driving force and pressure, the green development status of logistics industry is mainly from two aspects of industry economic scale and environmental sustainability. From the logistics industry itself, the relevant indicators of the current situation can be selected from the industrial scale and industrial structure of the logistics industry, mainly including the number of parcels, gross domestic product and so on. From the system level, it should also include social economy, ecological environment and other contents, and comprehensively elaborate the current situation brought about by the development of logistics industry. In recent years, China's e-commerce industry has developed rapidly, and the property industry closely related to it has also risen rapidly, becoming a torrent injecting into the world economy.

At present stage, the development status of China's logistics industry can be summarized from two aspects: the development speed is high while the industrial profits are declining with the expansion of the industry scale. From the first aspect, as one of the largest industries in China, the logistics industry has more than 10 trillion GDP annually, which plays a huge role in the development of the tertiary industry and has become an important support for the national economic development in some areas of China. It is reported that many coastal cities in eastern China have taken the development of logistics industry as the key area of the 13th Five-Year Plan, and issued various policies to encourage the development of logistics industry. Secondly, compared with the phenomenon of low logistics profit reflected by the small drop in unit price, the astonishing number of energy consumption in logistics industry which attracts more social attention is more intuitive. According to some research data, the energy consumption of logistics industry increased from 116,113,11,000 tons of standard coal in 2001 to 38,317,666,000 tons of standard coal in 2015, with a total increase of 26,704,555,000 tons; the carbon emissions of logistics industry increased from 65,368,900 tons in 2001 to 202,312,200 tons in 2015. Among them, the data after 2010 show that the growth rate of energy consumption has slowed down significantly, indicating that in recent years, while focusing on the rapid development of logistics industry, the concept of green logistics has played a certain role, and the quality and efficiency of energy consumption has also been improved.

5.4 Impacts

The current situation of logistics industry has a far-reaching impact on the environment, ecology and economic situation. Ecological environment is a necessary condition for the survival and development of human society. In the field of logistics, its economic value is mainly embodied in two aspects: first, the value of environmental resources directly entering the logistics system, such as land use, roads, railways, logistics centers, water and air transport, energy, raw materials and so on; second, the value of environmental resources indirectly participating in logistics activities, such as fresh air, suitable climate, etc. As a high energy consumption industry in China, the impact of logistics industry on the ecological environment is immeasurable. If the pollutants and wastes discharged by the logistics industry exceed the carrying capacity of environmental resources, the logistics activities will be restricted by the environment. At present, domestic energy, soil resources, water resources and per capita resources are far less than the international standards of other countries, and the development of green logistics still has a long way to go.

5.5 Response

Firstly, after entering the 21 century, China will take improving the ability of sustainable development and promoting the harmonious coexistence of man and nature as its important goal of development. Environmental policy has become an important pillar of national policy. In view of China's basic national conditions of large population, shortage of resources, small environmental capacity, fragile ecology, heavy economic structure and extensive mode of economic growth, a pilot project of green GDP accounting has been carried out in ten provinces to take environmental losses into account development costs, and a win-win development model of circular economy has been implemented to vigorously promote the development of resources, environment and employment economy.

Secondly, considering that the logistics industry is the basic and strategic industry to support the development of national economy, in recent years, the state's policy towards the logistics industry has become more and more benign guidance and strong support. In the "Twelfth Five-Year Plan for Energy Conservation and Emission Reduction" and the "Twelfth Five-Year Plan for Circular Economy Development" issued successively by the State Council in 2012, the requirements of promoting energy conservation in transportation and implementing green transportation were also put forward. On the other hand, all industry sectors are also actively responding to the call of this era. E-commerce, as an important support of logistics industry, is also increasing the importance of various indicators of this related industry. In recent years, Taobao and Jingdong have vigorously promoted green logistics, established and updated logistics system, improved the recycling and disposal channels of garbage in logistics industry, and improved the standardization level of e-commerce logistics.

In terms of organizational implementation and guarantee, the state has put forward five requirements for relevant departments to implement organizational implementation and guarantee measures, including strengthening the implementation of planning and organizational implementation, creating a good environment for development, strengthening and improving policy support, improving credit and supervision system, and improving the statistical monitoring system of e-commerce logistics.

6. Conclusions

Since the 21st century, the rapid rise of e-commerce has greatly promoted the development of logistics and other related industries. The development of logistics industry is facing tremendous opportunities and challenges. For a long time, extensive logistics industry has brought a lot of waste of environmental and economic resources. The transformation of a new green logistics system with environmental protection, low entropy and recyclability is the necessary condition for the further development of the industry. Based on DPSIR model, this paper makes a concrete analysis of the comprehensive environment of green development faced by China's logistics industry. Combining with the existing application scenarios of the DPSIR, the practicability of the framework applied to China's logistics industry is discussed, and the overall analysis of the environmental sustainable development of China's logistics industry is carried out. Innovative application of DPSIR theoretical framework to the logistics industry, through the gradual analysis of the driving force, pressure, current situation, impact and response of China's logistics industry, this paper highlights the current situation and problems of sustainable environmental development of China's logistics industry from a macro perspective, and provides implications to logistics service providers and supply chain members in the future development of sustainability.

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