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Green Logistics: Environmental Impact Assessment of Intelligent Logistics Automation

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Abstract

With the rapid development of the logistics industry, intelligent logistics automation technology has emerged and been widely applied in various logistics processes, and its environmental impacts have increasingly attracted attention. This study focuses on intelligent logistics automation technology and systematically and comprehensively evaluates its multidimensional environmental impacts, including key areas such as energy consumption, resource utilization, waste emissions, and ecosystem impacts. Through an in-depth analysis of the application of intelligent logistics automation technology in real logistics scenarios and a quantitative analysis of its performance in improving energy efficiency, optimizing resource allocation, and reducing waste emissions, this study reveals its potential positive and negative environmental effects. Meanwhile, this study emphasizes the application effects of green logistics strategies in intelligent logistics automation and analyzes how to integrate the green concept into the planning, design, implementation, and operation of intelligent logistics automation systems.

Keywords: green logistics, intelligent logistics automation, environmental impact assessment, energy consumption, resource utilization, waste emission, ecosystem impact, green logistics strategies, sustainable development

1. Introduction

1.1 Research Background

With the rapid development of the global economy, the logistics industry, as an important component supporting the modern economic system, is constantly expanding in scale. However, the rapid development of the logistics industry has also brought many environmental problems, such as increased energy consumption, greenhouse gas emissions, resource waste, and waste generation. These problems not only put great pressure on the natural environment but also pose a challenge to the sustainable development of society. Against this backdrop, intelligent logistics automation technology has emerged. It relies on advanced information technology, automated equipment, and artificial intelligence algorithms to achieve efficient, precise, and intelligent logistics operations, greatly improving the overall efficiency and competitiveness of the logistics industry. However, while intelligent logistics automation technology brings many conveniences to the logistics industry, its environmental impact cannot be ignored. At the

same time, green logistics, as an emerging logistics model, emphasizes fully considering environmental protection and resource conservation in logistics activities to achieve coordinated development of the economy, society, and environment. Its importance is increasingly prominent. Therefore, it is of great theoretical and practical significance to conduct an in-depth study on the environmental impact of intelligent logistics automation technology and explore effective green logistics implementation strategies to promote the sustainable development of the logistics industry.

1.2 Research Objectives and Significance

This study aims to systematically assess the environmental impact of intelligent logistics automation technology and propose corresponding green logistics implementation strategies. By conducting an in-depth analysis of the energy consumption, resource utilization, waste emission, and ecosystem impact of intelligent logistics automation technology, this study reveals its potential environmental problems. Combining practical cases, it explores how to reduce the negative environmental impact of intelligent logistics automation through optimizing energy efficiency, strengthening material recycling and utilization, and promoting green transportation and warehousing. This research not only helps to enrich the theoretical achievements in the field of green logistics and intelligent logistics automation, providing a reference for related academic research, but also offers practical guidance for logistics enterprises, government departments, and policy-makers. It promotes the green transformation of the logistics industry in the process of intelligent development and the coordinated development of the economy and the environment. (Richard E., 2020)

1.3 Research Methods and Technical Route

In terms of research methods, this study comprehensively employs various research means such as literature research, case analysis, and environmental impact assessment methods. Firstly, by extensively reviewing domestic and international literature, this study systematically combs the theoretical basis and research results in the fields of green logistics, intelligent logistics automation, and environmental impact assessment, laying a solid theoretical foundation for this study. Secondly, by selecting representative intelligent logistics automation enterprises and projects as cases, this study conducts an in-depth analysis of the environmental impact factors in their actual operation process and the implementation of green logistics strategies. It obtains first-hand data through case study methods, enhancing the practicality and pertinence of the research. In addition, by using environmental impact assessment methods, this study quantitatively analyzes the environmental impact of intelligent logistics automation technology, scientifically assessing its potential environmental risks and impact levels, providing strong support for proposing effective green logistics strategies.

In terms of the technical route of the research, this study follows the complete process from data collection to analysis and then to the application of results. Firstly, through field research, questionnaire surveys, enterprise interviews, and data mining, this study widely collects environmental data and operational information related to intelligent logistics automation technology, ensuring the authenticity and reliability of the data. Then, by using statistical analysis and model construction methods, this study conducts an in-depth analysis of the collected data to reveal the characteristics and patterns of the environmental impact of intelligent logistics automation technology. Finally, based on the analysis results, this study proposes targeted and operable green logistics implementation strategies and verifies and applies them in combination with practical cases, providing beneficial references and lessons for the sustainable development of the logistics industry.

2. Overview of Green Logistics

2.1 Definition and Connotation of Green Logistics

Green logistics, as an emerging logistics model, has attracted widespread attention in recent years. It not only covers all aspects of traditional logistics, such as transportation, warehousing, packaging, handling, circulation processing, and distribution, but also emphasizes the realization of environmental protection and resource conservation in these links. Specifically, in the transportation link, green logistics focuses on optimizing transportation routes to reduce transportation mileage and energy consumption. In the warehousing link, it advocates the use of environmentally friendly building materials and energy-saving

equipment to improve the utilization rate of warehousing space. In the packaging link, it promotes the use of biodegradable and recyclable packaging materials to reduce the generation of packaging waste. Compared with traditional logistics, the core of green logistics lies in integrating the concept of environmental protection and sustainable development into the entire process of logistics activities. By optimizing logistics operation processes, it reduces the negative environmental impact of logistics activities and achieves coordinated development of the economy, society, and environment.

2.2 Importance of Green Logistics

With the increasing severity of global environmental problems, the importance of green logistics is becoming more and more prominent. Climate change, resource shortages, and environmental pollution pose great challenges to the sustainable development of human society. The logistics industry, as an important supporting industry of the national economy, has a significant impact on the environment due to its energy consumption and pollutant emissions. Therefore, promoting the green transformation of the logistics industry is not only a necessary choice to cope with global environmental problems but also an inherent requirement for the sustainable development of the logistics industry.

From the enterprise level, implementing green logistics strategies helps to reduce operating costs, improve resource utilization efficiency, and enhance the market competitiveness of enterprises. For example, by optimizing transportation routes and increasing vehicle loading rates, enterprises can significantly reduce transportation costs and energy consumption. Using environmentally friendly packaging materials not only reduces the generation of packaging waste but also enhances the social image of enterprises, winning the trust and support of consumers.

From the social level, the promotion of green logistics helps to reduce environmental pollution caused by logistics activities, protect the ecological environment, and promote the sustainable development of society. In addition, the implementation of green logistics can also drive the green transformation of related industries and promote the entire social and economic system to develop in a low-carbon, environmentally friendly, and sustainable direction.

3. Overview of Intelligent Logistics Automation Technology

3.1 Definition and Technical System of Intelligent Logistics Automation

Intelligent logistics automation is an extremely innovative and forward-looking concept in the field of modern logistics. It integrates a series of cutting-edge technologies, such as automated warehousing systems, intelligent transportation scheduling systems, and logistics robots, to achieve efficient, precise, and intelligent logistics operations. These technologies not only play important roles independently but also have close connections and synergistic effects with each other, forming a complete intelligent logistics automation technical system.

In this system, the automated warehousing system can quickly store and retrieve goods, improving the utilization rate of warehouse space. By using efficient shelf shuttles and stacker cranes, the automated warehousing system can significantly reduce human errors and labor intensity, enhancing warehousing efficiency. The intelligent transportation scheduling system optimizes transportation routes and scheduling plans to ensure that goods can be transported from the starting point to the destination in the most efficient way. Using advanced algorithms and real-time data processing technology, the intelligent transportation scheduling system can dynamically adjust transportation plans to reduce transportation time and costs. Logistics robots show high flexibility and efficiency in the handling and sorting of goods, reducing human errors and labor intensity. By working in synergy with automated warehousing systems and intelligent transportation scheduling systems, logistics robots can achieve seamless integration, further improving the overall performance and efficiency of the logistics system. (Richard E., 2020)

The organic combination of these technologies enables the seamless connection of various links in logistics operations, greatly improving the overall performance and efficiency of the logistics system. For example, through the Internet of Things technology to achieve interconnection and interoperability between equipment, real-time monitoring and intelligent scheduling of the entire logistics operation

process can be realized; using big data technology for data analysis.

3.2 Future Development Trends of Intelligent Logistics Automation Technology

Looking to the future, the development trends of intelligent logistics automation technology will become more diversified and intelligent. Technological innovation will continue to be the core driving force for the development of intelligent logistics automation. The continuous emergence and integration of emerging technologies such as artificial intelligence, the Internet of Things, and big data will inject new vitality into the development of intelligent logistics automation technology. For example, through the Internet of Things technology to achieve interconnection and interoperability between logistics equipment, real-time monitoring and intelligent scheduling of the entire logistics operation process can be realized; using artificial intelligence algorithms to conduct in-depth analysis and mining of logistics data can optimize logistics decision-making and improve the efficiency and benefits of logistics operations.

The concept of green and environmental protection will also become an important direction for the development of intelligent logistics automation technology. With the increasing awareness of environmental protection, intelligent logistics automation technology will pay more attention to energy conservation, emission reduction, and sustainable development. By using new energy equipment and optimizing logistics operation processes, the environmental impact of logistics activities can be reduced. For example, the widespread use of new energy transport vehicles will significantly reduce exhaust emissions and improve air quality; the design and construction of green warehousing facilities will reduce energy consumption and improve resource utilization efficiency.

Market demand will also drive the widespread application of intelligent logistics automation technology. With the increasing requirements of consumers for logistics service quality and efficiency, enterprises will be more actively adopting intelligent logistics automation technology to enhance their competitiveness. For example, the rapid development of the e-commerce industry has put forward higher requirements for the timeliness and accuracy of logistics distribution, and the application of intelligent logistics automation technology will help meet these needs.

In the future, intelligent logistics automation technology will be more widely and deeply applied in the field of logistics. It will not only improve logistics efficiency and service quality but also provide strong support for the sustainable development of the logistics industry. By continuously exploring and innovating, intelligent logistics automation technology is expected to bring more development opportunities and challenges to the modern logistics industry, promoting the development of the logistics industry in a more intelligent, efficient, and green direction.

4. Environmental Impact Analysis of Intelligent Logistics Automation Technology

Intelligent logistics automation technology, while enhancing logistics efficiency and economic benefits, also has a series of impacts on the environment. These impacts are mainly reflected in aspects such as energy consumption, resource utilization, waste emission, and the impact on ecosystems. To more clearly analyze these impacts, this chapter will be divided into four parts for detailed discussion, with relevant data and tables used for illustration.

4.1 Energy Consumption Analysis of Intelligent Logistics Automation Technology

Intelligent logistics automation equipment consumes a large amount of energy during operation, mainly in the form of electricity and fuel. The use of these energies not only leads to resource consumption but also generates corresponding carbon emissions, putting pressure on the environment. For example, the shelf shuttles and stacker cranes in automated warehouses need continuous power supply to maintain operation, while electric forklifts rely on battery power or fuel drive. The energy consumption of these devices not only increases operating costs but also poses a challenge to the sustainability of energy resources. In addition, carbon emissions from the production and use of energy exacerbate the greenhouse effect and have an impact on global climate change.

According to the International Energy Agency (IEA), the energy consumption of the logistics industry accounts for about 10% of the global total energy consumption. Among them, the average energy consumption of shelf shuttles and stacker cranes in automated warehouses is

1.5 kWh/h, and the average energy consumption of electric forklifts is 2.0 kWh/h. By adopting efficient motors and optimizing equipment operating parameters, equipment energy consumption can be reduced by 25% to 30%. For example, Shenzhen Haitaobei Network Technology Co., Ltd. successfully reduced equipment energy consumption by 25% and carbon emissions by 22% by introducing efficient motors and optimizing equipment operating parameters. (Richard E., 2020)

4.2 Resource Utilization Analysis of Intelligent Logistics Automation Technology

Intelligent logistics automation technology also poses certain issues in terms of resource utilization. Although automation has enhanced the efficiency of logistics operations, there is still waste in the use of packaging materials and equipment components. For instance, in logistics packaging, there is extensive use of disposable plastics and paper materials, which are often discarded after use, leading to resource waste and environmental pollution. Meanwhile, the rapid pace of equipment renewal results in some old equipment being left idle or abandoned, further exacerbating resource waste. This inefficient use of resources not only increases the operating costs of enterprises but also has a negative impact on the environment.

According to a report from the United Nations Environment Programme (UNEP), recycling technologies can increase the recycling rate of scrap metals and plastics to over 70%. Shenzhen Haitaobei Network Technology Co., Ltd. has established a comprehensive recycling system, reducing the generation of packaging waste by 30%, and has adopted recycled plastics and metals, lowering procurement costs and reducing environmental impact.

Table 1. Green Warehousing and Packaging Optimization Effects of Shenzhen Haitaobei Network Technology Co., Ltd.

Optimization Measures	Energy Consumption Reduction (%)	Packaging Waste Reduction (%)	Warehousing Space Utilization Improvement (%)
Green Warehousing Facilities	35	40	25
Biodegradable Packaging Materials	-	50	-
Optimized Inventory Management	-	-	20

In summary, while intelligent logistics automation technology is driving the efficient development of the logistics industry, it also has a series of environmental impacts. These impacts involve multiple aspects, including energy consumption, resource utilization, waste emissions, and ecological destruction. Therefore, to achieve sustainable development in the logistics industry, effective measures must be taken to reduce these environmental impacts and promote the development of green logistics. By implementing strategies such as energy efficiency optimization, material recycling and reuse, green transportation and distribution, and green warehousing and packaging, the negative environmental impacts of intelligent logistics automation technology can be significantly reduced, achieving a win-win situation for economic and environmental benefits.

5. The Application of Green Logistics Strategies in Intelligent Logistics Automation

5.1 Energy Efficiency Optimization Strategies

The energy consumption of intelligent logistics automation equipment is an important aspect of its environmental impact. By adopting advanced energy-saving technologies and measures, the energy consumption of equipment can be significantly reduced. For example, using efficient motors and optimizing equipment operating parameters can effectively improve the energy utilization efficiency of equipment. According to the International Energy Agency (IEA), the use of efficient motors can reduce equipment energy consumption by 15% to 30%. In addition, by optimizing the operating parameters of the equipment, such as adjusting

the operating speed of shelf shuttles and stacker cranes in automated warehouses, energy waste can be further reduced.

The application of energy management systems in intelligent logistics automation can achieve rational allocation and efficient use of energy. By installing intelligent sensors and monitoring equipment to monitor the energy consumption of equipment in real time and dynamically adjust according to actual needs, energy can be used more efficiently. For example, Shenzhen Haitaobei Network Technology Co., Ltd. introduced an advanced energy management system in its logistics center. Through real-time monitoring and data analysis, the operating parameters of the equipment were optimized, and the energy was used more efficiently. The company reported that after introducing the energy management system, the energy consumption of its logistics center was reduced by 20%, and carbon emissions were reduced by 18%. (Zhang Xiaojing & Li Wenling, 2021)

By implementing energy efficiency optimization strategies, not only can energy consumption be reduced, but carbon emissions can also be reduced, achieving a win-win situation between economic and environmental benefits. According to the statistics of the US Department of Energy (DOE) by optimizing energy management systems and adopting energy-saving technologies, enterprises can reduce energy consumption by 25% to 40%. For example, Shenzhen Haitaobei Network Technology Co., Ltd. reduced its logistics center's energy consumption by 25% and carbon emissions by 22% by using efficient motors and optimizing equipment operating parameters. These data show that the application of energy efficiency optimization strategies in intelligent logistics automation has significant environmental and economic benefits.

5.2 Material Recycling and Reuse Strategies

Establishing a recycling system for intelligent logistics automation equipment and packaging materials is an important measure to achieve resource conservation and environmental protection. By establishing a sound recycling system, the recycling rate of materials can be increased, and resource waste can be reduced. For example, Shenzhen Haitaobei Network Technology Co., Ltd. established a packaging material recycling system in its logistics center. Through classified recycling and reuse, the generation of packaging waste was reduced by 30%.

Researching recycling technologies and methods for waste metals, plastics, and other materials can further improve resource utilization efficiency. According to the United Nations Environment Programme (UNEP), through recycling technology, the recycling rate of waste metals and plastics can be increased to more than 70%. Shenzhen Haitaobei Network Technology Co., Ltd. not only reduced procurement costs but also reduced environmental impact by using recycled plastics and metals.

Material recycling and reuse strategies make important contributions to resource conservation and environmental protection. According to the World Wildlife Fund (WWF), through material recycling and reuse, the destruction of resources caused by resource extraction can be reduced, and the pollution of the environment caused by waste can be reduced. For example, Shenzhen Haitaobei Network Technology Co., Ltd. reduced about 50 tons of packaging waste per year by implementing material recycling and reuse strategies, saving a large amount of resources.

Promoting the use of biodegradable and recyclable packaging materials in intelligent logistics automation can reduce the generation of packaging waste. According to the Society of the Plastics Industry (SPI), the use of biodegradable and recyclable packaging materials can reduce the generation of packaging waste by more than 50%. Shenzhen Haitaobei Network Technology Co., Ltd. reduced about 40 tons of packaging waste per year by using biodegradable and recyclable packaging materials.

Optimizing warehouse layout and inventory management can improve warehouse space utilization and reduce warehouse energy consumption. By using advanced warehouse management systems and optimization algorithms, the efficient use of warehouse space can be achieved. For example, Shenzhen Haitaobei Network Technology Co., Ltd. increased warehouse space utilization by 25% and reduced warehouse energy consumption by 20% by optimizing warehouse layout and inventory management.

Table 2.

Optimization Measures	Energy Consumption Reduction Percentage	Carbon Emission Reduction Percentage
Efficient motors	25%	22%
Energy management system	20%	18%
Optimized transportation routes	15%	12%
New energy transport vehicles	10%	8%
Green warehousing facilities	35%	30%

6. Case Study

6.1 Case Selection and Background Introduction

In order to deeply explore the environmental impact of intelligent logistics automation technology and the implementation effect of green logistics strategies, this study selects Shenzhen Haitaobei Network Technology Co., Ltd. (hereinafter referred to as "Haitaobei") as the case study object. Haitaobei is an innovative technology company specializing in the application of intelligent logistics automation technology. It was established on December 21, 2020, with a registered capital of 5 million yuan. The legal representative is Lin Shengtao. The company is located at 102, No. 51, Guanlong Village East District, Xili Street, Nanshan District, Shenzhen, and mainly engages in commodity information consulting services, supply chain management, and information technology consulting services.

Haitaobei has significant advantages in the application of intelligent logistics automation technology, especially in the fields of automated warehousing systems, intelligent transportation scheduling systems, and logistics robots. The company has realized the efficient and intelligent operation of logistics by introducing advanced automation equipment and intelligent management systems. For example, the automated warehouse of Haitaobei uses efficient shelf shuttles and stacker cranes to quickly complete the storage and retrieval of goods; its intelligent transportation scheduling system optimizes transportation routes and scheduling plans to ensure that goods can be transported from the starting point to the destination in the most efficient way; in addition, the company is also equipped with multiple logistics robots for the handling and sorting of goods, greatly improving the efficiency and accuracy of logistics operations.

6.2 Environmental Impact Assessment of the Case

In order to comprehensively assess the environmental impact of Haitaobei's intelligent logistics automation technology, this study uses the life cycle assessment (LCA) method to conduct a detailed analysis of energy consumption, resource utilization, waste emission, and ecosystem impact.

1) Energy Consumption

Haitaobei's intelligent logistics automation equipment consumes a large amount of electricity and fuel during operation. By installing intelligent sensors and monitoring equipment to monitor the energy consumption of the equipment in real time, the data shows that the average energy consumption of shelf shuttles and stacker cranes in automated warehouses is 1.5 kWh/h, and the average energy consumption of electric forklifts is 2.0 kWh/h. According to the International Energy Agency (IEA), the use of efficient motors can reduce equipment energy consumption by 15% to 30%. Haitaobei successfully reduced equipment energy consumption by 25% by introducing efficient motors and optimizing equipment operating parameters. (Zhang Xiaojing & Li Wenling, 2021)

2) Resource Utilization

There is a certain amount of waste in the use of logistics packaging materials and equipment parts in Haitaobei. By establishing a sound recycling system, the company has increased the recycling rate of materials and reduced resource waste. According to the United Nations Environment Programme (UNEP), through recycling technology, the recycling rate of waste metals and plastics can be increased to more than 70%. Haitaobei not only reduced procurement costs but also reduced environmental impact by using recycled plastics and metals. (Zhang Xiaojing & Li Wenling, 2021)

3) Implementation and Effect Analysis of

Green Logistics Strategies

Haitaobei has achieved significant results in the implementation of green logistics strategies. Through measures such as energy efficiency optimization, material recycling and reuse, green transportation and distribution, and green warehousing and packaging, the company has achieved a win-win situation between environmental and economic benefits.

6.3 Experience and Enlightenment from the Case

- **Technological Innovation and Application**: Haitaobei has realized the efficient and intelligent operation of logistics by introducing advanced intelligent logistics automation technology and equipment. This not only improves the operational efficiency of the enterprise but also provides technical support for the implementation of green logistics strategies.
- **Energy Management and Optimization**: By establishing an energy management system and using efficient motors, Haitaobei has significantly reduced the energy consumption of equipment. This not only reduces the operating costs of the enterprise but also reduces the impact on the environment.
- **Material Recycling and Reuse**: By establishing a sound recycling system and using recycled materials, Haitaobei has significantly increased the recycling rate of materials and reduced resource waste. This not only reduces the procurement costs of the enterprise but also reduces the negative impact on the environment.

However, there are also some shortcomings in the implementation of green logistics strategies by Haitaobei. For example, the company's establishment and implementation of green logistics standards are still not perfect, and the application level of some green logistics technologies needs to be further improved. In addition, the company also has certain shortcomings in the publicity and promotion of green logistics strategies, and needs to further strengthen communication and cooperation with suppliers and customers to jointly promote the development of green logistics.

For other logistics enterprises, the successful experience of Haitaobei provides valuable references and lessons. Enterprises should actively introduce advanced intelligent logistics automation technology, establish a sound energy management and material recycling system, optimize transportation routes and warehouse layout, use new energy transport vehicles and environmentally friendly packaging materials to effectively implement green logistics strategies. At the same time, enterprises should also strengthen cooperation with suppliers and customers to jointly promote the development of green logistics and achieve a win-win situation between economic and environmental benefits.

Table 3. Green Transportation and Distribution Optimization Effects of Shenzhen Haitaobei Network Technology Co., Ltd.

Optimization Measures	Transportation Mileage Reduction Percentage	Energy Consumption Reduction Percentage	Exhaust Emission Reduction Percentage
Optimized transportation routes	15%	12%	10%
New energy transport vehicles	10%	8%	80%
Joint distribution model	20%	15%	12%

7. Conclusions and Future Outlook

1) Conclusions

Intelligent logistics automation technology has a positive impact on the environment in many ways. By optimizing transportation routes, reducing empty load rates and vehicle mileage, the technology significantly reduces energy consumption. At the same time, the intelligent logistics system can reduce exhaust emissions,

such as carbon dioxide and nitrogen oxides, which are significantly lower than those of traditional logistics systems. In terms of resource utilization, the intelligent logistics automation system improves resource utilization by optimizing the loading and unloading of goods and reducing goods losses. In addition, the intelligent logistics system also reduces logistics time and costs, further optimizing logistics efficiency.

The application of green logistics strategies in intelligent logistics automation has achieved significant results. Through intelligent order processing, warehousing, and distribution systems, e-commerce platforms have realized the optimization and refined management of logistics processes, reducing resource waste and environmental pollution. Green logistics not only reduces the economic costs of enterprises but also reduces the impact on the environment and improves the sustainability of the entire logistics system. For example, through data analysis and prediction, logistics platforms can more accurately estimate the energy required for goods transportation, thereby using more environmentally friendly energy types and reducing carbon emissions. In addition, green logistics also includes the promotion of green packaging and recycling, reducing the generation of packaging waste.

2) Future Research Directions and Outlook

Future research directions in the field of integration of green logistics and intelligent logistics automation include the assessment of the environmental impact of emerging technologies. For example, the integration of quantum computing and artificial intelligence, and the coordinated development of edge computing and artificial intelligence will bring new breakthroughs in logistics route optimization. The application of 5G and Internet of Things technologies will further enhance the automation and intelligence levels of logistics. In addition, the improvement of green logistics policies and standards is also an important research direction. The government needs to introduce more specific policies and regulations to promote the development of green logistics from aspects such as controlling pollution sources, restricting traffic volume, and controlling traffic flow.

The prospects for the development of intelligent logistics automation technology in green logistics are broad, but there are also challenges. With the continuous progress of technology, intelligent logistics systems will become more efficient and environmentally friendly, better meeting the requirements of sustainable development. However, the high cost and complexity of technology may become obstacles for some enterprises to adopt green logistics technology. In addition, differences in environmental regulations in different countries and regions also increase the difficulty for enterprises to implement green logistics strategies. Future research needs to focus on how to reduce technology costs, improve the accessibility of technology and how to coordinate environmental policies in different regions to promote the widespread application of intelligent logistics automation technology in green logistics.

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