Evaluation and Analysis of Green Supply Chain Management in New Energy Vehicle Enterprises Based on the Analytic Hierarchy Process

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Abstract

Against the backdrop of accelerating green development principles, domestic automotive manufacturers continue to confront systemic challenges such as underdeveloped environmental awareness, inefficient resource utilization, and significant pollution from logistics activities. Focusing on these industry-wide pain points, this research adopts Company B as a representative case to investigate pathways for sustainable transformation. By integrating the Analytic Hierarchy Process (AHP) with expert scoring methodology, the study systematically diagnoses key environmental bottlenecks within the supply chain and establishes a clear priority sequence for corrective actions. Based on the analytical results, targeted optimization strategies are proposed, including the introduction of IoT-based real-time energy monitoring systems, the establishment of reusable packaging cycles to reduce logistics waste, and the implementation of a green performance rating mechanism for suppliers to promote coordinated eco-friendly governance across the entire chain. The findings provide actionable guidance for Company B and other industry players to enhance green supply chain management, while contributing meaningful insights to the broader pursuit of ecological and sustainable development in the industrial sector.

Keywords

Sustainable Development, Green Supply Chain, Analytic Hierarchy Process (AHP)

1. Introduction

The "New Energy Vehicle Industry Development Plan (2021-2035)" represents a cornerstone policy document formally promulgated by the General Office of the State Council in 2020. This comprehensive blueprint establishes a clear strategic pathway aligned with China's "dual-carbon" objectives (peaking carbon emissions by 2030 and achieving carbon neutrality by 2060), aiming to steer the new energy vehicle (NEV) sector towards high-quality and sustainable development [1]. A critical early implementation measure mandates that, starting from 2021, within National Ecological Civilization Pilot Zones and key regions for air pollution prevention and control, no less than 80% of newly added or replaced vehicles in public transport, taxi, and logistics sectors must be new energy vehicles. This directive accelerates the electrification of public mobility.

The plan outlines ambitious medium to long-term market penetration targets. By 2025, NEVs are projected to constitute 20% of total new vehicle sales in China, signaling a significant market transition. Looking further ahead to 2035, the vision is for battery electric vehicles (BEVs) to become the dominant vehicle technology [2], with a comprehensive transition to electrification across all public sector fleets. To underpin this massive infrastructural shift, the plan explicitly advocates for the parallel development of battery swap models and charging infrastructure, aiming to enhance user convenience and alleviate range anxiety, which are crucial for widespread adoption.

Guided by this policy framework, China's NEV industry is undergoing a profound transformation, actively building a green supply chain that spans the entire product lifecycle. This integrated approach encompasses green design, material sourcing, manufacturing, sales, transportation, usage, and end-of-life recycling [3]. Green design forms the foundational stage, focusing on optimizing vehicle chassis for lightweighting, enhancing window glazing for thermal efficiency, refining aerodynamics, and developing efficient driving modes to maximize energy savings. In terms of green materials, the emphasis extends to key components and systems, including high-energy-density batteries, high-efficiency electric motors, advanced electronic control units, and various sensors, promoting the use of recyclable and lower-carbon footprint materials. This holistic policy-driven initiative is fundamentally reshaping the automotive industry's structure, fostering technological innovation, and positioning China to be a global leader in the future of smart, low-carbon transportation. The success of this plan is evident in the rapid market growth, with NEV sales in 2023 significantly exceeding the interim targets, demonstrating the powerful impact of a clear, long-term industrial policy.

2. Literature Review

In the realm of supplier selection, Ma Lina and Chang Ruijie (2024), from the perspective of "big data analytics + artificial intelligence," proposed big data-driven supply chain transformation strategies, emphasizing the comprehensive consideration of multiple factors including technology, environmental requirements, and cost [4]. Employing the

Analytic Hierarchy Process (AHP) can assist enterprises in quantifying the weights of these various factors, thereby facilitating the selection of optimal suppliers. Furthermore, Ganguly and Kumar (2019) introduced an AHP-based supply chain risk assessment model, particularly highlighting its application in green supply chain management for addressing potential environmental, social, and economic risks through risk assessment [5].

Regarding green supply chain performance evaluation, Liu Jie, Wang Yuxin, and Zhang Jingxuan (2024), through their research in the new energy vehicle sector, explored how to use the AHP method to comprehensively evaluate the emission reduction effectiveness of the new energy vehicle supply chain under the influence of government subsidies and power structures [6]. This research provides a reference for enhancing environmental performance through green supply chain management strategies.

With the application of blockchain technology in supply chain management, an increasing number of new energy vehicle enterprises are exploring its potential in green supply chain management. Research by Zhang Yingdan et al. (2024) in Frontiers of Science and Technology of Engineering Managementpointed out that blockchain technology can enhance supply chain transparency and traceability, contributing to the reduction of environmental pollution and resource waste [7]. The integration of AHP with blockchain technology can provide more scientific management and evaluation means for all stages of the green supply chain.

Additionally, based on the fuzzy AHP method, Wang Yilei et al. (2020) proposed a low-carbon supplier selection model [8]. By integrating corporate green requirements and suppliers' low-carbon capabilities, this model optimizes the decision-making process within supply chain management. In the new energy vehicle industry, this model aids in assessing suppliers' environmental performance, thereby promoting the achievement of corporate green supply chain goals.

Green design and green financing are critical elements in the new energy vehicle green supply chain. Research by Yao Fengmin et al. (2023) in the Journal of Systems Science and Mathematicsinvestigated the impact of green design on low-carbon supply chain pricing and proposed optimization schemes for green design and pricing strategies [9]. This strategy is particularly important in the new energy vehicle field, as the design phase directly influences carbon emissions and resource consumption during production. Consequently, using AHP to evaluate green design decisions can provide a basis for enterprises to optimize production processes and reduce carbon emissions.

Simultaneously, research by Wen Zhu et al. (2020) in the Journal of Guizhou University of Finance and Economicsfocused on green supply chain financing decisions considering corporate risk aversion and fairness preference [10]. Through an AHP model, the study proposed how to incorporate factors such as environmental requirements and social responsibility into financing decisions to ensure the sustainability of the corporate green development path.

The AHP-based green supply chain performance evaluation framework has gradually become a powerful tool for decision-making in the new energy vehicle industry. Research by Zhang Jiping and Li Zengfu (2024) in East China Economic Managementproposed integrating supply chain digitalization with green transformation. Using the AHP evaluation method, they comprehensively considered the impact of digital transformation on green supply chain management. As the green transformation of the new energy vehicle industry accelerates, the refinement and optimization of this performance evaluation framework become particularly important.

3. Green Supply Chain Management Issues in the New Energy Vehicle Industry

The supply chain system of China's new energy vehicle (NEV) industry is structured into three interconnected segments: upstream, midstream, and downstream. The upstream segment focuses on raw material extraction and core component manufacturing, where cost considerations include procurement expenses for critical materials like lithium and cobalt, transaction costs from supplier negotiations, opportunity costs of resource allocation, and logistics expenditures for material transportation.

The midstream segment encompasses vehicle research, development, and production, integrating operational costs for manufacturing facilities, R&D investments in battery technology and autonomous driving systems, and administrative overhead for project management. The downstream segment handles sales and distribution, prioritizing marketing expenses, after-sales service networks, and final-mile delivery costs to consumers through dealerships and digital platforms. This tripartite structure enables specialized operation while requiring coordinated strategic management to optimize efficiency across the value chain.

3.1 Upstream Segment

The upstream segment of China's new energy vehicle (NEV) industry is fundamentally dependent on critical mineral resources that form the foundation of modern electric drivetrains. The core materials include battery-grade lithium carbonate, cobalt, and nickel-essential for lithium-ion battery cathodes-along with neodymium iron boron (NdFeB) permanent magnets crucial for high-performance drive motors [11]. Rare-earth permanent magnet synchronous motors, renowned for their exceptional power density, broad speed regulation range, and superior energy conversion efficiency, have become the technology of choice for most NEV manufacturers. This technological preference has created continuously growing market demand for these specialized materials, positioning them as strategic commodities in the global automotive transition.

The upstream market exhibited significant volatility in recent years, particularly highlighted in 2022 when battery-grade lithium carbonate prices experienced a dramatic surge from approximately 300,000 RMB/ton to nearly 600,000 RMB/ton. This price spike directly increased power battery production costs by over 15%, with these cost pressures inevitably being transferred downstream through multiple rounds of vehicle price adjustments. This price instability stems from a complex interplay of factors: slow expansion of upstream material production capacity due to stringent energy consumption policies and environmental approval processes; the capital-intensive and time-consuming nature of lithium resource development, compounded by delays in domestic mining projects; and China's continued heavy reliance on imported lithium resources, with the global supply chain dominated by Australian spodumene mines and South American salt lake operations.

While power battery recycling technologies have seen progressive advancement, several barriers impede their large-scale commercial implementation. The structural complexity of modern battery packs, combined with the absence of standardized design specifications across manufacturers, creates significant challenges for efficient disassembly and material recovery. Looking ahead, strategic priorities must focus on achieving technological breakthroughs in closed-loop lifecycle management, particularly in the efficient recovery of high-value metals like lithium, cobalt, and nickel. Developing these capabilities is not merely an economic imperative but a crucial strategic measure to enhance China's resource security and reduce supply chain vulnerabilities in the increasingly competitive NEV landscape. Current recycling efficiency rates for critical metals remain below optimal levels, requiring substantial research and development investment to establish a truly circular economy for traction batteries.

3.2 Downstream Segment

In recent years, China's charging infrastructure has experienced rapid expansion, with the total number of charging piles maintaining a steady growth trajectory. However, this growth has not kept pace with the accelerating market penetration of new energy vehicles (NEVs), resulting in a supply-demand gap that indicates substantial potential for further development. A notable trend within this expansion is the significantly higher installation growth rate of private charging piles compared to public ones, largely driven by homeowner incentives and convenience factors. This early-stage development, however, suffered from a lack of integrated planning and coordination, leading to inefficient resource allocation. The consequence is a pronounced regional imbalance: major urban centers and developed coastal areas often face a critical shortage of publicly accessible charging points, contributing to long wait times, while charging stations in some suburban or less-developed regions remain chronically underutilized. A significant infrastructural challenge persists in older residential communities, where existing electrical grids frequently lack the necessary capacity to support the installation of new charging equipment, creating a major barrier to widespread NEV adoption for a substantial segment of the urban population.

Furthermore, the market is characterized by a high degree of operator fragmentation and a lack of standardized payment and access systems. This forces users to navigate multiple mobile applications, membership cards, and payment platforms from different service providers, severely compromising the convenience and user experience of public charging. The absence of a unified, interoperable network remains a significant hurdle.

Turning to maintenance and reliability, the failure profile of NEVs differs fundamentally from that of traditional internal combustion engine vehicles. The primary issues are concentrated in the "three electric" systems-the battery, electric motor, and electronic control unit-which form the core of the vehicle's powertrain. This contrasts sharply with traditional vehicles, where mechanical failures related to the engine and transmission system are most common. The power battery, representing approximately 40% of the total vehicle cost, is particularly critical. It exhibits a relatively high failure rate, and its longevity is profoundly affected by factors such as usage frequency, charging habits, and ambient temperature. Industry data highlights a notable reliability gap: the overall failure rate for NEVs is reported at 36.7%, which is approximately 10.4 percentage points higher than the 26.3% failure rate observed for traditional fuel vehicles. This disparity underscores the technical challenges associated with new EV technologies and points to the need for enhanced durability engineering, more robust diagnostic systems, and the development of a specialized after-sales service network capable of maintaining these complex electronic systems. The establishment of such a network is crucial for building long-term consumer confidence in NEVs.

4. Green Supply Chain Issues at New Energy Vehicle Manufacturer B Company

As a prominent player in China's new energy vehicle sector, Company B demonstrates notable achievements in market expansion and technological innovation. However, a systematic evaluation reveals significant opportunities for enhancing environmental sustainability throughout its supply chain operations. The company's current approach requires strategic upgrades across multiple dimensions to align with global best practices in green supply chain management.In the critical area of green planning, Company B's decision-making processes exhibit a strong emphasis on traditional economic indicators, with insufficient integration of environmental considerations in production scheduling and transportation routing. The company should incorporate carbon accounting frameworks and lifecycle assessment methodologies at the strategic planning phase, establishing a dedicated sustainability committee to ensure environmental factors are embedded in all operational decisions.

The procurement function presents another crucial area for improvement. The current supplier evaluation system disproportionately weights purchase price against environmental performance, overlooking significant risks associated with long-distance transportation [12]. Implementing a comprehensive evaluation framework that includes transport distance and suppliers' green certifications would address this gap. A tiered supplier certification program with regular environmental audits would incentivize continuous improvement among business partners.

Manufacturing operations at Company B require enhanced focus on circular economy principles. While progress has been made in energy efficiency, solid waste management systems need significant upgrades to minimize landfill contributions. Process optimization should extend to water recycling, material recovery, and industrial symbiosis opportunities. The adoption of advanced manufacturing technologies could further reduce material waste during production. The logistics and distribution network exhibits substantial potential for environmental improvement. The current reliance on conventional fuel-powered vehicles contradicts the company's clean mobility mission. A phased transition toward fleet electrification, combined with route optimization software and intermodal strategies, would dramatically reduce the carbon footprint of distribution activities.

Regarding returns management, inconsistent quality control processes lead to elevated return rates and associated resource waste. Implementing statistical process control methodologies and developing comprehensive remanufacturing capabilities would maximize value recovery from returned products while minimizing environmental impact.In conclusion, Company B must systematically integrate green concepts across its entire supply chain to achieve substantive sustainability improvements. This transformation requires strong commitment from senior management, cross-functional collaboration, and a phased investment strategy prioritizing high-impact initiatives. Through these measures, Company B can solidify its leadership in sustainable mobility while contributing meaningfully to global climate objectives.

5. Evaluation and Optimization of the Green Supply Chain Based on the AHP Method

5.1 Evaluation of the Green Supply Chain Based on the AHP Method

Under its current production model, Company B maintains a strong emphasis on economic benefits, while the concept of a green supply chain has not been systematically integrated across all operational stages. This approach, while financially viable in the short term, presents challenges for long-term sustainability and environmental compliance. To scientifically identify key areas for improvement and establish a structured framework for green transformation, this study employs the Analytic Hierarchy Process (AHP) to construct a comprehensive evaluation model. The model is organized into three distinct yet interconnected layers: the goal layer focuses on enhancing overall supply chain performance through the simultaneous improvement of efficiency, cost-effectiveness, and environmental metrics; the criterion layer establishes three fundamental evaluation dimensions-cost management, operational efficiency, and environmental protection standards; and the solution layer encompasses critical operational components including strategic planning, supplier procurement, manufacturing processes, transportation logistics, and returns management systems.Through rigorous quantitative AHP analysis, this methodology enables the precise determination of improvement priorities for each supply chain component [13]. By calculating relative weights and conducting sensitivity analysis, the model identifies the most impactful areas for intervention, allowing for optimal resource allocation and strategic focus. This systematic approach not only clarifies the sequential steps for implementation but also facilitates the synergistic optimization of Company B's supply chain operations. The ultimate objective is to guide the company toward a more sustainable business model that balances economic objectives with environmental responsibilities, thereby enhancing both its market competitiveness and ecological stewardship in the rapidly evolving new energy vehicle sector, as shown in Figure 1:

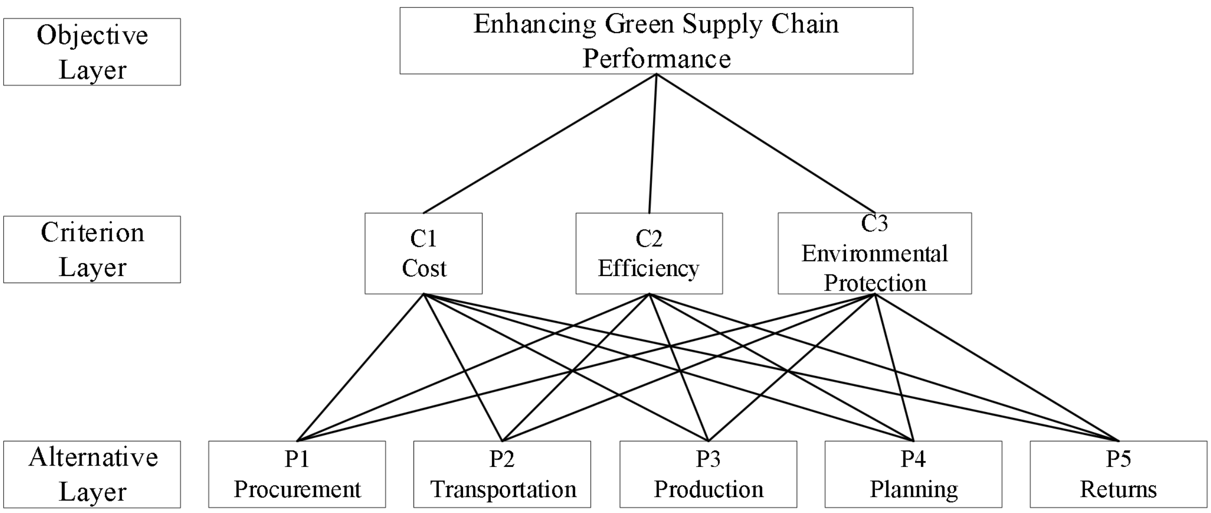

Figure 1. Hierarchical Structure Model

Secondly, Constructing the Judgment Matrix. To mitigate the bias of individual subjective judgment and enhance the scientific rigor of weight allocation, Saaty's 1-9 scale was employed. Experts conducted pairwise comparisons of indicators within the same hierarchy to assess their relative importance, thereby transforming qualitative judgments into quantifiable values. This matrix provides the basis for subsequent weight calculation and consistency verification. Based on the selected scale method and the hierarchical structure model, a corresponding table was constructed, resulting in the hierarchical structure table for Company B, as shown in Table 1.

Table 1. Hierarchical Structure of Company B

	C1 Cost	C2 Efficiency	C3 Environmental Protection
C1 Cost	1	2	3
C2 Efficiency	1/2	1	2
C3 Environmental Protection	1/3	1/2	1

Based on the aforementioned data, the results of the consistency check indicate a maximum eigenvalue (λmax) of 3.0092. The calculation performed in Python yielded a consistency index (CI) of 0.0046. By comparing this with the corresponding average random consistency index (RI), the consistency ratio (CR) was calculated as 0.0079. Since the CR is less than 0.1, the consistency of the judgment matrix is considered acceptable, confirming that it passes the consistency test.The eigenvector obtained from the matrix was normalized, resulting in the final indicator weights: WA = [0.5396, 0.2970, 0.1634]. Based on the statistical compilation of expert ratings, the judgment matrices for criteria B1, B2, and B3 were constructed and subsequently normalized through the data normalization process, as shown in Table 2.

Table 2. Cost Judgment Matrix

C1 Cost	Procurement	Transportation	Production	Planning	Returns
Procurement	1	3	4	5	6
Transportation	1/3	1	2	3	4
Production	1/4	1/2	1	2	3
Planning	1/5	1/3	1/2	1	2
Returns	1/6	1/4	1/3	1/2	1

Based on the consistency check results of the cost judgment matrix, the maximum eigenvalue λmax is 5.0988. Through calculation in Python, the consistency index (CI) is obtained as 0.02469. By comparing it with the corresponding average random consistency index (RI), the consistency ratio (CR) is calculated as 0.02205. Since CR $<$ 0.1, the consistency of the judgment matrix is acceptable, indicating that it has passed the consistency test. After normalizing the corresponding eigenvector, the final indicator weights are obtained as WB1 = [0.4904, 0.2264, 0.1406, 0.0867, 0.0557], as shown in Table 3.

Table 3. Efficiency Judgment Matrix

C2 Efficiency	Procurement	Transportation	Production	Planning	Returns
Procurement	1	2	3	4	5
Transportation	1/2	1	2	3	4
Production	1/3	1/2	1	2	3
Planning	1/4	1/3	1/2	1	2
Returns	1/5	1/4	1/3	1/2	1

Based on the consistency check results of the efficiency judgment matrix, the maximum eigenvalue (λmax) is 5.0680. The calculation performed in Python yields a Consistency Index (CI) of 0.00170. By comparing it with the corresponding Average Random Consistency Index (RI), the Consistency Ratio (CR) is calculated as 0.0152. Since CR is less than 0.1, the consistency of the judgment matrix is considered acceptable, confirming that it passes the consistency test. After normalizing the corresponding eigenvector, the final indicator weights are obtained as WB2 = [0.4185, 0.2625, 0.1599, 0.0972, 0.0617] , as shown in Table 4.

Table 4. Environmental Protection Judgment Matrix

C3 Environmental Protection	Procurement	Transportation	Production	Planning	Returns
Procurement	1	3	5	7	9
Transportation	1/3	1	3	5	7
Production	1/5	1/3	1	2	3
Planning	1/7	1/5	1/2	1	2
Returns	1/9	1/7	1/3	1/2	1

Based on the consistency check results of the environmental protection judgment matrix, the maximum eigenvalue (λmax) is 5.1028. Calculation via Python yields a Consistency Index (CI) of 0.0257. By comparing this with the corresponding Average Random Consistency Index (RI), the Consistency Ratio (CR) is calculated as 0.0229. Since CR is less than 0.1, the consistency of the judgment matrix is deemed acceptable, confirming it passes the consistency test. After normalizing the corresponding eigenvector, the final indicator weights are obtained as WB3 = [0.5222, 0.2667, 0.1074, 0.0637, 0.0399].The overall WB matrix is derived from WB = [WB1, WB2, WB3]. Using the formula C = WA × WB^T, the comprehensive weights for each component are calculated as C = [0.4742, 0.2437, 0.1409, 0.0860, 0.0549]. The overall consistency check results in a CR of <0.1, indicating that the judgment matrix passes the consistency test. Based on the compiled data, Table 5 is generated.

Table 5. Indicator Weights and Ranking

	Indicator Weights	Procurement	Transportation	Production	Planning	Returns
C1 Cost	0.5396	0.4904	0.2264	0.1406	0.0867	0.0557
C2 Efficiency	0.2970	0.4185	0.2625	0.1599	0.0972	0.0617
C3 Environmental Protection	0.1634	0.5222	0.2667	0.1074	0.0637	0.0399
Comprehensive Scores		0.4742	0.2437	0.1409	0.0860	0.0549

6. Conclusion

6.1 Comprehensive Strategies for Green Supply Chain Optimization and Empirical Insights

In the contemporary business landscape, green supply chain optimization requires a systematic approach that balances economic, operational, and environmental objectives. Companies should prioritize cost control through strategic optimization of procurement channels, production processes, and transportation networks. This involves adopting data-driven procurement systems to select environmentally responsible suppliers, implementing lean manufacturing to minimize waste, and optimizing logistics routes to reduce fuel consumption and emissions. Enhancing operational efficiency is equally critical; investments in automation, artificial intelligence, and IoT-based monitoring systems can significantly improve resource utilization, reduce errors, and accelerate response times, thereby strengthening competitive advantage.

Environmental sustainability must be embedded across all supply chain stages. In product design, emphasis should be placed on modular structures for easy disassembly and material recovery. Material selection should prioritize renewable or recycled inputs, while production processes need to integrate energy-efficient technologies and carbon capture mechanisms. The sales phase should actively communicate the product's green attributes, encouraging consumers to adopt renewable energy solutions. Simultaneously, reverse logistics systems must be strengthened to manage product returns effectively-enhancing quality control to minimize defects and establishing remanufacturing protocols to extend product lifecycles. For critical components like power batteries, developing a closed-loop recycling system is essential to reclaim valuable materials, reduce reliance on virgin resources, and minimize environmental footprint.

6.2 Methodological Framework and Managerial Implications

This study leverages the Analytic Hierarchy Process (AHP) to evaluate the green supply chain management practices of Company B, a representative player in the new energy vehicle sector. By constructing a multi-level evaluation framework-comprising objective, criterion, and alternative layers-and validating it through consistency checks (CR < 0.1), the research ensures methodological robustness. The AHP-based weight analysis reveals that Company B excels in green procurement, design, and production, attributed to its stringent supplier assessments and eco-design initiatives. However, significant gaps persist in green logistics and resource recycling, where dependencies on fossil fuel-based transportation and underdeveloped circular economy models hinder overall performance.

The findings underscore that green technology innovation and supply chain collaboration are pivotal drivers of improvement. To address these gaps, Company B should: (1) implement a fuzzy AHP model to evaluate suppliers' environmental performance quantitatively, (2) transition to electric vehicle fleets and optimize warehouse locations for logistics decarbonization, and (3) establish joint R&D initiatives with suppliers to advance battery recycling technologies. This study not only provides a scalable evaluation framework for Company B but also offers actionable insights for the broader industry to align with global sustainability standards, demonstrating how AHP can transform subjective environmental goals into measurable, prioritized action plans.

References

[1] Xiang, P. C., Zhao, X. P., & Yang, Y. L. Research on Risk Propagation in New Energy Vehicle Supply Chain Based on SEIR Model. Journal of Systems Science and Mathematical Sciences, 1-20.

[2] Ma, L. N., & Chang, R. J. The Impact of "Big Data Analytics + Artificial Intelligence" on Digital Supply Chain Transformation: An Empirical Study Based on the Automotive Industry. Soft Science, 1-15.

[3] Liu, J., Wang, Y. X., & Zhang, J. X. Research on Emission Reduction Decisions of Electric Vehicle Supply Chain Considering Government Subsidies and Power Structure under Battery Swap Mode. Industrial Engineering and Management, 2024, 29(06), 141-152.

[4] Zhang, Y. D., Fan, X. M., & Yuan, H. X. Research on the Impact of Digital Transformation in Logistics and Supply Chain on Blockchain Technology Adoption in Automotive Manufacturing. Frontiers of Science and Technology of Engineering Management, 2024, 43(05), 17-24.

[5] Lyu, Y., & Deng, L. J. Efforts to Enhance the Resilience and Security of Industrial Chains and Supply Chains: Measurement and Analysis Based on the Case of China's Automotive Industry Chain. Journal of International Trade, 2023, (02), 1-19.

[6] Zhu, Z. W., Wang, S. H., & Liang, X. Technical Strategy of Automotive Manufacturing Supply Chain from the Perspective of Blockchain. Machinery Design & Manufacture, 2022, (11), 1-5.

[7] Lu, Z. N., Zhang, C. H., & Luo, Y. S. Research on Green Supply Chain Performance Evaluation of Manufacturing Enterprises under the "Dual Carbon" Goals. Ecological Economy, 2023, 39(07), 58-66.

[8] Wang, Y. L., Zhu, Q. H., & Xia, X. Q. A Low-Carbon Supplier Selection Model Based on Fuzzy AHP-GP. Operations Research and Management Science, 2020, 29(11), 121-128.

[9] Li, M., Meng, H., & Xu, S. Q. Research on Evaluation and Selection of Fabric Suppliers Based on AHP and Multi-Objective Programming. Journal of Beijing Institute of Fashion Technology (Natural Science Edition), 2017, 37(03), 63-74.

[10] Ganguly, K., & Kumar, G. Supply Chain Risk Assessment: A Fuzzy AHP Approach. Operations and Supply Chain Management: An International Journal, 2019, 12(1), 1-13.

[11] Dong, Q. X., & Cooper, O. An Orders-of-Magnitude AHP Supply Chain Risk Assessment Framework. International Journal of Production Economics, 2016, 182(04), 144-156.

[12] Yao, F. M., Du, W. L., & Sun, J. Y. Pricing and Subsidy Strategies of Low-Carbon Supply Chain Considering Green Design from the ESG Perspective. Journal of Systems Science and Mathematical Sciences, 1-20.

[13] Wen, Z., Bai, D. X., & Hou, J. Research on Green Supply Chain Financing Decision Based on Corporate Risk Aversion and Fairness Preference. Journal of Guizhou University of Finance and Economics, 1-12.