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# Technological Integration in Environmental Supply Chain Optimization: Logistics Cost Management Strategies for the Wood Processing Industry



**Abstract:** - Type Ia supernovae (SNe Ia) are among the most luminous and uniform stellar explosions, making them valuable cosmic distance markers. This paper explores the key features of SNe Ia, focusing on their spectral evolution and the role of iron-group elements in shaping their observable properties. Beginning with their classification and theoretical models, the study highlights the homogeneity of SNe Ia, linked to the thermonuclear disruption of white dwarf stars near the Chandrasekhar limit. Through a detailed analysis of spectral transitions from early to late phases, we gain a deeper understanding of the nuclear processes driving these explosions. Additionally, the work addresses the diversity within SNe Ia subclasses, discussing their implications for cosmological studies.

**Keywords:** : Environmentally Conscious Supply Chain, wood processing enterprises, logistics costs, strategic management

"Dual carbon", namely carbon peaking and carbon eutrality, has become a global consensus to address climate change<sup>(1)</sup>. In the process of national economic development, the wood processing industry, as a pillar industry of the forestry industry, has the unique dual characteristics and effects of natural low-carbon and carbon

storage. Meanwhile, with the acceleration of global economic integration, logistics costs have become a key factor in improving the development level of wood processing enterprises and an important component of the competitiveness of the forestry industry. Therefore, based on the background of green supply chain, it is particularly important to strengthen the strategic management of logistics costs in the wood processing industry.

## 1. Research Background and Significance

In 2021, the sales revenue of China's wood processing and wood, bamboo, rattan and grass products industries was 965.55 billion yuan, an increase of 12.51<sup>(2)</sup> percent year-on-year. In the wood processing industry, the important component of product cost is logistics cost; Logistics cost control is the key to enhance the core competitiveness of wood processing enterprises. Therefore, strengthening the logistics cost management of wood and related products can effectively reduce the price of wood products; It helps wood processing enterprises to better protect the environment and save resources in production and circulation, thus greatly improving the competitiveness and innovation of wood processing enterprises in the market economy; It is helpful to improve the

competitiveness of the wood processing industry in the international market<sup>(3)</sup>.

China's wood processing industry is in a stage of rapid development, from wide to strong is the way to choose<sup>(4)</sup>. Combining the theory of green supply chain and the concept of sustainable development, the problems existing in the logistics cost management of traditional wood processing enterprises are analyzed. The modern wood processing logistics industry should be developed as soon as possible to reduce the logistics costs in the process of wood production and circulation<sup>(5)</sup>. Thus improve the overall level of logistics cost management of the whole country's wood processing industry. The transformation of Chinese forestry from traditional quantity forestry to modern benefit forestry; It has important economic significance and practical significance, and is conducive to the sustainable development of China's forestry industry in the new era.

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## 2. Concepts Related to Green Supply Chain and Logistics Costs for Wood

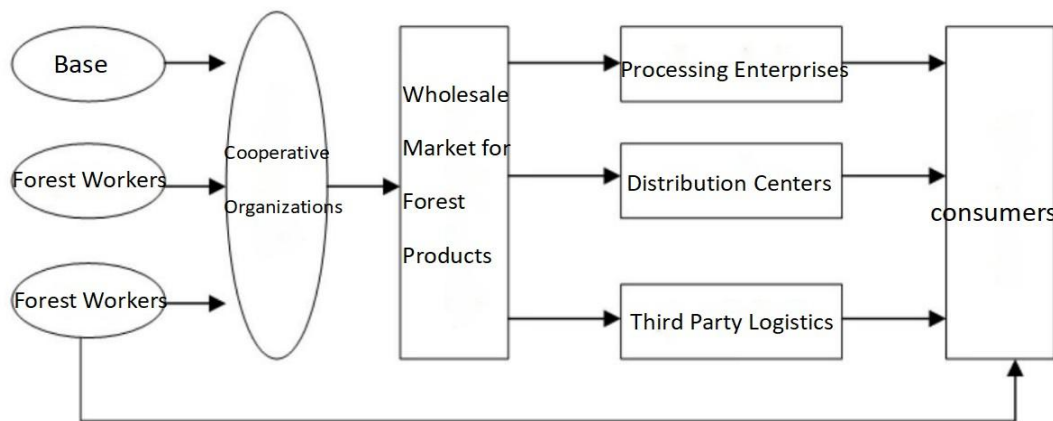
### Processing Enterprises

#### 2.1 Concept of Green Supply Chain

The Green Supply Chain theory is produced on the basis of the Supply Chain theory, and it is obtained by integrating the green factor into the Supply Chain<sup>(6)</sup>. As in the case of supply chain management, the concept of green supply chains is not yet uniformly understood by academics. In 1996, the concept of Green Supply Chain was first formally introduced when a study on “Environmentally Responsible Manufacturing (ERM)” was conducted at the Manufacturing Research Institute at Michigan State University in the United States<sup>(7)</sup>. Among domestic scholars, Dan Bin (2000) believes that Green Supply Chain is “a modern management model that takes environmental impact and resource efficiency into account in the whole supply chain, which is based on green manufacturing theory and supply chain management technology and involves suppliers, production factories, sellers and users, and its purpose is to make the products have the least impact on the environment and the highest resource efficiency in the whole process of acquiring materials, processing, packaging, warehousing, transporting, using and disposing of products at the end of life”,<sup>(8)</sup>.

#### 2.2 Supply Chain Models for Wood Processing Enterprises

The supply chain model of China’s wood processing enterprises mainly consists of forest product processing enterprises represented by state-owned forest farms organizing and guiding forest farmers in the vicinity of forest product processing enterprises to engage in forest product production and operation activities through contract, shareholding cooperation and other relevant cooperation mechanisms<sup>(9)</sup>. According to the experience of the United States, Canada and other developed countries, China’s value-added amount will be as high as 1-10 times through the circulation<sup>(10)</sup>, processing, packaging and change of the properties of forest products such as forest fruits. Therefore, the supply chain model also forms a value-added chain along with the flow of forest products, as shown in Figure 1 below.



**Figure 1:** Supply Chain Models for Wood Processing Enterprises

Pictured: Wang, 2015, Figure(1)

#### 2.3 Composition of Logistics Costs for Wood Processing Enterprises

According to the national standard *Composition and Calculation of Enterprise Logistics Costs* (GB/T20523-2006), logistics costs refer to the monetary performance of physical labor and living labor consumed in logistics activities of an enterprise, including the sum of manpower, material and financial resources expended in the process of transportation, storage, packaging, loading and unloading, circulation processing, logistics information, logistics management, etc., as well as the costs of working capital occupation related to inventory,

inventory risk costs and inventory insurance costs (Jieru & Khan, 2024).

The logistics costs of wood processing enterprises are mostly reflected in the cost

of processed wood and other forest products, which are inseparable from the cost of products. The composition of logistics costs for wood processing enterprises is shown in Table 1.

**Table 1:** Composition of Logistics Costs for Wood Processing Enterprises

Labour costs	Including wages, funds, allowances, and welfare costs for employees in the supply, storage, handling, and marketing of wood and other forest products
Procurement costs for materials such as wood	Including costs of transportation, insurance, and reasonable wear and tear
Sales costs of wood and other forest products	Including costs of advertising, transportation, exhibition promotion and information
Warehousing and storage costs	Including costs of warehouse maintenance and handling
Equipment costs	Including depreciation, repair, and maintenance costs of equipment and warehouses related to wood processing
Operating costs	Including costs of energy consumption, material consumption, depreciation, office expenses, travel, insurance, labour protection.
Financial costs	Including the interest on the funds occupied by storage materials such as wood
Recycling costs	Including logistics costs for recycling waste products such as wood

**Table 1:** Composition of Logistics Costs for Wood Processing Enterprises

(For more information, please refer to: Wang, 2012, Table 1)

### 3. Problems in the Logistics Cost Management Strategy of Wood Processing

#### Industry in the Context of Green Supply Chain

##### 3.1 Lack of Innovation in Cost Management Concept and Shortage of Logistics

###### *Professionals*

On the one hand, China's research on forest product logistics is still in the early stage of exploration, resulting in a low level of understanding of logistics in wood processing enterprises (mainly reflected in the low awareness of logistics costs), and a lack of innovation in cost management concepts, resulting in the absence of a clear goal of logistics cost management in relevant enterprises (Li & M.S, 2023).

On the other hand, there is a serious shortage of financial management talents in China who are familiar with the wood processing process, proficient in logistics management technology, mastering the entire supply chain management extending outwards from the logistics within the forestry industry<sup>(11)</sup>.

##### 3.2 Lack of Independence in Logistics Management Department and Lack of System on

### *Cost Accounting*

At present, wood processing enterprises still adopt traditional accounting methods and do not set up a separate logistics management department, which makes the accounting system of logistics costs has not been constructed, the information of logistics cost reports is incomplete, and the basic data of involved costs in the logistics system are less, so that they cannot calculate the logistics costs of the relevant forest products, and even less can accurately and timely reflect the logistics costs (Waheed, A. *et al.* 2023). As a result, it is impossible to make vertical and horizontal comparisons of relevant logistics costs in the entire forestry industry, which leads to the fact that processing enterprises in the forestry industry cannot effectively control the costs incurred in the process of wood logistics operations. At the same time, the strategic decision-making of relevant enterprises is affected<sup>(12)</sup>.

#### *3.3 Long Wood Inventory time and High Storage Costs*

Wood inventory run through the entire line in the supply chain while the structure of China's wood market is not yet perfect (mainly because in most regions, the wood market is just a trading venue established by local organizers). In addition, due to the weak management concept of enterprises on supply chain, the low degree of information network sharing in the forestry industry and other factors, the processing enterprises of forest products with wood as raw materials have been in stock after purchase and before sales, so that the storage costs of wood processing enterprises are too high.

#### *3.4 Outdated Logistics Infrastructure and Low Distribution Efficiency*

The means of transport in wood processing enterprises, especially the collection and transportation of wood, are still dominated by simple means of transport, such as root-digging machinery, branch collection and baling machines, mobile winch machines, scraper transporters and other forestry-specific tools, which are not utilized at a high rate, affecting the efficiency of the collection and transportation of wood. Information technology in logistics of wood processing enterprises is relatively backward, so that the information transmission of the wood market is not accurate and timely, the speed and accuracy of logistics are affected, the efficiency of logistics services is not high, so that the efficiency of logistics distribution in wood processing enterprises is low (Khan *et al.* 2022).

#### *3.5 Emphasis on the Economic Benefits of the Industry and Neglect of the Ecological*

##### *Benefits of Forestry*

China's wood-processing industry is still in a state of small-scale, decentralized and disorderly competition. And some enterprises in the forestry industry have frequently overloaded their transport vehicles in pursuit of short-term economic benefits. These not only cause serious damage to the road network, but also contribute to air pollution (mainly caused by increased emissions). This one-sided emphasis on the economic benefits of the wood processing industry, and the neglect of environmental pollution caused by the logistics circulation links of wood such as mining, collection, transportation, storage, etc., is not conducive to the coordination and sustainable development of wood processing enterprises in terms of ecological, economic and social benefits (Tanveer *et al.* 2020).

## **4. Optimization Strategy for Logistics Cost Management in Wood Processing**

### **Industry under the Background of Green Supply Chain**

In the context of increasingly severe environmental pollution, it is necessary to include environmental factors in the logistics cost assessment of the wood processing industry under the background of green supply chain; Meanwhile, logistics cost control for wood processing enterprises is the key to improving their core competitiveness<sup>(13)</sup>.

#### *4.1 A new thinking of logistics cost management in the wood processing industry*

In the face of the ever-changing, fiercely competitive market environment and the continuous improvement of customer demand diversification, personalization and consumption level, in order to formulate long-term development strategies and operate stable, enterprises must focus on changing concepts, improving cost awareness, improving logistics awareness, and establishing logistics management ideas to cultivate core

competitiveness, so that the wood processing industry can build a high-efficiency

and low-cost forest products logistics supply chain system as soon as possible<sup>(14)</sup>. It is

conducive to improving the economic benefits of timber and promoting the sustainable development of the forestry industry. Therefore, the new concept of wood logistics cost management is innovated, and the comprehensive level of logistics cost management of China's wood processing industry has been further improved.

#### *4.2 Establishing a green supply chain to promote the upgrading of the wood processing industry with scientific and technological progress*

With the deterioration of human living environment, governments, enterprises, and the public are paying more and more attention to environmental protection. In the supply chain, the consideration of the overall environmental impact of all products and supply chain processes is becoming increasingly important, and the concept of green supply chain has emerged<sup>(15)</sup>. Green supply chain, as an innovative environmental management approach, integrates concepts such as full lifecycle and extended producer responsibility

into traditional supply chain management. It regards the ecological and environmental system as an internal subsystem, relies on the supply relationship between upstream and downstream enterprises, and takes core enterprises as the fulcrum to carry out green supplier management, green procurement, and other work, focusing on the forestry industry economy. Building a green supply chain not only helps to reduce industrial chain risks, adapt to the trend of green development, but also promotes industrial chain collaboration, win-win and high-quality development, and enhances enterprise

competitiveness<sup>(16)</sup>.

Due to the weak characteristics of wood production, such as long cycles, slow turnover of forestry funds, and the impact of climate disasters, forestry investment faces dual risks of nature and the market. Therefore, it is necessary to transform the forestry development model and rely more on innovative elements such as technology, talent, knowledge, and information to drive development. Firstly, it is vital to strengthen forestry scientific research and the transformation of scientific and technological achievements, and enhance the supporting role of scientific and technological innovation. Secondly, it is also important to accelerate the construction of forestry talent echelon, so as to comprehensively enhance the innovation ability and level of forestry talents. From the perspective of green supply chain, green technology innovation is necessary throughout the entire supply chain, namely from resource cultivation to distribution

services<sup>(17)</sup>. However, due to the high cost of innovation, the supply chain requires strong

support from policies such as fiscal policies. In the context of accelerating the green economy, the green supply chain can affect directly or indirectly the improvement of enterprise value. Relying on technology, policies and funds to continuously improve the development of the green supply chain, and then promote the transformation and upgrading of the entire industrial chain.

#### *4.3 Strengthen the collaborative management capabilities of core enterprises in cross industry, cross process and cross chain*

The collaboration of forestry green supply chain with highly complex characteristics covers the entire process from seedling cultivation to forest product sales, crossing three industries of forestry. In order to effectively coordinate green supply chain cooperative enterprises, the core enterprises engaging in wood processing should have high-level collaborative management capabilities. Firstly, training all the employees of the green supply chain on supply chain collaborative management. Enterprises at each section of the supply chain must establish the "win-win" concept and conduct extensive and thorough cooperation based on confidence, commitment, and sharing and strengthen the internal and external connections between enterprises and departments at each section and consider the enterprises on the entire chain as an organic whole. The most important thing is to improve the collaborative management capabilities of core enterprises, develop supply chain collaborative management plans for the entire industry, chain and process and attach importance to collaborative communication, trust, and

decision-making in problems solving, gradually improve high-level green forestry supply chain management capabilities. In addition, cultural collaboration should also be incorporated into the supply chain to help the parties concerned to achieve better communication, establish an overall awareness and ultimately improve the flexibility of the entire supply chain and optimize its value.

#### *4.4 The government shall incorporate ecological performance, resource performance and social performance into the supply chain performance evaluation system*

Forestry is an integrated industry combining the economic value, ecological value and social value of forests. Due to the importance of the green coordinated and sustainable development of overall benefits in the forestry green supply chain, it is not only necessary to achieve economic benefits, but also to continuously increase resources and improve the ecological environment. Therefore, the logistics activities of timber should also be consistent with this goal. While completing the timber logistics activities, it is necessary to take the social, ecological benefits and sustainable development of forestry into consideration. The goal of wood processing enterprises is to maximize profits, while from the perspective of the entire industry, process and chain of the forestry green supply chain, a forestry green supply chain without any benefits is unsustainable. Therefore, in the supply chain performance evaluation system, resource, ecological and social

performance should be introduced as measurement indicators<sup>(18)</sup>. Therefore, in the supply

chain performance evaluation system, resource, ecological, and social performance should be introduced as measurement indicators. When managing the wood processing supply chain, attach importance to the preparation and reserve of forest resources and use them scientifically and efficiently as reliable sources of competitive advantage. In the process of utilizing forest resources, it is conducive to recycle wood waste transform if we transform from traditional "end control" to full process quality and source prevention, treat the green wood supply chain as a whole and build a green wood supply

network<sup>(19)</sup> and promote the improvement of forestry ecological and economic benefits. At

present, the green supply chain has infiltrated into the economy and society which cultivates people's green consumption concept, optimize the human being's living environment, promote employment and drive the development of local social economy

<sup>(20)</sup>.

In summary, it is imperative to strengthen the cost management strategy. By optimizing the strategy and relevant measures, we can ensure the steady improvement of the economic and social benefits of wood processing enterprises, consolidate their advantages, demonstrate their unique advantages in the same industry and promote the sustainable and healthy development. Therefore, the concept of "green efficiency, intelligent standards and systematic collaboration" in logistics cost management of the wood processing industry under the background of green supply chain is an innovative application of "accelerating the environmentally friendly development mode transformation" proposed in the 14th Five Year Plan; It is significant to promote environmentally friendly, low-carbon and sustainable development of logistics and build a beautiful China.

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