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Research on Innovation and Application of Green Packaging Energy Saving Technology for E-commerce Logistics

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Abstract: In view of the current situation and problems of e-commerce logistics packaging, this paper proposes a green packaging solution for e-commerce logistics, promotes green packaging technology and product application, and innovates green logistics packaging management mode, standards first, and promotes recyclable packaging, reduce packaging and degradation of packaging and other green packaging technologies to promote the green development of logistics packaging.

1. Introduction

At present, China has become the most developed country for online shopping, but there are still a lot of resources, energy consumption and waste in the aspects of production, circulation, warehousing, consumption and recycling. On the one hand, it has intensified the pressure on environmental protection, on the one hand, it has increased the operating costs of logistics enterprises. Promoting green supply chain management, promoting green packaging, green procurement, green logistics, green recycling, and significantly reducing resource consumption and pollutant emissions during production and distribution have become particularly urgent and important.

2. Status of e-commerce logistics packaging

2.1 The status of express package usage

According to the "2018-2024 China Packaging and Printing Market Evaluation and Future Development Trend Research Report" published by Zhiyan Consulting, the packaging in China's express delivery field mainly focuses on express waybills, woven bags, plastic bags, envelopes, packing boxes, tapes and Internal buffer.

According to the State Post Bureau report, in 2016, the country consumed 31.28 billion express orders, 3.2 billion woven bags, 1.47 billion plastic bags, 3.4 billion envelopes, and 8.6 billion packaging boxes.



2.2 express logistics packaging printing industry development trend

2.2.1 The volume of express delivery continues to grow, and the use of express packaging is further expanded.

The current development level of China's express delivery industry can't meet the requirements of rapid economic development. The growth space of China's express delivery market is still very huge. With the rise of e-commerce in the central and western regions, the express logistics service network has expanded to the west, further extending to third- and fourth-tier cities, and even in rural areas, and gradually increasing investment in transportation capacity and integrated service platforms. In the eastern region, the base of express delivery services is relatively large. At present, efforts are being made to improve the level of development, competition level and technology content. Although its growth rate has slowed down, it still maintains a relatively high growth rate.

According to statistics, China's per capita express use increased from 1.1 in 2008 to 15.0 in 2015, and the annual per capita express expenditure increased from 30.8 yuan in 2008 to 201.5 yuan in 2015, although the growth rate is large, but the phase Compared with the United States and Japan, the annual per capita express usage still has a large gap. Therefore, China's per capita express expenditure and express usage have a large room for development.

According to statistics, in 2016, the volume of express delivery reached 31.35 billion pieces, a year-on-year increase of 51.7%, and it continued to rank first in the world. According to forecasts, the number of e-commerce logistics parcels in China is expected to reach 100 billion in 2020. During 2016-2020, China's express delivery business is expected to maintain a CAGR of 33.64%, reaching 100 billion units by 2020.

At the same time, the use of express packaging in China will continue to grow in the future. According to forecasts, by 2020, China's express packaging consumption will reach 1,002.5 billion express delivery orders, 14.66 billion woven bags, 4 billion plastic bags and 15 billion envelopes. There are 4,800 million boxes, 82 billion meters of tape and 1.44 billion cushions. 2014

2.2.2 Green packaging will become the mainstream of the industry

At the same time, the rapid development of China's express logistics business has brought about the huge consumption of express packaging materials, and the tens of billions of calculated express packaging waste, resulting in environmental pollution and waste of resources. At present, the express package that has been used has no specific requirements for the storage, storage and recycling (destruction) of express delivery orders, and there is no uniform requirement for other types of express packaging, which is handled by the enterprise or the consumer. From the perspective of environmental protection, most of the plastic products used in express packaging are non-degradable. The main component is polyvinyl chloride. Due to the lack of classification awareness and special recycling system, huge environmental pressure and waste of resources are caused.

3. E-commerce logistics green packaging solution

A comprehensive solution to the problem of green packaging for e-commerce logistics must be preceded by comprehensive standards, and standardization is the basis for comprehensive management. Through the promotion and implementation of a series of standards for logistics packaging specifications, the chaotic logistics packaging, especially the e-commerce package packaging, is standardized to lay a foundation for improving logistics efficiency and promoting green logistics packaging. On this basis, promote the green development of logistics packaging by promoting green packaging solutions such as recyclable packaging, reduced packaging and degradable packaging.

3.1 Promote green packaging technology and product application

3.1.1 Increase the research and development of environmentally friendly packaging materials

Traditional packaging materials mainly include paper, plastic, glass, iron products, etc., while green packaging materials mainly refer to good performance or function, low pollution to ecological environment, easy degradation, easy recycling, high recycling efficiency or energy. Materials that are effectively recycled and do not cause harm to the human body. Whether the packaging is “green” or not, the key point is whether the packaging material is recyclable and degradable. Environmentally friendly packaging materials generally include reusable and renewable packaging materials, edible packaging materials, degradable materials and natural paper materials. Environmentally friendly packaging is reflected in the use of materials, waste is minimal and energy saving, easy to recycle and reuse, packaging waste does not produce secondary pollution. Therefore, the choice of environmentally friendly packaging materials should be consistent with the basic principles of harmless, non-polluting and renewable.

In recent years, many companies have made breakthroughs in packaging materials and developed degradable plastic, aluminum and other materials packaging. One tears to launch a green bag Nbag that is green and cost-effective. The biggest difference with traditional plastic bags is that the new products use biological materials, and 30% plant starch replaces some PE plastics, with a light corn flavor and lubricious touch; in terms of quality, its heat seal strength, right angle tear, puncture strength, The tensile strength and other properties are significantly better than the national standard and toxic black bags; in terms of breakage rate, it is significantly lower than the ordinary courier bag at 6% to 11%.

With the efforts of all parties, some composite materials are beginning to get more and more applications, such as wood-plastic composite materials used in the production of pallets or crates, which are waste plastics and waste wood, including sawdust and wood branches. , clam shells, peanut shells, etc., in a certain proportion, adding special adhesives, after high temperature and high pressure treatment, not only good performance, economical, but also to protect the environment. In addition, the honeycomb paperboard, which is often used as a liner, is also a kind of environmentally-friendly and energy-saving material with a new sandwich structure composed of a high-strength honeycomb paper core and various high-strength kraft papers, which has low cost, less material consumption, and sound absorption. Insulation, high strength, good impact resistance and so on. Honeycomb paperboard is made entirely of recycled paper, which can replace wood and can be recycled and reused after use.

A technology company in Shanghai dedicated to R&D, production, operation and recycling of environmentally-friendly circulating packaging has independently developed a green recycling cycle. This kind of revolving express box has many advantages: the material is changed from paper to polypropylene, and can be recycled and recycled; no need to seal the belt, sonic hot melt technology can be used to stick the bottom of the box; the pressure resistance is very strong, can withstand one Adults stand on the pressure above; using a recurring express box, the cost of packaging will drop from 2 yuan to 0.5 yuan for each transaction completed by e-commerce. In order to get through the "last mile" of the return courier from the consumer to the merchant, the company is taking the lead in creating a "reverse logistics" system, launching couriers, waste collectors and consumers to participate, and deploying self-service recycling machines on the streets. .

3.1.2 Research and development of simple packaging technology

Green and simple packaging means not only the material needs to meet the low-carbon environmental requirements, but also the recyclability of the packaging itself, but the green humanistic concept throughout the packaging product production and design process, from the packaging material the choice of design, the shape of the packaging, and the amount of packaging materials should be simple, low-carbon, but also aesthetically pleasing. It is necessary to eliminate environmental pollution and avoid visual pollution. Through packaging standardization and automation, we realize simple packaging, reduce packaging fillers and outer packaging, and realize energy saving and consumption reduction technologies.

3.1.3 *Promote recycling of recycling packaging technology and packaging materials*

By means of the standard convenience box parcel packaging technology, the direct multi-cycle use of the small parcel packaging box can be realized, and the discarded cardboard boxes in the sorting operation can be reasonably reused. For example, in the car parts industry, the main engine factory usually manufactures and assembles the body parts. All the parts are produced by the supplier, so many parts and components are shipped. Along with the actual logistics of parts and components, there is a lot of packaging materials, such as cartons, linings, trays, and so on. In the early period of the development of the Chinese car industry, the parts suppliers mainly used the method of transporting cartons and pallets. The packaging materials were basically used once, resulting in great resources and dross. Car parts suppliers have also developed a variety of methods for the use of recyclable packaging materials. The following are three levels of detailed implementation examples.

In the first instance, plastic or metal totes are used instead of cartons. Scope of application: transportation within 500 kilometers, small planning. Strengths: Standardized tonnage boxes for easy identification and recovery. Each item is fixed in the tote, making it easy to calculate inventory. Convenient warehouse loading and unloading. The turnover box can be used directly on the production line by using the pulley car, eliminating the need to go online for packaging. Turnover boxes are inexpensive. Defect: The totes can't be folded during the return transport, occupying space and high transportation costs.

Case 2: Replace the carton with a retractable folding box + liner. Scope of application: domestic transportation within 1500 km, medium planning. Strengths: Packaging materials can be recycled. The outer packaging can be folded at the time of return trip, reducing the shipping cost. The new plastic outer box has strong pressure resistance and maintains goods. Defect: The capital is higher. If the life cycle of the product is over, the lining package will not continue to be used. The production line needs to be re-packaged.

Case 3: Use standardized collapsible retraction box with additional lining. Scope of application: World multimodal transport, large planning transoceanic transport. Strengths: Standardized handling of turnover containers, planning effects to improve container loading rate, thereby reducing world shipping costs. Metal mesh turnover boxes and plastic crates can be folded during the return trip, reducing shipping costs. Defects: There is a professional management team that needs to establish and maintain a professional container information system.

The above three cases are for different companies and detailed application. The company's needs are based on actual conditions, select appropriate plans, and actively promote the use of recyclable packaging materials internally and externally.

3.2 *Green logistics packaging management model innovation*

3.2.1 *Packaging technology standards and package reduction innovation*

(1) Packaging standard innovation

Through the means of big data analysis and other means, the company has streamlined the specifications of the packaging box. In this respect, the rookie network and the SF Express have carried out useful explorations and achieved great results. Suning made a selection in half a year, using large data analysis and calculation to select 9-15 kinds of packaging specifications, and promoted packaging standardization and achieved great results. In terms of packaging safety, some companies use FedEx's safety testing standards to solve the problems caused by the lack of relevant domestic standards; packaging suppliers need to actively participate in the national packaging standards research and development, innovation in smart packaging, environmental packaging.

Sealing mode innovation

The sealing mode of logistics packaging is closely related to delivery handover, green environmental protection, product fidelity, weight reduction packaging, and circulation sharing. Once the box is torn, it is sealed with a sticky box method. It does not need iron nails or tape. It is easy to recycle and recycle. It can be opened and opened, which greatly facilitates the customer's unpacking.

Packaging companies can cooperate with well-known brand enterprises, starting from the source, designing the packaging box (box) according to the standard product packaging modulus, implementing a one-time packaging seal on the product, unable to unpack and replace the goods in the middle, and pass one box and one yard. Wisdom tracking technology realizes the fidelity of products from the source to the end customer and enhances the brand value of the products.

In addition, some enterprises in the promotion of turnover cycle sharing, with the irreversible lock to lock the box and delivery documents, through the tamper box to achieve anti-theft in logistics distribution, to achieve unopened delivery of goods.

(2) Reduced packaging innovation

Encourage e-commerce enterprises to cooperate with product suppliers. Considering the packaging of e-commerce logistics and distribution from the product packaging of production plants, in the e-commerce logistics distribution, make full use of the original packaging of products to reduce the waste of secondary packaging; Support intelligent packaging technology innovation, according to the size and quantity of products, intelligently select the most suitable standard packaging box, reduce the size of filling and packaging, and reduce packaging; 3, encourage e-commerce enterprises to use smart logistics technology to merge customers Orders, package and deliver the same batch of different product orders to customers, reduce the number of packages and the number of delivery; vigorously promote electronic waybills, reduce the waste of e-commerce logistics package waybills.

There has always been an over-packaging problem in e-commerce logistics. In order to prevent violent sorting in the process of logistics distribution, e-commerce parcels are often wrapped with a large amount of tape, which wastes materials and is difficult to unpack, which brings difficulties in recycling cartons. Due to the lack of standard specifications, e-commerce parcels are often used. Packing boxes contain small items, often need to add fillers; many small appliances in the distribution often add a layer of e-commerce distribution packaging on the product packaging, bringing a lot of waste; due to plastic bags, cartons, foam fillings, etc. Packaging materials cannot be recycled, and some packaging materials are toxic and cause environmental pollution.

Reduced packaging is promising, product packaging and e-commerce packaging combined, using smart logistics technology, not only can achieve reduced packaging, but also can achieve product fidelity through packaging; promote electronic waybill, not only reduce paper waste, but also protect customer privacy.

Through the differentiated analysis of products, for the fragile and non-fragile products, different packaging according to product characteristics, to achieve packaging reduction; such as: Jingdong and other enterprises in the logistics and distribution of some items directly use product packaging instead of logistics packaging; Through the improvement of packaging materials, SF has greatly reduced the thickness of packaging cartons and packaging bags, and achieved reduced packaging.

In short, by encouraging enterprises to promote packaging reduction through technology and management innovation, and actively formulating reduction packaging standards, packaging waste can be greatly reduced and logistics costs reduced.

Logistics turnover box cycle sharing

According to the survey, rookie, Jingdong, No. 1 shop, SF, La Chapelle, Suning, COFCO and other companies have introduced the standard logistics turnover box cycle sharing model and related technological innovation. Among them, the rookie is ready to implement the recycling of public totes in all over the country; La Chapelle uses the logistics turnover box to achieve rapid sorting on the automated assembly line.

Degradable packaging innovation

At present, the rookie logistics commissioned by the relevant research institutions to develop degradable packaging bags, degradable tape and other products, can achieve rapid degradation; Jingdong is commissioned research institutions to actively develop degradable packaging materials.

At present, the biggest problem encountered by enterprises in developing degradable package packaging is the rising cost. At present, enterprises have given certain subsidies to the use of

environmentally-friendly packaging bags in the logistics system. In this regard, the government needs to introduce relevant support policies.

3.2.2 *Packaging materials recycling technology and mode*

Taking the logistics transportation of home appliances as an example, reusable packaging technology and packaging applications are applied to the logistics transportation and distribution of home appliances. The most effective improvement is to improve the original disposable packaging containers (carton and recycled pallets) into Recyclable totes, the packaging design work focuses on the customer's product characteristics, combined with the dimensional requirements and protection requirements used in the product storage and transportation process, the packaging operation design reasonable size and the number of packages of the combined modulus, to implement the packaging program.

Reusable packaging needs to focus on design points such as durability, safety, and easy disassembly. After the package arrives at the user, it needs to make full use of the space of the transportation tool for storage and recycling, and improve transportation efficiency. Under the premise of integrity, folding, splicing and other convenient operation methods, you can also use the turnover box to replace the bulk of the used boxes, stacked.

After using the totes, through analysis, the overall packaging and logistics costs are reduced. Achieving optimized logistics transportation and distribution links can also enable manufacturers, distributors and logistics service providers to form effective communication channels to provide efficiency, reduce inventory and fine management.

Improvement method: Logistics service providers will integrate the logistics recycling of home appliance sales into the scope of logistics services, and establish a new logistics model for recycling use of turnover boxes.

3.2.3 *E-commerce package can be recycled convenience box cycle technology and mode*

The greening of logistics packaging, the changes in packaging technology, and the construction of a recycling system are also important. Through the innovative research of packaging structure, packaging form and wrapping method, the use amount of carton, cushioning material and paper surface can be reduced or reduced, thereby achieving cost reduction and efficiency increase. At the same time, through the use of new packaging containers that can be recycled and recyclable, and the repeated use of these packaging materials, the use and waste of materials such as cartons and tapes can be reduced, thereby achieving green environmental protection. In terms of recycling, many companies are testing water. Jingdong has introduced a recirculating packaging bag, which uses a drawstring to complete the sealing of the packaging bag. After the consumer picks up the merchandise from Jingdong, the packaging bag will be recycled by the delivery staff and sent back to the warehouse for use when repackaging. The rookie will replace the current traditional packaging with a non-adhesive carton, and set up a green recycling area at the rookie station to allow more cartons to join the cycle. Suning has launched a shared express box nationwide. This recyclable plastic bin, which is about 0.3 meters long and 0.2 meters wide, can replace the goods purchased by consumers in the carton. It is delivered by the courier in the last mile, which directly saves the carton and tape, and can be used for 3C, mother and baby, Quickly eliminate fragile goods at the door to sign, self-delivery delivery. Suning released the fresh version of the shared express box, as the first cold chain recycling box product in China, will be the first to launch in the Suning cold chain network for scene testing applications.

In addition to the voluntary sharing system implemented by e-commerce and express delivery companies, some logistics equipment manufacturers and service providers are also actively constructing a wider range of cyclical sharing platforms. For example, as a pallet recycling system service provider, China Merchants Lukai has been striving to promote the sharing of pallet transport and pallet recycling. It has now promoted nearly 100 projects across the country, such as China Resources Vanguard, Wal-Mart, Yihai Kerry, and China Merchants. Well-known enterprises in the

industry such as logistics and P&G have established long-term cooperative relationships. Through the integration of platform resources, not only the use of disposable trays is effectively reduced, but also the transportation is greatly reduced.

4. Conclusion:

The e-commerce logistics packaging problem is a new problem. It is necessary to mobilize social forces, comprehensively promote technological innovation and management model innovation, strengthen guidance and reward support for green packaging technology innovation, and actively promote the standardization and green development of logistics packaging.

References

- [1] Analysis of the development status and future development trend of China's express logistics packaging and printing industry in 2017, China Industry Information Network <https://www.chyxx.com/industry/201801/605942.html>
- [2] Wang Jixiang. An important starting point for promoting the construction of supply chain system in circulation field [J]. Logistics Technology and Application, 2018, 23 (06): 72-73.
- [3] Wang Jixiang. The development path of innovative logistics greening [J]. Environmental Economy, 2018 (14): 44-48.
- [4] Wang Jixiang. Shared Logistics: China's warehousing and distribution innovation trend [J]. Logistics Technology and Applications, 2016, 21 (07): 52-56.
- [5] Wang Jixiang. How to implement green warehousing and distribution in China [J]. Logistics Technology and Application, 2015, 20(04): 136-143.
- [6] Wang Linlin, Tu Manli, Yi Junjun. Effective recycling of express packaging under green logistics [J]. Modern Trade and Industry, 2018, 39 (36): 31-32.
- [7] L'Oreal, Alibaba Boost Efforts to Green up Packaging in China [J]. China Detergent & Cosmetics, 2018, 3(03): 7.
- [8] Zhong Xia. Packaging needs standards also need legislation [J]. Green packaging, 2018 (11): 80-82+86.
- [9] Liu Mingjing, Chen Yu. Exploring the green development path of China's express packaging [J]. Logistics Engineering and Management, 2018, 40 (11): 23-24+16.
- [10] Zhang Xueqin, Wen Guigan. Innovative design of new express delivery box under the concept of green packaging [J]. China Packaging, 2018, 38 (11): 54-56.
- [11] Khan Syed Abdul Rehman. The Drivers and Barriers of Green Supply Chain Management: In the Context of Manufacturing Firms of Pakistan [D]. Chang'an University, 2018.
- [12] Fei Fang. Research on the Application of Green Element in Packaging Design [A]. Institute of Management Science and Industrial Engineering. Proceedings of 2018 International Conference on Culture, Literature, Arts & Humanities (ICCLAH 2018) [C]. Institute of Management Science and Industrial Engineering: Computer Science and Electronic Technology International Society, 2018: 4.
- [13] Carsten Herbes, Christoph Beuthner, Iris Ramme. Consumer attitudes towards biobased packaging – A cross-cultural comparative study [J]. Journal of Cleaner Production, 2018, 194.