ISSN: 1813-4890

Green Development of Express Packaging: A Brief Review

Lijia Yang

School of Modern Post, Chongqing University of Posts and Telecommunications, Chongqing 400065, China

Abstract

With the rapid growth of China's express delivery industry, the problems of resource waste, environmental pollution and greenhouse gas emissions caused by express packaging waste are becoming serious. Increasing the supply of green products for express packaging and promoting the green development of express packaging has become an urgent task for the express industry and the government authorities. In this paper, we review the trends in green development strategies and assessment of green development for express packaging to identify directions for research and development. This can help to better understand the trend of green development of express packaging.

Keywords

Express Packaging; Green Development Assessment; Green Development Strategy.

1. Introduction

At present, the research on the green development strategy of express packaging mainly includes the reduction, recycling, reuse and degradability of packaging. The assessment of green development of express packaging is mainly carried out from the perspectives of product attributes and technical attributes, which mostly stay at the theoretical level and are not in-depth enough, and the research lags behind the development of reality, without providing theoretical support for the prior development and post-evaluation of express packaging products, which is also not conducive to the government to grasp the overall situation of green development of express packaging from the macro level. The use of green packaging will bring about a reduction in carbon emissions, but it will also increase other environmental and economic costs [1], which need to be assessed from an economic perspective by taking into account their social costs and social benefits, combined with life cycle cost analysis and externalities in a circular economy. The assessment of social costs requires the application of cost-benefit analysis in welfare economics [2], such as environmental economic accounting methods, to analyses the environmental impact of actions that generate externalized costs.

2. Research Related to the Assessment of Green Development of Express Packaging

2.1. Carbon Footprint

At present, relevant studies mainly measure the greening level of packaging through carbon emissions. China's carbon peaking work has entered a critical period, and carbon emission reduction of express packaging is the goal of the express industry moving forward. In recent years, the measurement of carbon footprint of packaging products has received extensive attention from academia as well as packaging product manufacturers.

D. Pandey et al [3] have studied the basic theory and calculation method of carbon footprint and pointed out that carbon footprint can be used as an important measure of greenhouse gas emissions. V.G. Lo-Iacono-Ferreira et al [4] compared the full life-cycle carbon footprint of corrugated boxes and polypropylene folding boxes (considering two scenarios of 20 and 50

ISSN: 1813-4890

uses) commonly used in international road refrigerated transport for vegetable packaging. In terms of carbon emissions from courier packaging, a study by Wang Yanli [5] and Yu Jinyan et al [6] on carbon emissions from the whole life cycle of courier packaging found that the packaging produced the most carbon emissions in the raw material and production stages. Some research [7] analyzed the generation characteristics, flow and direction of flow, whole life cycle carbon emissions and social management costs of courier packaging waste in China.

2.2. Cost and Benefit Study of Carbon Emission Reduction

Accounting for carbon abatement costs is an important element of carbon peaking and carbon neutral policies [8]. The forms of accounting for carbon abatement costs include marginal abatement costs [9, 10], average abatement costs, incremental abatement costs, and shadow prices [11].

There are few relevant studies on cost-benefit accounting for green development of express packaging, and studies on carbon emission reduction cost accounting are mainly focused on traditional mature industries such as iron and steel, based on practice and research there have been long-term comprehensive statistics to account for their carbon emission reduction costs and benefits. The practice and application of green development measures for express packaging such as reduction, reuse, recycling and biodegradability are still immature, and this method is not applicable considering the availability of data. And mainly from the local evaluation, cost accounting scope has not yet formed a unified, specific definition, researchers are mostly on the basis of actual cases to discuss. For example, in the cost study of the recycling process, Zhou Yu Kai [12] summarized that the packaging recycling process is mainly divided into four stages: sorting, inspection, repair and inventory, and established a logistics packaging recycling cost accounting model in terms of both fixed and variable costs, but it is only a qualitative analysis.

3. Research Related to Green Development Strategies for Express Packaging

3.1. Reduce

Packaging material reduction refers to reducing the amount of packaging materials on the premise of meeting the basic functions of packaging, giving priority to lighter and thinner materials that are lighter in quality, tougher, stronger, recyclable and reusable, and solving the problem of packaging material pollution from the root. Wang Fuyu et al [13] proposed that packaging with low usage and few types of materials is green packaging, and the reduction techniques of plastic packaging include direct reduction, indirect reduction by adding recycled materials and invisible reduction of reusable packaging. Yi Yi et al [14] and Fan Weiguo et al [15] used the life cycle evaluation method to analyses the environmental impacts of courier packaging, such as polyethylene courier bags and cartons, which are currently commonly used in the A. Dormer et al [16] found that the use of recycled materials had a significant impact on the carbon footprint of packaging, and that a reduction in packaging weight could lead to almost an equal percentage reduction in carbon footprint, and that packaging should be pursued for The reduction in packaging weight and high recycling rates should be pursued.

3.2. Recycle

There are more studies on express packaging recycling, including the analysis of the current situation of express packaging recycling, recycling system, recycling pricing and recycling models, and relevant policy recommendations are put forward based on these studies.

In terms of courier packaging recycling, Li Ling et al [17] studied a hybrid decision-making framework for prioritizing courier packaging recycling modes, considering factors such as cost,

consumers and the environment, and the results showed that the recycling bin model was optimal. Duan Huabo et al [18] studied the material flow and environmental impact of courier packaging waste in China. Qin Peng et al [19] studied the recycling system. Xu Ying et al [20] analyzed the recycling pricing of express packaging.

Cui Hailong et al [21] studied optimal recycling rates and utilization rates, analyzing the recycling efficiency and recycling decisions for highly recyclable materials including paper, plastic, metal and glass in the US from both economic and environmental perspectives, concluding that recycling of all common materials except glass is beneficial in reducing operational costs. J. Pasqualino et al [22] evaluated the production of different materials and sizes of packaging and their final disposal methods (landfill, incineration and recycling) and concluded that recycling was the most environmentally friendly disposal option, with incineration or landfill being the second-best option depending on the packaging material.

3.3. Reuse

With regard to research on the recycling aspects of packaging, the results of L. Meherishi et al [23] show the importance of recycling and recovery of packaging for sustainable development. S. Albrecht et al [24] compared the environmental, economic and social potential of disposable wooden boxes, cardboard boxes and reusable plastic boxes throughout their life cycle and showed that reusable packaging is the most cost effective. Based on the concept of green development, many scholars have done research on the design of recyclable courier packaging, mainly in terms of tape-free design, anti-opening safety features, inflatable cushioning and the modular concept, such as the shared courier transport packaging designed by Xiong Xingfu et al [25]. The key to the operation of recycled packaging is the construction of a recovery and recycling system, which has not formed a clear recovery and recycling system, and the recycling of recycled packaging is mostly about the optimization of the recycling network system. Li Ruiyang et al [26] constructed a recycling network for recyclable express packaging and established a heuristic algorithm for optimization, and the experiment showed that their scheme could significantly reduce the total cost.

3.4. Degradable

Regarding the related research on the degradation of packaging materials, J. Brizga et al [27] studied the replacement of petrochemical plastic packaging with bioplastics and analyzed its impact on the environment from three perspectives: carbon emissions, land resources and water resources, and found that bioplastics would lead to a significant increase in the use of land resources and water resources.

Judging from the rapid development of courier packaging in China, there are still difficulties in implementing biodegradable plastics, and there is no fundamental solution to the rapid growth of plastic packaging in the courier industry. Possible solutions are to strengthen the regulation of the courier industry, implement the whole process management of plastic packaging use to avoid excessive packaging; use plastic packaging alternatives and increase the reuse rate of courier packaging as much as possible [28], which means developing and using recyclable courier packaging.

4. Summary

We review the literature related to express packaging green development strategies and green development assessment, and find that the current express packaging green development strategies are mainly related to the 3R1D principles, but there hasn't further analysis of the specific strategies. The assessment of the green development of express packaging is mainly about an environmental perspective. The assessment from the economic perspective should be

added in the future, and the social costs and social benefits of express packaging should be considered comprehensively.

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