

Research on the Development Strategy of E-Business Green Logistics Based on AHP

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Abstract. With the vigorous development of E-business in modern society, the logistics industry, which is closely related to it, has also developed rapidly. Background: while improving economic benefits, logistics Enterprises inevitably bring a series of problems, the most prominent of which is environmental pollution. Whether it is from packaging, express transportation, storage, waste of product resources, etc., it highlights the drawbacks of current logistics enterprises. Methods: in this paper, questionnaires were used to investigate and analysis of green logistics from multiple perspectives, and AHP was used to quantify the evaluation. Results: the evaluation index system of green logistics based on the E-business environment was established, and the evaluation standard of green logistics was established to measure the performance of green logistics. Conclusion: Based on the results of the questionnaire survey and AHP, the index evaluation system of green logistics under the E-business environment is established, and the development strategies and directions of green logistics under the E-business environment are proposed from the aspects of society, enterprises, policies, technology, etc.

1 Introduction

With the continuous development of Internet technology after the 1990s, E-business has developed rapidly [1]. Because it is more and more efficient, convenient, low-cost, user experience, and other characteristics, E-business will also have great development potential for a long time in the future. With the development of E-business, the logistics express industry associated with it has also flourished. The Chinese State Post Office released the express order data of logistics during the "double 11" period in 2017. The express business volume during the whole double 11 periods (November 11 - November 16) exceeded 1.5 billion pieces. In addition, relevant departments have also made statistics, including 13 billion plastic bags, 15 billion packaging boxes, 25.2 billion meters of sealing tape, and tens of millions of tons of carbon dioxide!

Green logistics (GL), also known as friendly logistics (EL), originated from the environmental factors considered in the logistics management research abroad in the 1970s, but unfortunately, it was only regarded as a secondary aspect of logistics management research at that time [2]. It was not until the environmental protection problem became popular in the 1990s that the whole society began to study green logistics on a large scale and consciously [3]. Economic level, urbanization rate, and transportation structure have a significant negative impact on the efficiency of green logistics. Logistics transportation intensity, logistics labor productivity, and scientific and technological innovation ability have a significant positive impact on the efficiency of green logistics [4]. The E-business logistics system dominated by the concept of economic and social new normal development must be a green ecosystem, which organically integrates consumers, suppliers, market regulators, financial traders, fiscal and tax systems, technology providers, etc., to achieve an agile, collaborative, low-

carbon professional logistics system. The establishment and operation of the green ecosystem of e-commerce logistics and the enhancement of its spatial benefits have attracted great attention from the government, industry, and enterprises [5].

In 2019, the total length of adhesive tape used in express packaging in China can surround the earth for 425 weeks, and in 2020, it has reached the peak point of parcel volume in the past decade [6]. In the future, with the development of E-business, the growth rate of logistics parcels will be more amazing, and the resulting huge amount of consumables and a large amount of parcel waste will affect the entire social environment and the quality of everyone's living environment. At present, the problem in the development of domestic green logistics is the lack of high-level green logistics talents, which is also accompanied by a low packaging rate of logistics enterprises, high logistics costs, backward logistics information technology, and imperfect logistics infrastructure construction [7]. Promoting the development of green logistics through technological innovation and industrial structure optimization, and forming the coordinated development and positive cycle of regional industrial structure optimization and upgrading, innovation emergence and green logistics development are the basic requirements for the transformation and upgrading of the economic development mode and the inevitable trend of the development of modern logistics industry, as well as an important topic to promote the high-quality and high-level development of the national economy [8].

Therefore, this paper aims to build a green logistics index evaluation system based on the analytic hierarchy process (AHP) in the E-business environment, and propose the development strategy and direction of green logistics in the E-business environment from the social, enterprise, policy, technology, and other aspects

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2 Materials and Methods

2.1. Research Development and Implementation

2.1.1 Research object

This survey selected staff of E-business logistics enterprises cooperating with the Guangzhou Institute of technology management and graduates of our school who are engaged in E-business logistics-related industries. The employment of graduates is concentrated in Guangdong Province. The survey uses the "questionnaire star" online survey platform to conduct an online questionnaire survey to collect data information. A total of 123 questionnaires were distributed, and 115 valid questionnaires were collected and recovered. The effective rate of the questionnaire was 93.49%, of which gender accounted for 56.54% and 43.46% respectively.

2.1.2 Research methods

The research method of this paper is mainly based on the questionnaire survey, using the analytic hierarchy process (AHP) to build the E-business green logistics indicator system. Through the questionnaire survey, we found four main information about green logistics:

(1) The awareness and concept of E-business green logistics need to be further strengthened. From the questionnaire collected in this survey, we can see that the respondents' awareness of green logistics is somewhat weak, accounting for 5.43% and 47.22% respectively, as shown in Figure 1, which reflects that the awareness of green logistics should be further strengthened in the future.

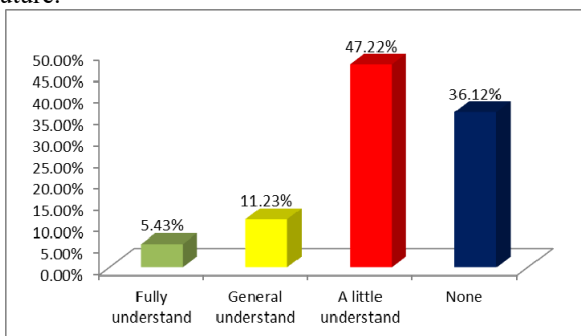


Fig. 1. Understanding of E-business green logistics awareness and concept.

(2) In terms of the monthly online shopping times of the surveyed people, as shown in Figure 2, 4-6 times are the most, which is equivalent to online shopping once a week. On the one hand, it shows the rapid development of E-business logistics, on the other hand, it shows the urgency of developing green logistics.

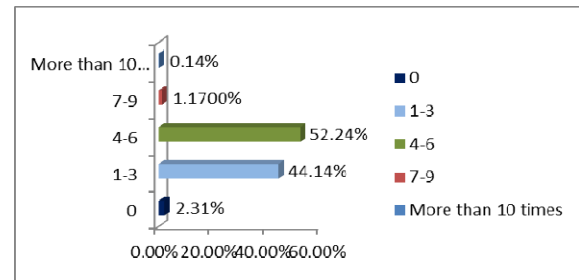


Fig. 2. Respondent's monthly online shopping times.

(3) There are many obstacles to promoting the implementation of green logistics. For example, this survey is shown in Figure 3 from the aspects of policy support, ideas, promotion technology, lack of talent, green logistics cost, etc., which are all factors that hinder the implementation of green logistics. Among them, the cost of green logistics accounted for 82.91% of the surveyed population, followed by the need to mobilize the ideas of green logistics, which accounted for 72.56%. The talent factor of green logistics accounts for the lowest 48.23% of the surveyed population.

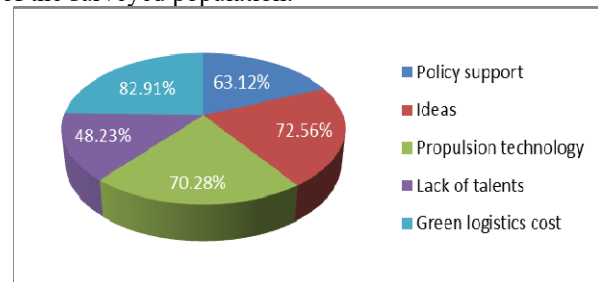


Fig. 3. Obstacles to promoting the implementation of green logistics.

(4) Among the feasible schemes investigated to realize the effective development of green logistics, as shown in Figure 4, the schemes of green packaging design, strengthening the research and development of green materials and technologies, using degradable materials for packaging, centralized processing of corner waste, setting up packaging recycling points, strengthening recycling, reasonably configuring distribution centers, and improving transportation efficiency are the most recognized.

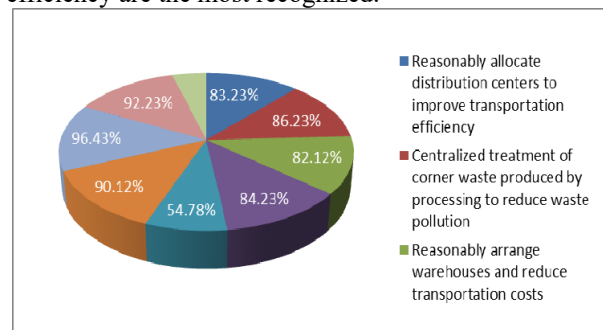


Fig. 4. Feasible scheme for effective development of green logistics.

2.2 E-business Green Logistics Performance Evaluation

2.2.1 Establishment of evaluation index system

This paper adopts the analytic hierarchy process (AHP), which has high reliability, few mistakes, and is more suitable for evaluation, and research methods with more nonquantitative indicators [9]. Analytic Hierarchy Process (AHP) is a systematic and hierarchical multi-objective decision-making analysis method, which is a combination of qualitative and quantitative analysis, proposed by T.L. Saaty, an American operations researcher, and others in the mid-1970s. In the practice of environmental science research, the AHP method is widely used in ecological security, environmental planning, regional carrying capacity, index system evaluation, and many other fields. The core of the AHP method is to quantify the experienced judgment of decision-makers, enhance the accuracy of decision-making basis, and it is more practical in the case of a complex target structure and lack of statistical data. Applying the AHP method to determine the weight of evaluation indicators is to comprehensively calculate the weight coefficient of indicators by comparing the relative importance of indicators at the same level based on establishing an orderly and hierarchical indicator system [10].

By consulting the relevant literature on E-business green logistics, referring to the green logistics index system built by scholar Leili Liu and improving it, a new E-business green logistics index system is established in Table 1 below.

Table 1. Composition of E-business green logistics index system

Target Hierarchy	Level 1 Index Level	Level 2 Index Level
Evaluation Of E-Business Green Logistics Index System	Industry Environment (A1)	E-Business Logistics Transportation Exhaust Emissions (B1)
		Non-Recyclable Waste From Packaging (B2)
	Industry Resources (A2)	Energy Consumption Of E-Business Logistics Industry (B3)
		Material Consumption Of Packaging And Other Logistics Activities (B4)
	National Economy (A3)	Gross National Product GNP (B5)
		Total Value Of Social Logistics (B6)
		E-Business Green Logistics Industry Asset Investment (B7)
	Logistics Technology (A4)	Investment In Advanced E-Business Logistics Equipment (B8)
		E-Business Green Logistics Modernization (B9)
		E-Business Green Logistics Talents And Level (B10)
	Policy Culture (A5)	Planning And Layout Of E-Business Green Logistics (B11)
		Relevant Systems And Policies (B12)
		People's Awareness And Concept Of Green Logistics In Social Life (B13)

2.2.2 Establishment of judgment matrix

For the construction of the judgment matrix, this paper uses the 1-9 scale weight method proposed by Professor Saaty to compare the quantitative values in pairs, as shown in Table 2 below, to compare the importance of indicators in pairs.

Table 2. Definition of quantitative value of importance between indicators

Comparison Between Index i and Index j	Quantized Value
Equally important	1
Slightly important	3
Relatively strong and important	5
Strongly important	7
Absolutely important	9
Intermediate value of two adjacent judgments	2,4,6,8
Reciprocal	$a_{ij}=1/a_{ji}$

In this paper, logistics staff working in school-enterprise cooperation and graduates majoring in logistics-related industries of E-business were selected to evaluate relevant indicators, collect opinions and sort them out. The judgment matrix is listed in table 3-8 below.

Table 3. Judgment Matrix A.

	A1	A2	A3	A4	A5
A1	1	3	5	6	4
A2	1/3	1	5	7	3
A3	1/5	1/5	1	5	3
A4	1/6	1/7	1/5	1	2
A5	1/4	1/3	1/3	1/2	1

Table 4. Judgment Matrix A1-B1\B2

A1	B1	B2
B1	1	2
B2	1/2	1

Table 5. Judgment Matrix A2-B3\B4

A2	B3	B4
B3	1	4
B4	1/4	1

Table 6. Judgment Matrix A3-B5\B6\B7

A3	B5	B6	B7
B5	1	5	3
B6	1/5	1	3
B7	1/3	1/3	1

Table 7. Judgment Matrix A4-B8\B9\B10

A4	B8	B9	B10
B8	1	7	3
B9	1/7	1	5
B10	1/3	1/5	1

Table 8. Judgment Matrix A5-B11\B12\B113

A4	B11	B12	B13
B11	1	7	4
B12	1/7	1	4
B13	1/4	1/4	1

2.2.3 Weight and consistency check calculation

The product of each row of vector elements of the above judgment matrix is geometrically averaged and then normalized. The obtained row vector is the weight vector.

a. Using the formula $\prod_{j=1}^n b_{ij}$ calculate the product

of each line, then calculate the geometric average, and then normalize it to obtain the weight of each index at each level.

$$W_A = (0.4634, 0.2907, 0.1289, 0.05628, 0.0607)$$

$$W_{A1-B1\B2} = (0.6666, 0.3334)$$

$$W_{A2-B3\B4} = (0.7388, 0.2612)$$

$$W_{A3-B5\B6\B7} = (0.6485, 0.2238, 0.1277)$$

$$W_{A4-B8\B9\B10} = (0.6795, 0.2204, 0.1001)$$

$$W_{A5-B11\B12\B113} = (0.7119, 0.1948, 0.0932)$$

b. The AHP method formalizes the expression and treatment of people's subjective judgments, and gradually eliminates subjectivity, to transform them into objective descriptions as much as possible. Its correctness and success depend on whether the objective elements can reach a reasonable level. Because of the complexity of objective things and the subjectivity of decision-makers understanding, consistency testing of the judgment matrix has become an indispensable link. Using the formula (1) maximum characteristic value $CI=(\lambda-n)/(n-1)$, find the corresponding analytic hierarchy process RI value.

$$\lambda_{max} = \sum_{i=1}^n \frac{[AW]_i}{nW_i} \quad (1)$$

Finally, the check value (2) was calculated, and the result was that all tests were less than 0.1, which passed the consistency test.

$$CR=CI/RI \quad (2)$$

3 Results

After the above calculation, the evaluation hierarchy weight of the E-business green logistics index system is obtained, as shown in Table 9 below.

Table 9. Evaluation hierarchy weight of E-business green logistics index system

Target Hierarchy	Level 1 Index Level	Level 2 Index Level	Total Weight
Evaluation Of E-Commerce Green Logistics Index System	Industry Environment (A1)	E-Commerce Logistics Transportation Exhaust Emissions (B1)	0.30890244
		Non-Recyclable Waste From Packaging (B2)	0.15449756
	Industry Resources (A2)	Energy Consumption Of E-Commerce Logistics Industry (B3)	0.21476916
		Material Consumption Of Packaging And Other Logistics Activities (B4)	0.07593084

National Economy (A3)	Gross National Product GNP (B5)	0.08359165
	Total Value Of Social Logistics (B6)	0.02884782
	E-Commerce Green Logistics Industry Asset Investment (B7)	0.01646053
Logistics Technology (A4)	Investment In Advanced E-Commerce Logistics Equipment (B8)	0.03824226
	E-Commerce Green Logistics Modernization (B9)	0.012404112
	E-Commerce Green Logistics Talents And Level (B10)	0.005633628
Policy Culture (A5)	Planning And Layout Of E-Commerce Green Logistics (B11)	0.04321233
	Relevant Systems And Policies (B12)	0.01182436
	People's Awareness And Concept Of Green Logistics In Social Life (B13)	0.00565724

4 Discussion

The greater the weight of each layer of factors affecting E-business green logistics, the greater the influence [11]. In the first level index level, the most influential factor is the industry environment, followed by the industry resource factor, the third is the national economic factor, the fourth is the policy and cultural factor, and the fifth is the green logistics technology. Among the secondary indicators, the largest impact is the emission of logistics and transportation, followed by the energy consumption of the logistics industry, and then the non-recyclable waste generated by packaging. The fourth place is the GDP, and the fifth place is the material consumption of packaging and other logistics activities. According to the above-mentioned Analytical Hierarchy Process (AHP) calculation and analysis results, the future development of E-business green logistics can be developed from the following aspects.

(1) From the perspective of the industry environment and industry resources, the waste gas emission of logistics transportation needs to be paid great attention [12]. The link that logistics causes the greatest pressure on the environment or is not green is transportation, followed by energy consumption, and then logistics packaging. Therefore, in terms of logistics transportation, energy consumption, and logistics packaging, we should strive to reduce carbon emissions and the use of non-renewable resources and try to use new energy vehicles. According to the first environmental, social and Governance Report 2021 (ESG) released by JD logistics, JD logistics will continue to optimize the storage technology in the park and improve the efficiency of energy recycling in 2021 by creating a dual-core power of "green infrastructure + carbon reduction technology innovation". Among them, JD logistics Xi'an "Asia one" intelligent logistics park has been certified as the first "zero carbon" logistics park in China. The concept of green logistics is put forward to meet the needs of the development of the times and make efforts for environmental protection from the perspective of the logistics industry. The development of green logistics meets the objective requirements of the scientific concept of development and is conducive to

improving the competitiveness of enterprises, and their market and image of their international competitiveness are enhanced. In the future, relevant E-business logistics enterprises can refer to JD's model to continuously improve and promote the development of E-business green logistics.

(2) From the perspective of the national economy, modern logistics is a powerful driving force for the development of a social economy. For example, from the 1980s to the 1990s, in Japan, the growth of the logistics industry by 2.6 percentage points will increase the total national economy of Japan by 1 percentage point based on the operating income of the logistics industry. At present, the green logistics promoted have the characteristics of resource conservation, low energy consumption, recyclability, and so on. This is in line with the core content and basic characteristics of the circular economy advocated by the national economy. Therefore, promoting E-business green logistics is a new economic growth point for a country or region, which helps to enhance the development momentum of the national economy and plays an irreplaceable role in reasonably coordinating the development framework of the national economy [13]. The logistics industry is a cross-industry and cross-sector comprehensive industry. The upgrading of industrial structure can bring the green transformation of the animal flow industry through the correlation effect of industry, region, industry, and sector. The upgrading of the industrial structure can also promote the aggregation of the logistics industry and related industries through the aggregation effect, form the scale effect of the logistics industry, and reduce the logistics cost, energy consumption, and pollution. In addition, the optimization and upgrading of industrial structure and the collaborative innovation of logistics enterprises have promoted the development of the tertiary industry, driven the upgrading of consumer demand, and thus promoted the development of green logistics. At the same time, the upgrading of the industrial structure will increase the investment in environmental protection, reduce the consumption of logistics energy, promote the reduction of carbon emissions in the logistics industry, and accelerate the development process of green logistics. In turn, the logistics industry centralizes some functions of transportation, communication, warehousing, and other industries, and also has a strong industrial correlation and spillover effect. Therefore, logistics can not only promote the common development of logistics links such as distribution and processing but also promote the development of transportation, information, and other industries. Green logistics reduces the impact of the logistics industry on the ecological environment and drives the development of a green economy by implementing energy conservation and emission reduction measures in all aspects of logistics [14].

(3) From the perspective of policy and culture, relevant national departments should carry out the planning and layout of E-business green logistics, promote E-business green logistics from the macro and micro levels, issue relevant policy documents, promote industries and enterprises to pay attention to green logistics, and gradually promote the public to form the awareness and con-

cept of green logistics in daily logistics activities. For the aspects involved in green logistics, including transportation, finance, taxation, environmental protection, etc., we will launch necessary supporting preferential policies to attract the whole society and relevant departments to participate in the construction of the E-business green logistics system. In addition, government departments should speed up the construction of an efficient and convenient information network system in the central and western regions, promote the construction of urban and rural logistics networks, build intelligent infrastructure service platforms such as roads and ports through the use of new technologies such as big data, 5G, and the Internet of Things, reduce the cost of highway traffic, continue to promote the institutional reform of toll roads, implement differentiated toll collection on highways, and reduce congestion in peak periods of highways, continuously improve the warehousing and transportation operation efficiency of logistics enterprises.

(4) From the perspective of green logistics technology, the economic profit level of different types of logistics enterprises in the modern logistics industry is quite different. For enterprises that prefer the product transportation and warehousing business of the traditional logistics supply chain, the logistics service mode and means are traditional and unitary, the management mode and information technology level are relatively backward, and the economic profit realized is low [15]. For integrated logistics enterprises that continuously integrate supply chain logistics resources and use information technology to improve logistics operation efficiency, they can obtain a higher profit share in the entire logistics industry. Therefore, on the one hand, we should increase the investment in advanced logistics equipment, improve the modern operation level of green logistics, and actively introduce new technologies related to green logistics. For example, Cainiao logistics currently releases the green logistics report: new technologies and new models lead to the great upgrading of environmental protection. In the report, Cainiao logistics combs the latest progress of green logistics in model innovation, technological achievements, etc. In terms of green logistics, it has been driven to a green mail road with the help of smart technology [16]. On the other hand, the whole education and logistics industry should cooperate to actively cultivate and develop several professional green logistics talent teams, encourage colleges and universities to cultivate logistics talents who are accurately connected with social needs, take green logistics as a compulsory course for E-business and Logistics Majors, pay attention to the cultivation of theoretical and practical skills, and provide high-quality talent guarantee for the development of E-business green logistics.

5 Conclusions

The development of E-business has led to the prosperity of the logistics industry. At present, under the deteriorating global environment, all walks of life are making efforts to protect the environment and contribute their strength. The logistics industry has also proposed to take

the road of green logistics. The paper describes in detail the analysis of green logistics from multiple perspectives through the method of a questionnaire survey, uses AHP to quantify the evaluation, and constructs a green logistics evaluation index system based on the E-business environment. This paper also constructs evaluation criteria for the performance of green logistics, which could help to pave the way for researchers and logistics practitioners explore the specific application of green logistics.

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