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Analysis of Green Supply Chain Construction and Driving Factors in the Context of New Retail: Case Study of JD.com

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Abstract: The retail industry occupies an important position in the national economy and is a fundamental industry. With the development of the Internet, retail is constantly innovating, and online retail is developing rapidly. Retail enterprises under the new retail model represented by JD.com have embarked on a new journey in the retail industry. With the further development and acceleration of industrialisation, reducing resource waste and environmental pollution has become a problem that retail enterprises must face. This paper introduces the case of JD.com in building a green supply chain in the context of new retail and analyses. It summarises the driving factors of JD's establishment of a green supply chain by combining the interdisciplinary perspectives of new retail and green supply chains. At the same time, specific case evidence is provided from the perspective of each link in the supply chain. It aims to provide multi-dimensional guidance for the green supply chain transformation of new retail enterprises, which can help improve their market competitiveness, provide better consumer experience, enhance consumer trust, and help avoid potential legal risks.

Keywords: New Retail, Green Supply Chain Management, JD, Driving Factors

1. Introduction

With the continuous progress of Internet technology, big data and other technologies, "new retail" as a booming sales mode came into being. In this new business environment, enterprises not only need to pay attention to market competition and consumer demand, but also need to integrate green development and sustainable development into their strategic planning. In this context, JD, as a typical case, shows the driving forces and measures for enterprises to implement green supply chain management. This paper takes the "new retail" era as the background and JD as the case to analyze the driving forces and measures for enterprises to implement green supply chain management. Through in-depth analysis of JD's practical experience in green supply chain management, it can provide valuable reference and inspiration for other enterprises to help them achieve sustainable development and promote the upgrading of the green industry chain in the "new retail" era.

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2. Literature Review

2.1. New Retail

The connotation of the "new retail" era can be summarised as using emerging technologies to meet customer needs, innovating the “online + offline + logistics” trinity model, and intelligently upgrading the entire retail industry chain.

The characteristics of new retail are as follows: Firstly, it establishes offline channels and combines them with online retail [1]. Secondly, it is consumer-oriented. New retail uses big data to locate consumer needs, carry out intelligent push, and receive consumer feedback. It also implements scenario-based operations through offline channels and realises scenario-based consumption [2]. Thirdly, it relies on cutting-edge technology and concepts. Consumers can access the network anytime and anywhere, enabling high levels of connectivity and convenience [3].

2.2. Green Supply Chain Management

The idea of Green Supply Chain Management was introduced by the University of Michigan in 1996. Especially in today’s era of global green development, this concept has received more attention and research. The concept of a green supply chain is already very rich. Gilbert indicates that GSCM is integrating environmental thinking into SCM [4]. Hervani and colleagues describe GSCM as a combination of green procurement, manufacturing, and distribution activities [5]. Hsu and Hu view GSCM as a strategy to enhance both process and product performance in alignment with environmental regulation demands[6]. Torielli et al.proposed that GSCM (integrating environmental considerations and SCM) effectively reduces a company’s environmental impact while enhancing business performance [7].

2.3. Green Supply Chain Management in the Context of New Retail

In Wan et al.’s study, they devised pricing and greening methods while taking into account the collaboration between offline and online channels in the context of an O2O green supply chain [8]. A study by Biswajit Sarkar et al. creates a sustainable online-to-offline (O2O) supply chain model and suggests a sustainable online-to-offline retail approach. The model tracks transportation expenses and carbon emissions in order to reduce emissions and maintain a clean environment [9].Wu et al. investigated the low-carbon supply chain for online shopping using the O2O paradigm incentive scheme implemented by the government. They pointed out that the comprehensive application of the policy of the government on carbon emissions, O2O operation practice and low-carbon incentive measures could maximise the low-carbon effect [10].

Throughout the relevant literature, because the concept of new retail was put forward late, there are few existing studies on the enterprise green supply chain field under the new retail model at home and abroad. There are some academic gaps, and more systematic, comprehensive, scientific and in-depth research is still needed. This paper investigates the green reform of providing green supply chain management for the full supply chain process against the backdrop of new retail, including manufacturers, suppliers, distributors, and consumers. It is based on JD's practice research on green supply chain construction under the new retail.

3. Driving Force Analysis of Green Supply Chain Management

This chapter will demonstrate the internal and external factors that drive and promote corporate green supply chain management. The driving factors include internal stakeholders such as managers, shareholders, employees, external stakeholders such as consumers, the legal and regulatory

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environment, and the public and supervisory agencies. JD has a strong logistics system and high-quality service capabilities, and the maturity of its green supply chain construction is further enhanced under these driving forces.

3.1. Internal Drive

Figure 1 shows the key driving factors within the supply chain of new retail enterprises, which have an important impact on the operation and development of the enterprise. By understanding these drivers, companies can better optimise their supply chain management strategies and enhance overall competitiveness.

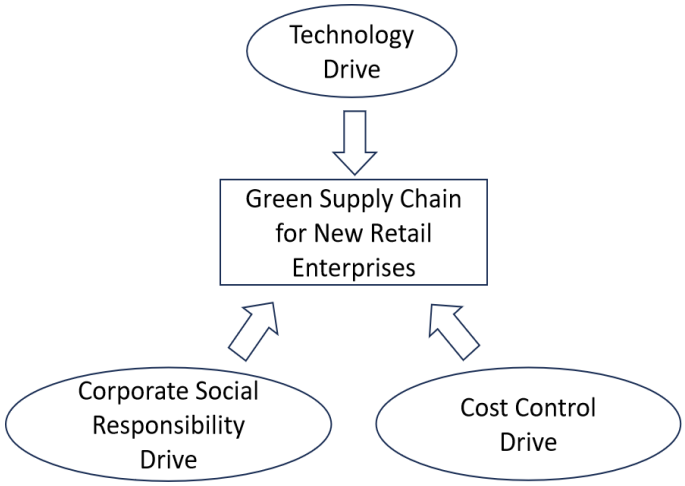

Figure 1: New retail enterprise supply chain internal driving factors.

3.1.1. Technology Drive

In the era of Industry 4.0, digitalisation and intelligence have become an important driving force to promote industrial transformation and upgrading and a key support for building competitive advantages [11]. New technologies like 5G, massive data, and green energy technology are booming and becoming a strong internal driving force for developing enterprises' green supply chains. Driven by 5G technology, integrating Internet of Things technology and supply chain management meets the demand for automated supply chain operations and intelligent internal and external decision-making of logistics enterprises [12]. JD Logistics completed the construction of the first 5G smart logistics demonstration park in Beijing Asia One in 2019, which promoted the landing of 5G technology in other enterprise scenarios [12]. Digital transformation can help companies identify and reduce waste emissions, positively impacting the supply chain by improving recycling rates and operational efficiency [13]. Through big data analysis, enterprises can better understand the supply chain's environmental impact and resource consumption and formulate targeted green supply chain management strategies to optimise production and logistics processes. At the same time, the development of green energy technology enables enterprises to use solar energy, wind energy, and other traditional energy sources to reduce carbon emissions. For example, JD Logistics hydrogen energy trucks have achieved part of "zero emission" transportation to reduce environmental pollution and achieve green supply chain goals. In summary, the rapid advancement of science and technology has encouraged the building of a green supply chain and laid a solid technical foundation.

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3.1.2. Corporate Social Responsibility Drive

JD has enhanced its brand image and market competitiveness by establishing a green supply chain. Corporate GSCM practices can improve the corporate image and stakeholder relations by sustainably utilising natural resources and energy, reducing waste, and preventing environmental pollution, thereby increasing brand value [14]. By actively responding to consumers' environmental concerns and proactively fulfilling its corporate social responsibility, JD has attracted consumers with a strong environmental protection awareness, thereby gaining a competitive advantage in the market.

3.1.3. Cost Control Drive

JD can achieve cost reduction and efficiency improvement by adopting measures to reduce resource consumption and waste in procurement, production, and logistics. JD has demonstrated the close connection between innovation and long-term development in building a green supply chain.JD implements eco-friendly innovative measures in various aspects such as product design, material selection, and logistics distribution. JD has significantly reduced environmental costs by promoting clean energy in key areas such as smart industrial parks, logistics parks, warehouses, and data centres. Additionally, JD actively encourages upstream and downstream enterprises within the supply chain to collaborate to optimise supply chain efficiency and reduce costs.

3.2. External Drive

Figure 2 shows the external driving factors of the new retail enterprise's supply chain. These factors cover the impact of the market, policy, competitive environment, etc.

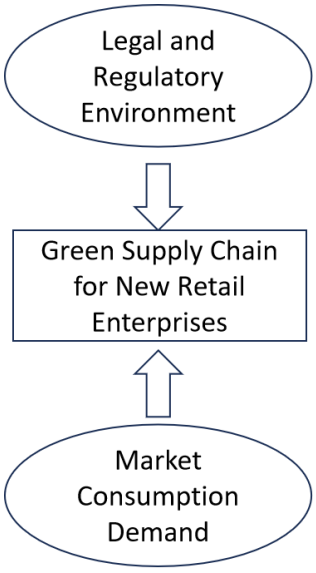

Figure 2: New retail enterprise supply chain external driving factors.

3.2.1. Legal and Regulatory Environment

The international community has called on all countries to take stronger actions to respond to climate change, and various industries in China are also further deploying plans under the "1+N" policy system. The "Carbon Peaking Action Plan before 2030" proposes accelerating the formation of low-carbon transportation methods. At the same time, all sectors of society are also actively responding to the concept of sustainability and strengthening supervision and cooperation.

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3.2.2. Market Consumption Demand

Various enterprises and platforms rapidly carry out green and low-carbon transformations and are committed to deeply integrating green concepts throughout the entire cycle, chain, and system. The concept of "responsible consumption" makes consumption more green value. Lo and Leung proposed that Chinese consumers are increasingly aware of environmental protection and have begun to favour "green products" [15]. This drives enterprises to form a new closed loop of green sales. JD e-commerce company launched the "Green Plan" to label green products such as energy-saving home appliances with a "green" label. Consumers who purchase products with "green" labels can enjoy preferential prices and accumulate points through the "Green Points" account system, helping the public establish awareness of green consumption.

4. JD's Green Supply Chain Management Practices

4.1. Transportation

4.1.1. Green and Digital Transformation of Last Mile Delivery

Through implementing a green delivery strategy, JD promotes the use of mechanised and intelligent devices in the "last mile" delivery process. Using cutting-edge technology like cloud computing, big data, artificial intelligence, 5G, and the Internet of Things, JD continuously advances its automation, digital intelligence, and smart decision-making capabilities to reduce energy consumption.At the same time, it actively promotes the use of environmentally friendly materials, ensuring that the green concept is extended throughout the supply chain.

4.1.2. Building Carbon Emission Management System

Controlling carbon emissions is a key part of JD Logistics' construction of a green supply chain. Carbon accounting is an important means of managing carbon emissions. JD's self-developed Supply Chain Emission Management Platform (SCEMP) is a vital tool in collaboration with supplier partners to build a low-carbon logistics transportation system. This platform is used for low-carbon management across the entire supply chain.

4.1.3. Green Transformation

Adopting new energy vehicles in the logistics segment can effectively reduce carbon emissions during transportation. JD Logistics promotes using more new energy vehicles among its third-party outsourced transportation suppliers. In August 2022, JD Logistics introduced its first batch of battery-swappable new energy vehicles, which use standardised battery modules that can be upgraded to even cleaner energy sources anytime. In places like Shandong and Yunnan, biomass fuel vehicles are promoted while actively adjusting the freight structure to shift from road to rail to water transportation.

4.2. Warehouse

4.2.1. Warehouse and Distribution Integration and Intelligent Logistics

JD has adopted an integrated warehousing and distribution pattern to establish its supply chain advantages. The e-commerce environment has formed a pattern in which e-commerce companies order goods directly from manufacturers, receive orders online, and finally contact logistics companies to deliver goods directly from manufacturers' warehouses or e-commerce companies. Intelligent logistics is realising more efficient and accurate warehouse operations through big data

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and other technologies. JD's integrated supply chain services effectively help reduce greenhouse emissions and create low-carbon digital intelligence in logistics. In addition, by deploying new logistics infrastructure in some low-tier cities and key county-level areas, JD Logistics has created a new warehousing model, significantly improving logistics reach.

4.2.2. Green Energy-Saving Warehouse

JD is committed to using energy-saving and environmentally friendly building materials, designs, and advanced energy management systems to build its warehouse spaces. In China, JD's 47 "Asia One" smart parks (including those built, under construction, and preparation) and thousands of warehouses will gradually promote a clean energy source based on photovoltaic power. The warehouse mentioned above can realise "dark light operation". According to calculations, smart devices can save 2,283 kilowatt hours of electricity per minute through "dark light operation", almost equivalent to an ordinary household's electricity consumption for one and a half years. In JD's intelligent warehouse, the full-link intelligent packaging system realizes planning use of different packaging materials, decreasing the consumption and waste of packaging materials.

4.3. Packaging

4.3.1. Standardisation of Green Packaging

JD Logistics actively responded to the country's call for resource recycling and formulated JD Logistics recycling Bag Use Management Standards within the company. In 2022, JD released the industry's first original straight packaging standards and certification process to ensure that the original packaging meets the three requirements of safety, void ratio and environmental protection. JD also participates in the compilation of a number of national standards, industry standards, and group standards and actively exerts the core influence of leading enterprises. JD has participated in the compilation of norms such as the Guide to Mail Express Packaging Recycling and Recycling and Requirements for Limiting Excessive Packaging of Mail Express, contributing to the comprehensive establishment of a unified, standardised and binding express green packaging standard system.

4.3.2. The Use of Green Packaging in Multiple Scenarios

JD Logistics continues to promote its "green flow plan" proposed in 2017 to promote the reduction and recycling of packaging and strive to achieve the use of green packaging in different situations. In the B2C fresh business, JD has used circular incubators on a large scale. Special insulation materials, VIP vacuum board, and canvas material replace traditional EPS white foam boxes and disposable ice packs with recyclable ice boards. In vulnerable businesses such as daily necessities or medicine, Deppon (JD Holdings) uses circular enclosure boxes, whose top cover and bottom are made of HDPE material, and the enclosure is made of PP hollow board, which is non-toxic and durable. At the same time, the circular green flow box was put into large scale by JD. Using the second-generation stackable structure, the one-time seal or tape is eliminated, and the box can be sealed only by relying on the logistics sheet. After the green flow box is cleaned and disinfected, it can be used again.

4.3.3. End Recovery

JD Logistics relies on the positive and reverse integrated logistics network to recycle the circular packaging at the end of the link and return it to the park or warehouse for reuse. In 2016, JD launched Carton Recycling, a green environmental protection program. After users purchase and receive the goods delivered on JD, they can voluntarily hand over the JD carton to JD's delivery personnel for

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recycling. By 2022, JD has joined hands with a number of enterprises in more than 100 cities to carry out public welfare activities such as recycling cartons, old clothes, old toys and old books.

4.4. Sustainable Development Knowledge and Technology Sharing

In 2022, the Green Supply Chain Committee of ACEF was formally established. JD Logistics is the first rotating lead unit of the special committee. The committee actively innovates green supply chain management and gathers all parties to promote knowledge and technology sharing for sustainable development. By the end of 2022, JD Logistics has conducted special sustainable development technology exchanges for more than 20 enterprises and professional institutions such as Volkswagen Group, Volvo and Decathlon. In December 2023, JD Group, Lenovo Group and BOE Technology Group jointly launched the "Green Supply Chain Technology Sharing Platform (Patent Pool)". In the shared platform (patent pool), JD and other enterprises in the field of green supply chain technology-related patents will be open to small and medium-sized enterprises free of charge, helping the supply chain develop in a sustainable and environmentally friendly manner.

5. Suggestions

5.1. Promote the Construction of Green Supply Chain Through Scientific and Technological Innovation

New retail enterprises should vigorously enhance the level of technological innovation and promote the construction of green supply chains through information technology means. First, new retail companies can use IoT technology and big data analytics to monitor energy consumption and carbon emissions during logistics and transportation in real time and optimise supply chain management. Second, new retail enterprises can utilise artificial intelligence and intelligent manufacturing technology to optimise production processes and supply chain design. At the same time, intelligent manufacturing technology can help enterprises achieve customised production and reduce inventory overhang and waste generation. Finally, new retail enterprises can use blockchain technology to establish a traceable supply chain system to achieve transparency and traceability of supply chain information.

5.2. Strengthen coordination across the supply chain and jointly promote green reform

Enterprises should follow the trend of cooperation with multiple parties and improve the internal and external connections of the supply chain. Firstly, enterprises should strengthen multi-party cooperation, determine common green goals and indicators, and let the entire supply chain share the same vision. Secondly, at the technical level, enterprises should promote cooperative innovation and joint research and development between upstream and downstream companies to promote more environmentally friendly production and supply chain processes. Finally, by establishing an open information-sharing platform, real-time and transparent data exchange can be achieved upstream and downstream of the supply chain. These measures allow enterprises to better understand production, procurement, sales, and other links, understand needs and changes, and optimise resource allocation. Consumers can choose, use and handle products more scientifically during shopping.

5.3. Build Industry Standards and Establish a Green Supervision System

When supervising corporate behaviour, the industry can set up incentive mechanisms or improve certification systems, involve multiple parties in formulating standards, reward upstream and downstream participants in the supply chain for their positive contributions to green reform, and stimulate enthusiasm for green reform. Enterprises can cooperate with the government and actively

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respond to the government's call to ensure that laws and regulations support compliance with industry standards. At the same time, the government should set up an independent compliance review agency to conduct regular inspections of enterprises to ensure they comply with green industry standards.

6. Conclusion

This paper, by analysing JD's construction of a green supply chain under the new retail model, provides a case study and theoretical guidance for the green transformation of the retail industry. Additionally, the paper demonstrates how new retail enterprises implement green strategies in various supply chain links such as transportation, warehousing, and packaging, thereby enhancing their operational efficiency and market competitiveness. This research considers the green supply chain's internal and external driving forces, offering a multidimensional perspective for a comprehensive understanding, analysis, and application of green supply chains.

This study also has certain limitations. Since the research focuses specifically on the case of JD, the generalizability of its conclusions is limited. The challenges and environmental differences faced by different retail enterprises require the support of more extensive case studies. Given the rapid development of technology and changes in the market environment, green supply chain strategies and practices need to be continuously adjusted according to the circumstances.

Future research could involve cross-industry case studies and comparisons among multiple cases within the same industry to enhance the universality and depth of the study. Alternatively, research on long-term effects, particularly the long-term impact of green supply chain practices on corporate environmental sustainability and social responsibility, could be valuable. It is advised to concentrate on merging technological advancements with green supply chains, investigating the possibilities of emerging technologies such as blockchain, Internet of Things, and artificial intelligence to improve productivity and fostering innovation within green supply chains.

Authors Contribution

All the authors contributed equally, and their names were listed alphabetically.

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