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Research on the Logistics Management of Fresh Produce from the Perspective of Green Supply Chain

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Abstract: With the continuous development and change of the times, people have a higher pursuit of quality of life, and the demand and quality requirements of fresh products are increasing, requiring a more refined and suitable logistics management for the context of the times. The existing literature today is mainly from the perspective of traditional supply chain, and the research from the perspective of green supply chain is relatively missing. In this paper, I analyze the current situation of fresh produce logistics system in the context of a green supply chain to analyze the imperfections in this field according to the questionnaire survey and collection, then propose improvement suggestions and measures. The research in this paper will play an effective role in promoting the implementation of green supply chain. At the same time for the environmental awareness supply chain in the construction of society to play a role in calling for, and jointly help the development of green production and life.

Keywords: green supply chain, fresh produce, logistics management

1. Introduction

1.1. Research Background

The concept of fresh produce originates from people's pursuit of a better life and is generally divided into several categories, such as fruits and vegetables, meat, aquatic products, cooked food, daily dairy products. It is characterized by high seasonality, high demand for freshness, high demand, high purchase frequency, wide audience, price sensitivity, and high risk of loss. With the improvement of living standards, people's demand for fresh products is increasing, and logistics play a vital role as the main way of fresh products delivery.

The outbreak of the new crown pneumonia epidemic since 2020 has catalyzed the development of the logistics system for fresh products to a certain extent. The handover process of ambient chain transportation is complex, and the products are highly exposed to virus contamination, making them risker. Cold chain logistics, on the other hand, is more controllable and the frequency of risk exposure is lower. With the increase in demand for fresh food e-commerce in recent years and the change in people's mentality and mindset in the post-epidemic era, the freshness and safety of fresh products are paramount. With the increase in demand and consumption of fresh products, the concept of cold chain logistics is becoming increasingly integrated into people's lives.

However, most of the research on fresh produce logistics management strategies today is based on the traditional supply chain model, while the logistics industry is developing rapidly as an important

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part of the supply chain in the face of growing economic and scientific technology, as well as the development of new international patterns and international demand for environmental protection. Nowadays, it is essential to integrate new development concepts into it, i.e., what are the differences and innovations in fresh produce logistics management strategies from the perspective of a green supply chain, what are the impacts on production and life, or what are the improvements needed, and how to realize the wide application and implementation of a green supply chain in the future, so as to form a green development pattern in fresh produce logistics industry, which becomes the primary development issue in this era. The first question of the era is how to achieve the widespread application and implementation of green supply chains, so as to form a green development pattern in the fresh produce logistics industry.

1.2. Research Objective

This study aims to improve the above-mentioned problems, mainly by combining the green supply chain and the green concept of fresh produce logistics management and by analyzing the relevant data to give the corresponding improvement and implementation strategies. In the era of rapid development and progress, the rapid rise of technology and the emphasis on the concept of green development, it is important to fill a small gap in the academic field of fresh produce logistics management from the perspective of green supply chain and add to it.

2. Literature Review

The use of a more developed level of technology and information interconnection to develop a cold chain logistics management strategy in the context of the new era is an issue that the theoretical academic community will focus on, and understanding the issue from the perspective of the green supply chain is also the trend today, with a large space for its development and a certain degree of foresight and unknowns. Nowadays, there are a lot of research on fresh product logistics in the academic field, but there is not enough mature research literature on fresh logistics management under the green supply chain concept.

The cold chain logistics of fresh produce have been developed internationally for more than 200 years. Nowadays, the United States, the United Kingdom, France, Canada, Japan and Korea have all initially built a nationwide fresh produce logistics information system. For example, the cold chain and quarantine system for pork in Canada and the ear tag tracking system in the UK enables real-time management and after-sale tracking of products through a full-process traceability information system, which has greatly improved the efficiency of fresh produce regulation in the above countries. Zhao Xurong and Cui Jia suggested that the livestock ear tag traceability system adopted in the UK has effectively improved the safety of fresh produce transportation [1]. Its role can be divided into three specific aspects. First of all, the traceability and recall of problematic products. Using this method in case of quality and safety problems, other products of the same batch and origin can be quickly located to avoid products deriving from larger public safety problems. This practice can effectively reduce public costs. Secondly, it can regulate the attribution of rights and responsibilities of fresh products. Product problems are directly linked to the producer, which can regulate the safety of the producer and improve the operation of the production source. The last is to ensure the consumer's interests. Consumers are able to trace the origin of products directly on the relevant website and give feedback on problems in the consumption process. These measures undoubtedly improve the credibility of the product and reduce the product problems caused by information asymmetry. In addition, Yu studied that introducing Internet technology [2], it can improve the level of cold chain storage, cold chain performance and cold chain control, and its application is greatly

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beneficial to the storage and preservation of fresh products, all of which can optimize the fresh product management system with the help of new Internet technology.

The production of green products under the concept of green development is the form needed for logistics in the perspective of green supply chain. Hui Wen, Minghui Xu, and Jianping Tao conducted a study on the difference in greenness between fresh produce produced by green produce suppliers and common produce suppliers [3], and the time-varying utility of consumers is affected by the greenness, retail price, and freshness of produce. The results show that the profit of retailers is negatively related to the price sensitivity coefficient and the cost coefficient of greenness, and positively related to the freshness sensitivity coefficient.

A study on the logistics system from the perspective of a green supply chain. Han Tingting and Ding Lin analyzed the problems of green logistics development in China and proposed improvement measures and the development path of green logistics under supply chain management in China [4]. You Meihong, Yan Mengling, and He Meizhang summarized experiences from the green logistics practices of e-commerce logistics enterprises and proposed the application of 5G technology to green logistics [5]; Zheng Xiaodan found that differential taxation can compensate for the spillover benefits generated by enterprises conducting green logistics [6], and the construction of green logistics should form a logistics alliance inspired by green supply chain ideas and led by core enterprises.

3. Methodology

3.1. Questionnaire Design

In terms of research methodology, a simple random sample of the general public of any gender, age, or occupational status will be used and surveyed using a questionnaire. The sample size is determined in relation to sampling error, survey cost, etc. The goal of this study was to randomly select 300 people with conditions such as those described above for the survey study. The questionnaire consisted of 11 questions, all of which were required. There were three basic information questions and eight questions within the scope of the study topic, which consisted of single, multiple choice and ranked questions. The questionnaire's questions were all non-scale, which helped to analyze the study topic more specifically.

Prior to the formal survey, a small pre-survey of eligible respondents was conducted via an online survey, the main purpose of which was to test the questionnaire for possible problems and to check the operability of the subsequent formal survey. The pre-survey was conducted for 2 days and 50 questionnaires were collected, of which 48 were valid, with an effective rate of 96%. Through the statistical analysis of the important indicators of the valid questionnaires and the reliability and validity analysis, we believe that this pre-survey is representative. At the same time, in order to better grasp the possible problems of the questionnaire content, we will also select some specific groups of people to conduct telephone interviews and face-to-face interviews, through these two kinds of question-and-answer surveys to collect respondents' feedback, in order to better improve the questionnaire content and prepare for the next formal survey.

Because there were no problems in the pre-survey, the questionnaire for the formal survey had the same set of questions as the pre-survey questionnaire. The average response time for the 11 questions was about 153 seconds. For missing, outlier and duplicate value questions. These biases can be avoided because the questionnaire is designed in such a way that all questions are mandatory and can only be submitted once per person. In addition, all questions were single or multiple choice, and there were no fill-in-the-blank questions. Therefore, there are no missing, abnormal or duplicate values in this questionnaire.

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The questionnaire was designed and collected online by "Questionnaire Star" for a period of 8 days from April 1, 2023 to April 8, 2023. After the questionnaire was collected, statistical analysis was conducted using both the "Questionnaire Star" and Excel spreadsheets.

3.2. Question Setup

For the setting of questions in the questionnaire, there is a series of potential logic.

First, start with basic information, such as gender, age, and occupation. Placing simple and easy-to-fill questions in the front of the questionnaire is more attractive to respondents and increases the probability of respondents completing the full questionnaire. After the basic questions, this questionnaire will investigate the respondents' overall perception of fresh produce in the overall questions. For example, the focus is on how much attention the public pays to various aspects of fresh produce, and how often people buy and simply feel about fresh produce in their daily lives. From the respondents' perspective, we observe people's attitudes toward fresh products and the existing problems that are commonly perceived. Finally, the question of promoting green concepts, such as the respondents' attitudes towards green packaging and their views and suggestions on the overall greening of the supply chain. In summary, this questionnaire survey draws on the voices of the public to understand the extent of penetration of the green concept in life and public opinion in many ways. The ultimate goal is to explore how to understand and face the green concept of fresh produce logistics, and to address and refine the ways and means of fresh produce logistics management under the perspective of the green supply chain.

4. Results

4.1. Gender Distribution of Sample Members

In the questionnaire survey, the study was conducted on respondents of different age groups, genders and occupations. A total of 274 samples were received in this study, and 274 valid samples were received. As shown in the gender distribution fan chart in Figure 1, there were 118 male samples and 156 female samples, the number of male samples was lower than the number of female samples, and the proportional distribution of the number of male and female samples was as follows.

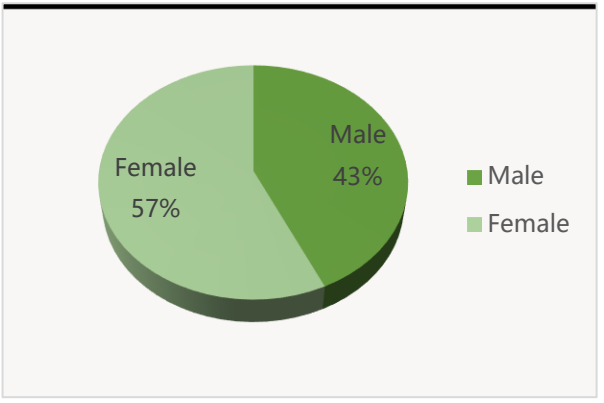

Figure 1: Sectoral map of sample gender distribution.

4.2. Age Distribution of Sample Members

From the age of the sample members shown in Figure 2, out of 274 samples, the most significant number of sample members were in the 26-35 age group with 74, which reached about 27%. This is followed by the age group of 46-55 years old with a total of 65 members, accounting for about 24%.

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The lowest percentage was in the under-18 age group, with only about 2%. In general, the prime and middle-aged people accounted for a larger proportion, while teenagers and older people accounted for a smaller proportion.

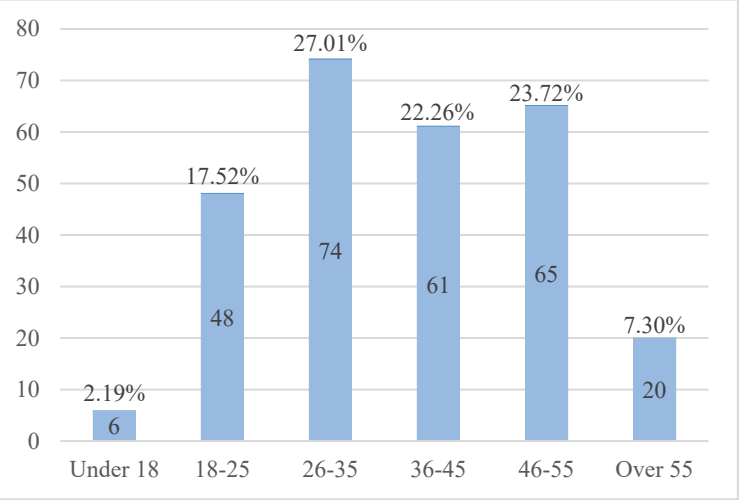

Figure 2: Histogram of sample age distribution.

4.3. Occupational Distribution of Sample Members

From the occupational distribution of the sample members shown in Figure 3, Civil servants, career staff accounted for the highest percentage, with a total of 75 samples, accounting for about 28%, in addition, Enterprise company employee and Teacher were both more numerous, accounting for about 26% and 24%, respectively.

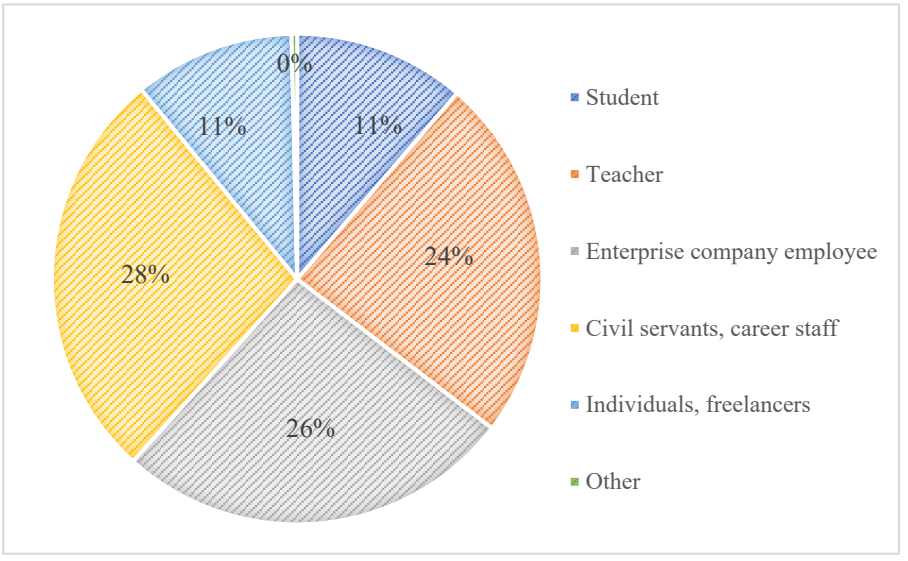

Figure 3: Sectoral map of the occupational distribution of the sample.

The sample characteristics can be understood from the distribution of each underlying information mentioned above, allowing the study to be confirmed in terms of its breadth, popularity, and recognition.

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5. Research Results and Analysis

Within the eight questions about the research topic, as seen in Figure 4, when the surveyed sample members were asked to rank their concerns about each feature of fresh produce, they generally agreed that safety, timeliness and freshness were the most important parts of fresh food.

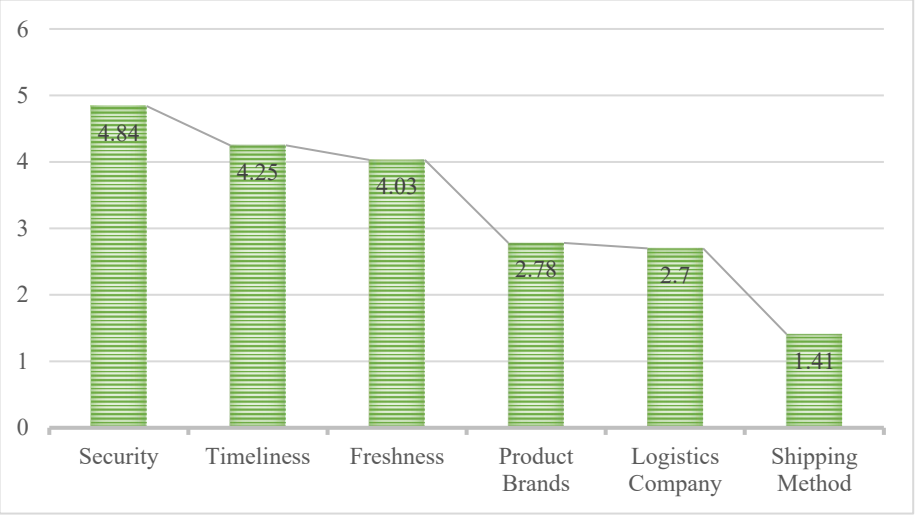

Figure 4: Histogram of attention to each feature of fresh produce.

Based on the above questions, respondents were partially informed about fresh produce and then investigated people's attitudes and purchase frequency of fresh produce. As shown in Figure 5, the frequency of fresh produce purchases was generally high, with most respondents buying weekly or even more than once. Buyers' recognition of the quality of today's fresh produce is reflected in how fresh they think the fresh produce they have bought is.

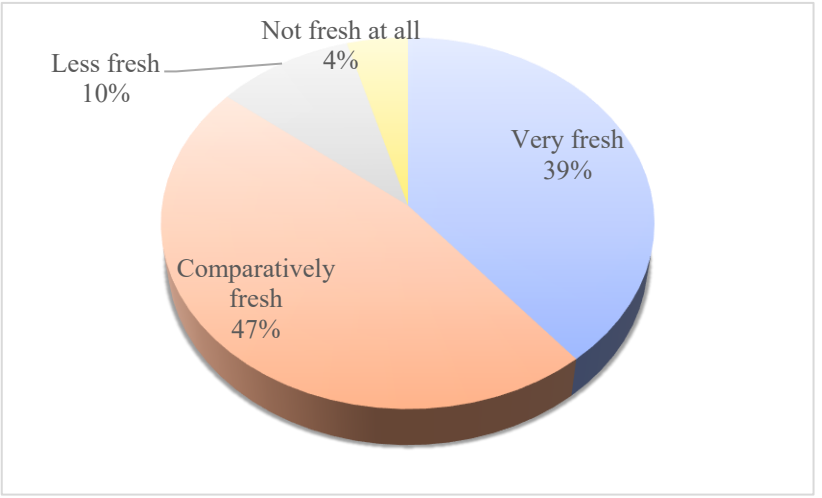

Figure 5: Fresh product freshness fan chart.

In response to the respondents' existing problems with fresh products, corresponding questions were also investigated in the questionnaire. Among the respondents of all ages and classes, the high price is generally considered to be the key issue that most affects the purchase of fresh produce, accounting for 54% of the respondents. Because of the seasonality, short shelf life, high risk of loss, and high quality requirements for transportation, fresh products are generally affected by the season,

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weather, transportation methods and costs, and market demand, so high prices are extremely normal. Fresh products inevitably involve the transportation of cold chain logistics, and the conditions that need to be considered for cold chain logistics need to be more adequate. Basic cold chain work such as freezing and preserving, automatic sorting and distribution services require a lot of human and material resources and higher infrastructure requirements. In addition, 52% of respondents believe that the lack of freshness is also a major problem for fresh products today. After all, the most important thing about "fresh" is freshness, so people will pay more attention to it. Finally, the long shipping time is also a problem for fresh products. There are many sites in big cities, but many small and medium-sized cities have not yet formed a fresh food logistics network, which may affect the transportation time to a great extent, thus affecting the buying experience of fresh products.

The respondents showed a more consistent attitude toward the green concept in their purchasing behavior. As shown in Figure 6, about 85% of the respondents were willing to purchase fresh produce in "green packaging", such as using paper bags, switching to more resource-efficient packaging, and reducing packaging and preservation supplies that have a high environmental impact. However, close to 20% of the respondents said that the premise of support is not to affect the normal use.

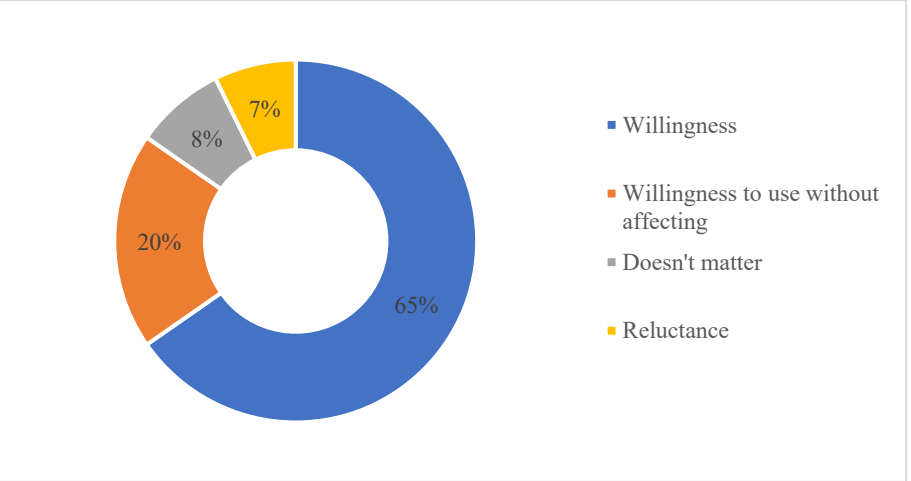

Figure 6: "Green packaging" application will degree distribution chart.

When investigating whether people are willing to support packaging recycling of fresh produce (such as ice bags, paper bags, Styrofoam boxes, etc. for recycling), about 74% of respondents said they were willing to support it, and about 20% said they would be reluctant to support it if it caused trouble. In general, their level of support is high. At the same time, about 88% of the respondents believe that it is necessary to enact relevant laws to implement specific measures, which can urge the public to improve their own behavior in order to achieve the purpose of green supply chain fresh produce logistics. The respondents' attitude toward the feasibility of greening fresh produce logistics is also optimistic, as shown in Figure 7, with 14%, 42%, and 30% of the respondents approving unconditionally, approving with policies in place, and approving with incentives and punishments, respectively, which can somewhat indicate that having regulatory measures will bring about more effective implementation.

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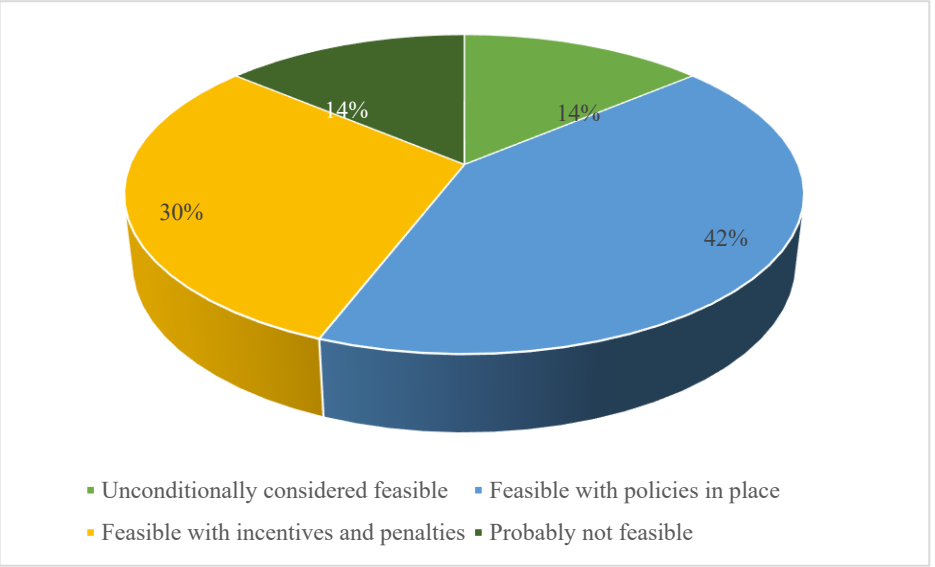

Figure 7: Sectoral diagram of the feasibility of "greening" fresh produce logistics.

6. Discussion

Based on the survey and analysis of the results of the questionnaire, it is possible to briefly understand the level of public awareness and knowledge of the green supply chain for fresh produce. In the ever-evolving modern life, the demand and purchase rate of fresh products are rising extremely fast, and their distribution pressure and quality requirements for fresh products are increasing accordingly. As a result, respondents generally believe that safety, timeliness and freshness are the most important attributes of fresh food and are the most important to focus on when purchasing.

Due to the rapid development of domestic logistics, but a late start, compared with developed countries, the relevant departments and local governments are in the initial exploration stage of thinking about green logistics and the green supply chains. Today, people's awareness of the greening of fresh produce logistics system is still shallow, and the concept of green living is not yet well established. However, it is optimistic that most of the respondents are willing to support the application and recycling of "green packaging", and the general public has a positive attitude towards the green concept and is willing to cooperate with the implementation of specific measures for greening fresh produce, and has a preliminary awareness of this. However, based on the reality, it may be difficult to implement green supply chain without policies and incentives and penalties, so policy support is a necessary element. In the world environment, countries are paying more attention to environmental protection day by day, and the new policies are inclined to include the concept of green environment, which is helpful to the popularity of green supply chain for fresh products. It is also the significance of this study to contribute to the development of green supply chains in the logistics field.

Relatively speaking, the study also has some limitations, that is, the angle of green supply chain in fresh produce that can be covered in the questionnaire survey is rather one-sided, because the content that is close to the public life is rather limited, and many of them are academic and professional, which is not suitable for a popular study with more daily and casual questions. Only more useful information can be extracted from the limited issues for research studies. Therefore, there may be a biased situation in the embodiment of research results, and when reflected to the broader meaning of green supply chain, it is more limited and cannot be analyzed as a very rigorous research.

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In further research, we should pay more attention to the multiple dimensions of green supply chain, and there should be more ways to reflect the green concept. Because green supply chain is also called "environmental awareness supply chain", it should include green design, green procurement, green manufacturing, green packaging, green materials, green recycling and so on. In the survey, we only focused on green packaging, green materials and green recycling, but we should further investigate how green design and procurement are applied, what is involved in the process of green manufacturing, and what improvement measures are available. These are the urgent issues that need to be solved from the perspective of green supply chain and should be studied more deeply.

7. Conclusion

In response to the above research and conclusion, the development prospect of fresh produce logistics management in the perspective of green supply chain is very wide and there is a certain construction foundation today, and it is only a matter of time and way to solve the implementation of greening fresh produce. With the support of the state and policies, the change and improvement of the national mentality and quality will make these difficulties solved and reach a greener production and lifestyle.

In terms of development suggestions, the future management of logistics system under the perspective of green supply chain should fully consider environmental issues, share resources among industries, and use green recycling for closed-loop operation of resources. With the development of the times and the popularity of network, it is also very necessary to apply modern network technology to further systematize the management of green supply chain network.

Since most of the available literature is on the management of fresh produce logistics system in the traditional mode or the application of green supply chain in other fields, there is no research that fully combines the two. This study has implications for the innovation and development of fresh produce logistics systems, and also has a positive impact on the overall field of supply chain management network system development. In addition, perhaps the study can also have some reference to the fresh food industry, such as green production marketing from the source, more focus on environmental friendliness in the food sector, and building awareness of environmental protection.

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