Platform Supply Chain Coordination Considering Fresh-Keeping Service

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With changes in demand and the emergence of new distribution channels, consumer-centric buyer's markets for many products have been formed. The platform supply chain has been continuously optimized and upgraded. Supply chain leaders have moved downstream to the end of the supply chain. The operational value has been further enhanced. The corresponding systematic construction of the platform supply chain has become an important driving force for future development.

retailer-led platform supply chain | fresh-keeping service | revenue sharing | supply chain contract coordination | numerical analysis

1. Research on Supply Chain Contract and Coordination

Previous research has defined supply chain coordination from a systems perspective, in terms of adopting appropriate methods to organize or adjust the system in an orderly fashion. Finally, the whole system is coordinated [1].

The main goal of supply chain coordination is to stabilize the relationships among several member subsystems. If the relationships among members are not properly handled through effective coordination and an agreement is not reached, the overall function of the supply chain system will be affected [2].

A supply chain contract is a document with legal effect that has been agreed upon by the internal members. It is mainly intended to solve two core problems in the supply chain. On the one hand, a bullwhip effect will occur if there is information asymmetry among supply chain members. On the other hand, supply chain members try to maximize their interests, which will cause a double marginal effect.

Cooperation among supply chain members has a direct and important impact on supplier performance. This shows that effective implementation of the contractual relationship contributes to cooperation and the gradual application of the contract in the supply chain.

Revenue sharing, buybacks, wholesale prices, and quantity elasticity contracts are the four main types of contractual relationships in the supply chain. Other contract types are derived from these four contractual mechanisms. **Table 1** presents the four main contractual relationships [3].

Table 1. Four main contractual relationships in fresh produce supply chain.

Contract Type	Main Content
Revenue-sharing contract	Upstream supply chain members sell fresh produce to downstream members at low wholesale prices and obtain sales revenue from downstream members at a fixed proportion after the sales period ends.
Buyback contract	After the product sales period ends, upstream supply chain members collect unsold fresh produce from downstream enterprises at repurchase price to encourage downstream members to expand their order range of fresh produce.
Wholesale price contract	Upstream member enterprises decide the wholesale prices of fresh produce, and downstream enterprises make order decisions based on market demand and wholesale prices of upstream companies.
Quantity flexibility contract	Downstream enterprises retain a certain amount of fresh produce for sale. When they receive more information about market demand, downstream members determine the final order quantity within the quantity provided by upstream enterprises.

As an important means of supply chain coordination and operation, contracts have been favored by many researchers. Some researchers have used relationship theory to study the cooperative relationship in contracts. They have proposed and studied principal agent theory, the price coordination mechanism, the contract mechanism, the inventory control mechanism, and other types of cooperative contractual relationships. Bouncken [4] divided contracts in the supply chain into complete and incomplete forms. Wu et al. [5] carried out research on the issue of explicit contracts. Wan et al. [6] provided the explicit option coordination conditions for a disrupted supply chain under two supply chain structures and then explored the effects of the disruption and supply chain structure on the option coordination conditions. In a stochastic demand supply chain composed of a single manufacturer and a distributor, the contractual relationship cannot help the manufacturer achieve the goal of compatibility with the cost of all distributors' efforts [7]. Revenue-sharing contracts [8][9], two-part tariff contracts [10], buyback contracts [11], and other contract forms have been used by many researchers to design effective incentives for the supply chain. Revenue-sharing and cost-sharing contracts are the basis of most contract studies [12]. Gualandris et al. [13] considered how the sustainability performance and buyer–supplier trust of key suppliers mediate and moderate such developments. Zhou et al. [14] studied an option contract model based on a basic model of the fresh agri-food supply chain and compared the production, profit, risk, and information sharing conditions of the supply chain in different cases. Scholars have designed different contracts to enable all supply chain members to form a vertical partnership, such as through revenue sharing, price discounts, or rebates [15]. These contracts encourage supply chain members to maximize their benefits in order to further improve the overall operational efficiency of the supply chain [16]. Kurpjuweit et al. [17] developed a typology of three supplier selection archetypes. Thomas et al. [18] decomposed social sustainability into dimensions of employee welfare and philanthropy to determine their effects on supplier selection.

2. Research on Platform Supply Chain Coordination Considering Fresh-Keeping Service

The coordination mode of the platform supply chain can effectively promote the operational level. However, many scholars have not considered or included perishable fresh produce and their characteristics in their studies. Currently, some research considers the impact of product loss and reduced freshness quality on the coordination of the fresh produce supply chain. Some scholars have proposed a supply chain optimization model that affects circulation loss. Based on this, some scholars put forward the loss problem of fresh produce, which is influenced by the two-stage effort in the transportation process. Cai et al. [19] studied checking the inventory and quality of fresh produce over time. Siddh et al. [20] provided a structured review of the existing literature on agri-fresh food supply chain quality (AFSCQ) and a platform for practitioners and researchers to identify the existing state of work, gaps in current research, and future directions in the field. Taleizadeh et al. [21] solved a chance–constraint platform supply chain problem with stochastic demand following a uniform distribution. Chen et al. [22] proposed a fresh platform model using a product production and sale system combined with IoT technology. Ju-ning et al. [23] proposed combined contracts and derived the value range of contract parameters that could realize coordination of the supply chain. Ghaemi et al. [24] constructed a new time-varying utility function around the loss of fresh produce and changes in consumer purchasing utility and quantity to maximize consumer utility.

Researchers have also comprehensively studied the key factors affecting the overall efficiency of the fresh produce supply chain and methods to improve the efficiency of supply chain integration [25]. Xu et al. [26] studied a new two-echelon supply chain, mainly using a model of short-term products with value loss, such as fresh produce. The retailer determines the order quantity according to the supplier’s quoted amounts. The supplier’s quoted amounts will help the retailer reduce the order cost. Ghiami et al. established a two-echelon supply chain for perishable fresh produce with limited storage space, where the market demand depends on the inventory level of retailers. They used genetic algorithms to find the best coordination strategy for allowing and not allowing shortage [27]. Trieneken et al. constructed a supply chain for perishable products comprising a manufacturer and multiple retailers. They obtained each retailer’s replenishment cycle length and the manufacturer’s replenishment time under the overall decision [28].

In summary, unlike an ordinary supply chain, a fresh produce platform supply chain has stricter requirements regarding freshness and loss, so its coordination and optimization issues are more complex. There are few studies on the coordination and optimization of a fresh produce supply chain, mainly because it is difficult to reflect its characteristics from one aspect alone. Some scholars have improved and innovated supply chain coordination and optimization methods according to the characteristics and actual situations, as shown in **Table 2**.

Table 2. Classification of related papers.

Research Type	Main Related Papers
1. Supply Chain Contract and Coordination	Feng L, Govindan K, Li C, 2017 [1]; Swinnen J, Vos R, 2021 [2]; Fan C, Zhang Q S, Chen Y M, 2022 [3]; Bouncken R B, Ratzmann M, Tiberius V et al., 2020 [4]; Wu J, Zou L, Gong Y et al., 2021 [5]; Wan N, Li L, Wu X et al., 2021 [6]; Liang L, Wang X H, Gao J G, 2012 [7]; Cachon G P, Lariviere M A, 2005 [8]; Palsule-Desai O D, 2013 [9]; Wu X Y, Fan Z P, Cao B B, 2023 [10]; Hong X P, Gong Y M, Chen W Y, 2020 [11]; Yan B, Wu X, Ye B et al., 2017 [12]; Gualandris J, Kalchschmidt M, 2016 [13]; Zhou L N, Zhou G G, Qi F Z et al., 2019 [14];

Research Type	Main Related Papers
	Gokarn S, Kuthambalayan T S, 2019 [15]; Ma X L, Wang S Y, Islam S M N et al., 2019 [16], Kurpjuweit S, Wagner S M, Choi T Y, 2021 [17], Thomas R, Darby J L, Dobrzykowski D, 2021 [18]
2. Platform Supply Chain Coordination Considering Fresh-keeping Service	Cai X Q, Chen J, Xiao Y B et al., 2010 [19]; Siddh M M, Soni G, Jain R et al., 2017 [20]; Taleizadeh A A, Niaki S T A, Wee H M, 2013 [21]; Chen X, Chen R, Yang C, 2021 [22]; Ju-ning S U, Chen-guang L I U, Yong Y et al., 2015 [23]; Ghaemi Asl M, Adekoya O B, Rashidi M M, 2022 [24]; Fritz M M C, Schoggl J P, Baumgartner R J, 2017 [25]; Xu X H, Nie S Y, 2009 [26]; Ghiami Y, Williams T, Wu Y, 2013 [27]; Trienekens J, Zuurbier P, 2008 [28]

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