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Supply and Demand Optimization of Agricultural Products in Game Theory: A State-of-the-Art Review

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Abstract: Optimizing the supply chain of agricultural products is an important way to revitalize the rural economy. The perishable products are agricultural products with special properties and great potential. Game theory is an effective research tool for maximizing revenue management in competition and cooperation. Therefore, this study reviews the literature on the pricing and procurement of perishable products in the past three years under the game theory. Firstly, this study summarizes the common game models of supply chain through the review of multi-objective models. Secondly, it summarizes the literature on pricing and purchasing, and explores the strategies of product management, benefit maximization and supply chain coordination. Finally, based on some cutting-edge results, this study proposes promising research directions in the future. This study is helpful to summarize the application of game theory in supply chain management, help rural agricultural products to achieve maximum benefit, and solve the problem of supply and demand optimization.

Keywords: Supply chain management; Multi-objective; Pricing mechanism; Procurement strategy; Game theory

1. Introduction

In order to optimize the supply and demand of rural agricultural products, supply chain game has become a research hotpot. Continuously optimizing the supply chain of rural agricultural products is one of the important ways to revitalize the rural economy. However, most of the agricultural products are perishable products. It has some unique characteristics, including short shelf life, perishable and so on. Specially, the gap between the nutritional value and market price of perishable products before and after processing is large. It leads to some serious problems in all aspects of the agricultural product supply chain. Perishable products have a great impact on the rural economy, the phenomenon of product supply chain is the most prominent. This paper mainly studies such products.

The theme of competition and cooperation among parties in the supply chain is increasing. Game theory is widely used as a tool to analyze competition and cooperation among enterprises. The application of supply and demand game in supply chain is mainly divided into cooperative and non-cooperative game. Due to human nature, all parties pursue the maximization of personal interests. We can find that non-cooperative games under decentralized decision-making in the market are most cases. In recent years, with the concern of maximizing the overall interests, cooperative game has also been valued by researchers.

Agricultural supply chain is facing a major challenge of supply and demand optimization of perishable products. This study mainly uses game theory to study the supply chain management of perishable products, in order to guide the parties to maximize the benefits and overall coordination of the supply chain. This paper studies the model of multi-objective, multi-agent and multi-stage benefit maximization of agricultural products supply and demand. This study aims to assist rural agricultural products to solve the problem of supply and demand optimization, and improve the value of rural revitalization of new agriculture.

In the development of retail industry, effective pricing mechanism and purchasing strategy is the key. This paper mainly uses game theory to study retailer' s purchasing strategy and pricing mechanism for perishable products. Text structure is as follows: In addition to the introduction, the second chapter summarizes the supply chain based on multi-objective model commonly used game theory and applicable game areas. The third chapter expounds the literature review of new retail, strategic procurement and pricing mechanism under game theory. Finally, according to some cutting-edge achievements of supply chain management of agricultural products, the future development direction is proposed.

2. Multi-Objective Game

The conflicting parties not only consider only one goal when making decisions, but also the goals preferred by each decision maker are different for their own development needs. But ultimately they must maximize their own interests. Under some game models, the overall optimal balance of the supply chain can be obtained, creating greater benefits than the sum of individual interests. This chapter selects the key factors in the supply chain to conduct game research on the multi-objective model. It will summarize the game matching model that enables all parties and the whole to maximize the benefits of the target. The summary content is shown in Table 1.

Differential game theory is a new idea to solve the problem of coordinated control. Li [1] builds a differential game model between a manufacturer and a retailer where credit support, government subsidies, and internal csr cost subsidies can all be used to strengthen corporate social responsibility management. Cheng and Ding [2] in order to achieve supply chain sustainability, a differential game between two supply chains was established. It found that corporate social responsibility is an effective tool, and centralized decision-making can maximize this utility.

Table 1. Multi state goal game model of supply chain

Reference	SC Structure	Research Field	Research Method
Li [1]	1M+1R	CSR credit support government subsidy the internal CSR	Differential game
Cheng and Ding [2]	2SC	CSR pricing	Differential game Dynamic game
Zhang and Yu [3]	1G+1M+1R	government subsidy low-carbon closed-loop supply chain	Differential game
Salcedo-Diaz et al. [4]	3E	carbon trading pricing	Cooperative game
Xing et al. [5]	1M+1R+2TR	carbon trading closed-loop supply chain	Stackelberg game
Xia et al. [6]	2M	carbon trading pricing sales volume	Non-cooperative game
Ghosh et al. [7]	1M+nR	prepayment pricing product green level	Stackelberg game
Wang and Hou [8]	1M+1S 2SC	green preference optimal price market stability	Stackelberg game Bertrand duopoly game
Liu et al. [9]	1S+1M+1R	fairness profit distribution	Cooperative game
Zhai et al. [10]	1M+1R	demand interruption service level pricing	Stackelberg game
Cao et al. [11]	1M+1R	payment method joint pricing	Stackelberg game
Sun et al. [12]	1R+1P+2M	seasonal sharing platform pricing replenishment	Complete information game Incomplete information game
Wu et al. [13]	1S+1M	risk avoidance Optimal order quantity trade credit	Stackelberg game
Li et al. [14]	2M+1R	green degree pricing profit coordination	Stackelberg game
He et al. [15]	3S	complementary products punishment strategy	Dynamic game
Cui et al. [16]	1G+1FI+1E+1C	green finance government regulation	Evolutionary game

S=supplier; M=manufacturer; R=retailer; SC=supply chain; G=government; P=Platforms; C=consumer; E=enterprises; FI=financial institution; TR=third-party recycler.

Carbon emissions have been widely concerned by the international community in recent years. In order to optimize the low-carbon behavior of enterprises and maximize environmental benefits, researchers analyzed models such as cooperative game [4], Stackelberg game [5], and non-cooperative game [6]. Zhang and Yu [3] studied the impact of government subsidies on parties in a low-carbon closed-loop supply chain from a long-term dynamic perspective.

Ghosh et al. [7] provided a model to optimize the manufacturer's wholesale price, the retailer's retail price and the product's green level under the manufacturer's advance payment policy. Wang and Hou [8] built a Stackelberg game between suppliers and manufacturers and a Bertrand duopoly game between two heterogeneous supply chains. The model shows that the centralized strategy is conducive to profit maximization and supply chain stability, and consumer green preference affects market equilibrium and adjustment.

Liu et al. [9] proposed a multi-method cooperative game model to theoretically solve the problem of supply chain coordination on fairness and seek reasonable profit distribution. Zhai et al. [10] studied the impact of decentralized and centralized decision-making on supply chain service level and pricing procurement when demand is interrupted. Cao et al. [11] studied the profit functions of prepayments, normal payments, and deferred payments by establishing a manufacturer's Stackelberg game. It found that the optimal payment scheme is not uniquely certain, but generally favors deferred payments. Sun et al. [12] explored the optimal pricing and replenishment strategies for sharing platforms based on the off-season and peak-season of products, and analyzed the impact of season on decision-making. Wu et al. [13] research shows that for risk-averse retailers, suppliers can obtain supply chain utility by managing trade credit and loss sharing.

The green degree of products will attract environmentally friendly customers and also affect the cost of enterprises. With the participation of pricing, market potential and other parameters, Li et al. [14] studies the change rule of green degree and profit level, and obtains the reasonable coordination mechanism of supply chain. Repetitive interaction among suppliers of complementary products in the supply chain to maintain cooperation and penalties can effectively reduce commitment deviation [15]. Green finance emphasizes the importance of industrial environmental protection, effective allocation of resources to achieve sustainable environmental development. Cui et al. [16] let the main participants of the supply chain participate in an evolutionary game model to study the equilibrium strategy and influence mechanism between the subjects.

Differential game studies the model of environment, state and participant behavior in continuous space. Multiple participants continue to game, trying to obtain the optimal strategy over time and achieve Nash equilibrium. The main purpose of using such game models is to learn how to acquire the ability to adapt to a continuously variable environment.

The Stackelberg game belongs to the complete information dynamic game, which studies the game process between participants in an unequal competitive relationship but with complete information. There are always the dominant party (leader) and the weak party (follower) in the game. The leader makes the decision first, the follower makes the action subsequently, and then commits to the strategy they choose. It is the most commonly used model in supply chain management because its main idea is to follow the strategy to ensure the maximization of their own interests.

Evolutionary game combines game theory with dynamic evolution. Different from dynamic game, evolutionary game pays more attention to the overall dynamic equilibrium.

Non-cooperative game mainly studies how people make decisions to maximize their benefits in the situation of mutual influence of interests. The most commonly used non-cooperative static game, which does not have strong constraints and does not have a significant decision-making order, is a one-time simultaneous choice behavior. No matter how other players change their strategies, their strategies are optimal for themselves. Non-cooperative game pursues the maximization of personal interests, which conforms to the view of rational people. It is also the main problem of modern game theory research and application.

Cooperative game theory requires participants to play games within the scope of the agreement, that is, to restrict the behavior of all parties. Such a game model is conducive to the overall optimization. Scale economy and risk reduction are the two main motives of the alliance.

3. Literature Review

This work involves four literature streams: new retail, pricing mechanism, strategic procurement. This section helps to clarify the supply chain's strategy for the two main operational aspects of pricing and procurement of perishable products.

3.1 New Retail

With the development of digital technology, traditional retail has gradually transformed. As an emerging retail model, the definition of new retail is as follows: by leveraging big data and artificial intelligence on the Internet, innovate every behavior in the process of selling goods and services to consumers.

After summarizing and summarizing the relevant literature on new retail, the current new retail model can be divided into the following three types: 1. Commodity and logistics channel integration while combining online and offline and logistics. 2. Provide a wider range of experiential consumption services to achieve consumption scenarios. 3. Create a' new retail' platform that includes internal employees of retail enterprises and upstream and downstream partners, to create an omni-channel industrial ecological chain.

For new retail future innovation development path, mainly to break the boundaries of retail, channel comprehensive and retail gapless and borderless. Such as Jingdong cloud storage, shorten the time consumers receive products. Capture consumer demand and provide a more complete shopping experience, such as' one land claim'. Relying on the Internet of Things technology to promote all aspects of cost reduction and increase efficiency.

Retail model change is the inevitable trend of consumer demand in the new era, but there are still some problems when the new retail and market integration. The market is gradually dominated by consumers, and consumption dynamics are difficult to grasp. The perishable product supply chain has problems such as high operating costs, difficult omni-channel integration, and poor user experience. The integration of new retail and market development has a long way to go.

3.2 Pricing Mechanism

Customer preferences have a special place in the supply and marketing system, and behavior-based price discrimination [17] and purchase records significantly affect distribution strategies. Consumers' requirements for the functional attributes and environmental attributes of green products are behavioral preferences [18]. When consumers prefer product freshness rather than price, the optimal pricing changes with inventory [19]. Zhang et al. [20] considered the two-stage pricing strategy of dual-channel supply chain when the public has a preference for green. The model shows that green preference can better improve supply chain performance by adopting contract strategy under centralized decision-making.

With perishable products entering a state of diminishing marginal benefit in terms of nutrition and price from harvest, industrial supply chain management faces major challenges. He et al. [21] focus on the best decisions and profits of enterprises under the dual sensitivity of consumers to carbon emissions and delivery time. Leng et al. [22] introduced the concept of marginal time cost in a game model to analyze supply chain strategies for perishable products. Real-time IoT sensor technology helps solve pricing issues during food loss. The quality of green products can be monitored by sensors, and real-time data can be used to optimize the dynamic pricing of goods based on customer quality and price requirements [23].

However, product freshness does not only follow time changes, its quality is also defined by other attributes, such as temperature, humidity, light and other environmental conditions [24]. Lejarza and Baldea [25] proposed a mixed integer programming model, which simplifies the definition of product freshness. Xu et al. [26] developed a real-time quality analysis framework to dynamically optimize route, pricing, inventory and other decisions. Incorporating environmental factors into product freshness research helps the market understand the product degradation process more accurately and slows degradation. Dynamic environmental control reduces quality losses and total costs, assisting production and sales planning.

Although demand is random and price-dependent, dynamic pricing is not always the optimal strategy. The optimal pricing strategy is affected by market parameters such as demand uncertainty, market size, supply chain upstream and downstream pricing strategies. Based on this, Li and Mizuno [27] studied the dynamic and static pricing strategies adopted by manufacturers and retailers respectively, and analyzed the optimal pricing strategy and inventory control level under different models.

Some perishable products are difficult to plant, high nutritional value, resulting in higher market prices, higher prices of fresh products. Therefore, in some cases price sensitivity must be an important and critical consideration. Liu et al. [28] established a Stackelberg game dominated by manufacturers and followed by retailers. It aims to obtain how product perishability and price-sensitive demand of such products affect procurement, pricing and sales. Retailers as followers to determine the product sales price and order quantity, the parties must be in consumer price sensitive demand decisions to maximize profits.

According to the demand curve, demand will decrease as prices rise. Advance payment, cash and credit payment are common trading combinations in business transactions. Feng et al. [29] explored an inventory system under this combination. It illustrates that the pricing and batch adjustment decisions of fresh goods when demand depends on unit price. The retailer's goal is to maximize the total profit by simultaneously finding its price and order cycle.

Cooperation is better than non-cooperation, but human nature tends to maximize personal interests. Therefore, external factors are added to the government's financial incentives and subsidies for the sale of perishable products [27, 30]. Kang et al. [31] studied the two-stage supply chain including peasant enterprises and core enterprises. It found that under reasonable government subsidies, the effectiveness of market resource allocation can be improved and the overall profit of society can be increased. Meng et al. [32] studied three government subsidy scenarios and demonstrated that governments' enthusiasm for subsidizing manufacturers can encourage green innovation in supply chains and improve social welfare. In order to help rural revitalization, the government must support agricultural products through some subsidies or supervision means to help underdeveloped markets achieve new economic growth.

Online platform setting subsidies not only help the sales of agricultural products, but also help the platform to maximize profits [33, 34]. In the context of the new retail industry, online platforms have become a very important sales channel. Wei et al. [35] used the Stackelberg game to study the impact of different forms of sales on the profits of online platform manufacturers. Li et al. [36] explored different coupon exchange pricing models to guide online platforms to choose appropriate discount strategies.

However, the continued use of subsidies is not conducive to the online market [37]. Input subsidies mean lower commodity prices, which will reduce the sensitivity of products to the market. When agricultural prices are high or rising, the impact of subsidies is diminishing. If the market scale expands later, the subsidy behavior may reduce the profitability of the platform. Therefore, the online platform subsidy strategy for selling agricultural products should be moderate.

In order to achieve supply chain channel coordination and pricing, cooperative game [38] and the implementation of various forms of contract [39] are two main strategies. Asghari et al. [38] compared these two types of coordination models in economic and environmental dimensions to obtain optimal pricing, environmental responsibility, and rate-of-return decisions to select the best channel coordination strategy.

Decentralized pricing and centralized pricing are discussions on the total profit of the supply chain. Decentralized pricing is a non-cooperative behavior of all parties in the supply chain, and centralized pricing is a cooperative behavior. Centralized pricing is more likely to maximize the overall benefit of the supply chain. Hosseini-Motlagh et al. [40] used evolutionary game to establish a profit surplus coordination and distribution mechanism under the long-term operation of the supply chain. The results show that all parties tend to choose cooperative decision-making to obtain long-term greater benefits. Supply chain fairness affects the cooperation between member decision-making and supply chain sustainable management [22]. Cooperative game under centralized decision-making is conducive to supply chain stability and fairness.

3.3 Strategic Procurement

In order to maximize the profit of the sales of perishable rural agricultural products, in addition to the study of pricing, procurement strategy is another important research object.

Purchasing is mainly divided into quantity decision-making and purchasing method selection. Appropriate purchasing strategy can increase profits and reduce risks. For the procurement method, Xin et al. [41] divided the sales cycle into two sections, considered the single and double purchase strategies. It established a two-stage dynamic Stackelberg game between the manufacturer and the retailer with or without the rebate mechanism. It was found that the double purchase strategy helps to induce the manufacturer to formulate the rebate strategy and obtain greater benefits. Kaur et al. [42] developed a flexible three-stage production and procurement model that captures the dynamic needs of markets in order to make supply chains resilient and sustainable.

In a dual-channel supply chain with online and offline channels, the selection of wholesale contracts and direct transportation contracts depends on the profit sharing rate. The profit sharing rate mainly depends on the relative size of the travel cost in transportation and the two contract costs [43]. In the case of uncertain demand, improve the supply chain profit and the number of orders, coordinated procurement is better than decentralized procurement. Contracting under a coordinated strategy reduces food waste and does not pose a risk to profits [44]. Assuming that customer demand continues to arrive and there is a loss to compensate, the retailer’s optimal ordering strategy is determined by the customer arrival rate and product life [45].

For the purchase quantity, Lee et al. [46] considers a three-echelon supply chain model in which the manufacturer’s products are distributed to the retailer by an intermediary. The study found that procurement costs will not affect the total order, but will affect the distribution of orders in the process. Hanh et al. [47] used the Salop space model to study the impact of price sensitivity on pricing and order quantity under different coordination modes. The optimal price and order quantity of the three-level supply chain are determined by Nash game. Dye [48] conducted a multi-period evaluation of deterministic models over continuous time, examining the joint pricing, inventory, and advertising of perishable products. They conclude that the company will choose static pricing in an infinite time, when the optimal pricing is unique.

The diminishing marginal benefit of perishable products needs to improve the supply chain procurement process. In the processing stage, an inventory model considering preservation technology investment can be developed to optimize the number and timing of processing [49]. Flexible revenue sharing strategies can induce logistics companies to take preservation actions and reduce losses during transportation [50]. At the same time, do a good job in transportation route planning [51] and inventory location optimization [52]. Retailers need to consider uncertain demand and distributor access intervals to determine their safety stock levels, and to consider fixed and minimum remaining shelf life [53].

Fully increasing product freshness is key for suppliers and retailers to benefit economically. In the case of price sensitivity of consumers with random demand, data sharing is very important to improve product freshness [54]. It can enable suppliers to improve product freshness, thereby increasing the freshness of retailers supply point products. Improving the awareness of supply chain preservation can also reduce the overall management cost.

Different sales models should adopt different preservation decisions. Yang and Tang [55] established a fresh product supply chain under three modes: Retail, dual-channel and online to offline, and studied the preservation decision of each mode. With the retailer's preservation efforts, the online to offline model enables retailers and consumers to achieve maximum benefits. When consumers prefer online channels, retailers can integrate online and offline channels to maximize consumer utility.

Perishable products have the highest nutritional value and market price when they are fresh and have a short selling cycle. Due to the uncertainty of product demand, all parties in the supply chain must prepare for sales, reduce the risk of cost loss and product shortage, and the option contract effectively solves this problem [56]. The option contract is a pre-ordered purchase, and the buyer and the seller reach a transferable standardized contract. It can partially transfer the risk of supplier demand uncertainty, allowing retailers to retain multiple options through option prices, managing costs and inventory. Option contracts are of great importance and attraction to the supply chain of perishable products.

Option contracts can only improve performance when coordinating supply chains. If the manufacturer is overconfident about its output and the demand is stationary and random, the option contract can coordinate the order and production of the entire supply chain and reduce the adverse effects of overconfidence [57]. In the face of non-stationary random demand, retailers can use the Bayesian method to update the initial demand information, and then carry out secondary replenishment through option contracts for effective two-stage inventory management [58].

The impact of option contracts on pricing and procurement strategies in the supply chain, as well as overall performance, but options mainly involve fairness issues when achieving channel coordination. Under the consideration of fairness, the higher the retailer's attention, the more the order quantity, which will make the pricing closer to the price of supply chain coordination. However, suppliers cannot achieve optimal pricing when equity channels are coordinated in option contracts [59].

In the option contract, the buyer and the seller have asymmetric rights and obligations. The buyer of the option has the right to perform the agreement, and can also give up exercising this right as needed, which makes the supply and demand of the product uncertain. In order to prevent supply disruptions caused by external choices, the government can provide subsidies [60]. The government subsidies mainly depend on the size and capacity of external prices. It is worth noting that subsidies to suppliers and manufacturers are not superior to a single subsidy model. In general, the supply and demand sides will choose to fulfill the option contract for risk avoidance. However, when competition intensifies, even government subsidies cannot prevent supply disruptions, so the risks and effects of options trading should be viewed objectively and comprehensively.

4. Frontier Achievements and Future Work

In this section, we summarize the frontier research of game theory and briefly introduce some promising directions to improve supply chain value in the future.

4.1 Shifting Research Focus

Most of the agricultural products are perishable products. In the past, the research on the pricing and procurement of perishable products mostly focused on the supply and demand game and decision-making with retailers as nodes. The development of digital technology has enabled technologies such as the Internet of Things [23] to be applied to the monitoring and control of product quality at all stages. Develop pricing and inventory strategies based on real-time data to maximize retailer benefits.

However, the most direct purpose of rural revitalization is to allow agricultural companies belonging to manufacturers to increase revenue and maximize benefits. In order to obtain greater market benefits, agricultural companies should not only directly involve fresh products in market competition, but also fully explore the market of processed products [61]. Previous studies have lacked attention to the processing of minimum fresh agricultural products.

According to the nature of perishable products and the requirements of new agricultural value enhancement, this study believes that the following three improvements should be made. Firstly, strengthen the multi-state research of agricultural company products, especially the supply and demand game of processed products. Secondly, carry out new retail model innovation, shorten the supply chain length, and improve supply chain sustainability. Thirdly, the use of agriculture 4.0 [62, 63] Conduct supply chain scientific decisions to improve supply chain stability.

4.2 Focus on Consumer Benefits

When focusing on consumers, the supply chain tends to make pricing and inventory decisions based on consumer behavior. Han et al. [64] obtained optimal pricing and quality strategies for innovative enterprises entering the market, taking into account brand goodwill and consumers' quality expectations. Consumers' expectations for product quality and price are related to the degree of corporate information disclosure [65, 66].

In the process of product diffusion, consumer preference affects product production mode and price coordination strategy, and cooperative game can achieve higher system performance [67]. Wang et al. [68] focused on the impact of consumer reviews and strategic inventory on pricing strategies.

According to the description, it can be found that when studying consumer interests, previous studies mostly focused on consumer heterogeneous behavior [69, 70] and green preferences [71-73]. This study believes that more attention should be paid to the actual satisfaction of consumers, from product pricing, delivery time, product quality, distribution strategy, etc., to maximize consumer benefits while maximizing supply chain benefits.

5. Conclusion

This study takes agricultural products, especially perishable products, as the research object, and game theory as the research method. This study aims to explore the value maximization model of agricultural products supply and demand game. Firstly, the game models of multi-objective use in supply chain are summarized, and the commonly used game models are summarized. This result is easy for researchers to determine the appropriate game model according to the research purpose in other fields.

Then it expounds the concept and application of new retail, and the pricing mechanism and strategic procurement of multi-agent under game theory. The literature content and logical arrangement of pricing mechanism consider the management of the product itself, the maximization of the interests of all parties in the supply chain, and the overall channel coordination. Strategic procurement literature is divided into three types: procurement method, procurement quantity and pre-procurement. This study is conducive to the use of game theory to optimize supply chain efficiency and management of perishable products have a more comprehensive understanding.

Finally, this study in the supply chain management of agricultural products to do cutting-edge research, found that the market lack of research on the following elements, the following promising research directions.

Firstly, the study of maximizing the interests of retailers will be transferred to agricultural companies. Agricultural companies participate in the market game as product processors, and strengthen the research on maximizing the value of supply and demand game in multiple states of agricultural products. New retail model innovation and Industry 4.0 technology applications help supply chains grow sustainably and steadily.

Secondly, the goal of supply chain management is to maximize consumer value. Previous studies have studied the decisions of manufacturers and retailers based on consumer behavior, but the market requires consumers as the research center to improve consumer satisfaction. These two points are areas of urgent concern for agricultural products, to revitalize the rural economy has a huge and direct role in promoting.

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Data Availability

Not applicable.

Conflicts of Interest

The authors declare no conflict of interest.

References

[1] Y. Li, "Research on supply chain CSR management based on differential game," *J. Clean. Prod.*, vol. 268, Article ID: 122171, 2020. https://doi.org/10.1016/j.jclepro.2020.122171.
[2] H. Cheng and H. Ding, "Dynamic game of corporate social responsibility in a supply chain with competition," *J. Clean. Prod.*, vol. 317, Article ID: 128398, 2021. https://doi.org/10.1016/j.jclepro.2021.128398.
[3] Z. Zhang and L. Yu, "Altruistic mode selection and coordination in a low-carbon closed-loop supply chain under the government's compound subsidy: A differential game analysis," *J. Clean. Prod.*, vol. 366, Article ID: 132863, 2022. https://doi.org/10.1016/j.jclepro.2022.132863.

[4] R. Salcedo-Diaz, J. R. Ruiz-Femenia, A. Amat-Bernabeu, and J. A. Caballero, “A cooperative game strategy for designing sustainable supply chains under the emissions trading system,” *J. Clean. Prod*., vol. 285, Article ID: 124845, 2021. https://doi.org/10.1016/j.jclepro.2020.124845.
[5] E. Xing, C. Shi, J. Zhang, S. Cheng, J. Lin, and S. Ni, “Double third-party recycling closed-loop supply chain decision under the perspective of carbon trading,” *J. Clean. Prod*., vol. 259, Article ID: 120651, 2020. https://doi.org/10.1016/j.jclepro.2020.120651.
[6] X. Xia, C. Li, and Q. Zhu, “Game analysis for the impact of carbon trading on low-carbon supply chain,” *J. Clean. Prod*., vol. 276, Article ID: 123220, 2020. https://doi.org/10.1016/j.jclepro.2020.123220.
[7] P. K. Ghosh, A. K. Manna, J. K. Dey, and S. Kar, “Supply chain coordination model for green product with different payment strategies: A game theoretic approach,” *J. Clean. Prod*., vol. 290, Article ID: 125734, 2021. https://doi.org/10.1016/j.jclepro.2020.125734.
[8] Y. Wang and G. Hou, “A duopoly game with heterogeneous green supply chains in optimal price and market stability with consumer green preference,” *J. Clean. Prod*., vol. 255, Article ID: 120161, 2020. https://doi.org/10.1016/j.jclepro.2020.120161.
[9] Z. Liu, X. X. Zheng, D. F. Li, C. N. Liao, and J. B. Sheu, “A novel cooperative game-based method to coordinate a sustainable supply chain under psychological uncertainty in fairness concerns,” *Transp. Res. Part E Logist. Transp. Rev*., vol. 147, Article ID: 102237, 2021. https://doi.org/10.1016/j.tre.2021.102237.
[10] Y. Zhai, C. Bu, and P. Zhou, “Effects of channel power structures on pricing and service provision decisions in a supply chain: A perspective of demand disruptions,” *Comput. Ind. Eng*., vol. 173, Article ID: 108715, 2022. https://doi.org/10.1016/j.cie.2022.108715.
[11] B. B. Cao, T. H. You, C. X. J. Ou, H. Zhu, and C. Y. Liu, “Optimizing payment schemes in a decentralized supply chain: A Stackelberg game with quality investment and bank credit,” *Comput. Ind. Eng*., vol. 168, Article ID: 108077, 2022. https://doi.org/10.1016/j.cie.2022.108077.
[12] Z. Sun, Q. Xu, and J. Liu, “Pricing and replenishment decisions for seasonal and nonseasonal products in a shared supply chain,” *Int J. Prod. Econ*., vol. 233, Article ID: 108011, 2021. https://doi.org/10.1016/j.ijpe.2020.108011.
[13] C. Wu, X. Liu, and A. Li, “A loss-averse retailer-supplier supply chain model under trade credit in a supplier-Stackelberg game,” *Math. Comput. Simul*., vol. 182, pp. 353-365, 2021. https://doi.org/10.1016/j.matcom.2020.10.025.
[14] P. Li, C. Rao, M. Goh, and Z. Yang, “Pricing strategies and profit coordination under a double echelon green supply chain,” *J. Clean. Prod*., vol. 278, Article ID: 123694, 2021. https://doi.org/10.1016/j.jclepro.2020.123694.
[15] Y. He, X. Zhao, H. Krishnan, and S. Jin, “Cooperation among suppliers of complementary products in repeated interactions,” *Int. J. Prod. Econ*., vol. 252, Article ID: 108559, 2022. https://doi.org/10.1016/j.ijpe.2022.108559.
[16] H. Cui, R. Wang, and H. Wang, “An evolutionary analysis of green finance sustainability based on multi-agent game,” *J. Clean. Prod*., vol. 269, Article ID: 121799, 2020. https://doi.org/10.1016/j.jclepro.2020.121799.
[17] M. Ziari and M. S. Sajadieh, “A behavior-based pricing model in retail systems considering vertical and horizontal competition,” *Comput. Ind. Eng*., vol. 152, Article ID: 107054, 2021. https://doi.org/10.1016/j.cie.2020.107054.
[18] M. L. Ren, J. Q. Liu, S. Feng, and A. F. Yang, “Complementary product pricing and service cooperation strategy in a dual-channel supply chain,” *Discrete. Dyn. Nat. Soc.*, vol. 2020, Article ID: 2314659, 2020. https://doi.org/10.1155/2020/2314659.
[19] A. Hendalianpour, “Optimal lot-size and Price of Perishable Goods: A novel Game-Theoretic Model using Double Interval Grey Numbers,” *Comput. Ind. Eng*., vol. 149, Article ID: 106780, 2020. https://doi.org/10.1016/j.cie.2020.106780.
[20] C. Zhang, Y. Liu, and G. Han, “Two-stage pricing strategies of a dual-channel supply chain considering public green preference,” *Comput. Ind. Eng*., vol. 151, Article ID: 106988, 2021. https://doi.org/10.1016/j.cie.2020.106988.
[21] P. He, Z. Wang, V. Shi, and Y. Liao, “The direct and cross effects in a supply chain with consumers sensitive to both carbon emissions and delivery time,” *Eur. J. Oper. Res.*, vol. 292, no. 1, pp. 172-183, 2021. https://doi.org/10.1016/j.ejor.2020.10.031.
[22] M. Leng, C. Luo, and L. Liang, “Multiplayer allocations in the presence of diminishing marginal contributions: Cooperative game analysis and applications in management science,” *Manag. Sci.*, vol. 67, no. 5, pp. 2891-2903, 2021. https://doi.org/10.1287/mnsc.2020.3709.
[23] Y. Kayikci, S. Demir, S. K. Mangla, N. Subramanian, and B. Koc, “Data-driven optimal dynamic pricing strategy for reducing perishable food waste at retailers,” *J. Clean. Prod*., vol. 344, Article ID: 131068, 2022. https://doi.org/10.1016/j.jclepro.2022.131068.
[24] D. Besik, A. Nagurney, and P. Dutta, “An integrated multitiered supply chain network model of competing

agricultural firms and processing firms: The case of fresh produce and quality," *Eur. J. Oper. Res.*, vol. 2022, 2022. https://doi.org/10.1016/j.ejor.2022.07.053.
[25] F. Lejarza and M. Baldea, "An efficient optimization framework for tracking multiple quality attributes in supply chains of perishable products," *Eur. J. Oper. Res.*, vol. 297, no. 3, pp. 890-903, 2022. https://doi.org/10.1016/j.ejor.2021.04.057.
[26] X. Xu, W. G. Guo, and M. D. Rodgers, "A real-time decision support framework to mitigate degradation in perishable supply chains," *Comput. Ind. Eng.*, vol. 150, Article ID: 106905, 2020. https://doi.org/10.1016/j.cie.2020.106905.
[27] M. Li and S. Mizuno, "Comparison of dynamic and static pricing strategies in a dual-channel supply chain with inventory control," *Transp. Res. Part E Logist. Transp. Rev.*, vol. 165, Article ID: 102843, 2022. https://doi.org/10.1016/j.tre.2022.102843.
[28] L. Liu, Q. Zhao, and M. Goh, "Perishable material sourcing and final product pricing decisions for two-echelon supply chain under price-sensitive demand," *Comput. Ind. Eng.*, vol. 156, Article ID: 107260, 2021. https://doi.org/10.1016/j.cie.2021.107260.
[29] L. Feng, W. C. Wang, J. T. Teng, and L. E. Cárdenas-Barrón, "Pricing and lot-sizing decision for fresh goods when demand depends on unit price, displaying stocks and product age under generalized payments," *Eur. J. Oper. Res.*, vol. 296, no. 3, pp. 940-952, 2022. https://doi.org/10.1016/j.ejor.2021.04.023.
[30] S. Chen, J. Su, Y. Wu, and F. Zhou, "Optimal production and subsidy rate considering dynamic consumer green perception under different government subsidy orientations," *Comput. Ind. Eng.*, vol. 168, Article ID: 108073, 2022. https://doi.org/10.1016/j.cie.2022.108073.
[31] K. Kang, M. Wang, and X. Luan, "Decision-making and coordination with government subsidies and fairness concerns in the poverty alleviation supply chain," *Comput. Ind. Eng.*, vol. 152, Article ID: 107058, 2021. https://doi.org/10.1016/j.cie.2020.107058.
[32] Q. Meng, Y. Wang, Z. Zhang, and Y. He, "Supply chain green innovation subsidy strategy considering consumer heterogeneity," *J. Clean. Prod.*, vol. 281, Article ID: 125199, 2021. https://doi.org/10.1016/j.jclepro.2020.125199.
[33] Z. Sun, Q. Xu, and J. Liu, "Pricing and replenishment decisions for seasonal and nonseasonal products in a shared supply chain," *Int J. Prod. Econ.*, vol. 233, Article ID: 108011, 2021. https://doi.org/10.1016/j.ijpe.2020.108011.
[34] N. Yan, Y. Liu, X. Xu, and X. He, "Strategic dual-channel pricing games with e-retailer finance," *Eur. J. Oper. Res.*, vol. 283, no. 1, pp. 138-151, 2020. https://doi.org/10.1016/j.ejor.2019.10.046.
[35] J. Wei, J. Lu, and J. Zhao, "Interactions of competing manufacturers' leader-follower relationship and sales format on online platforms," *Eur. J. Oper. Res.*, vol. 280, no. 2, pp. 508-522, 2020. https://doi.org/10.1016/j.ejor.2019.07.048.
[36] C. Li, M. Chu, C. Zhou, and L. Zhao, "Two-period discount pricing strategies for an e-commerce platform with strategic consumers," *Comput. Ind. Eng.*, vol. 147, Article ID: 106640, 2020. https://doi.org/10.1016/j.cie.2020.106640.
[37] M. Chen, W. Xue, and J. Chen, "Platform subsidy policy design for green product diffusion," *J. Clean. Prod.*, vol. 359, Article ID: 132039, 2022. https://doi.org/10.1016/j.jclepro.2022.132039.
[38] T. Asghari, A. A. Taleizadeh, F. Jolai, and M. S. Moshtagh, "Cooperative game for coordination of a green closed-loop supply chain," *J. Clean. Prod.*, vol. 363, Article ID: 132371, 2022. https://doi.org/10.1016/j.jclepro.2022.132371.
[39] N. Jabarzare and M. Rasti-Barzoki, "A game theoretic approach for pricing and determining quality level through coordination contracts in a dual-channel supply chain including manufacturer and packaging company," *Int. J. Prod. Econ.*, vol. 221, Article ID: 107480, 2020. https://doi.org/10.1016/j.ijpe.2019.09.001.
[40] S. M. Hosseini-Motlagh, T. M. Choi, M. Johari, and M. Nouri-Harzvili, "A profit surplus distribution mechanism for supply chain coordination: An evolutionary game-theoretic analysis," *Eur. J. Oper. Res.*, vol. 301, no. 2, pp. 561-575, 2022. https://doi.org/10.1016/j.ejor.2021.10.059.
[41] C. Xin, Y. Zhou, M. Sun, and X. Chen, "Strategic inventory and dynamic pricing for a two-echelon green product supply chain," *J. Clean. Prod.*, vol. 363, Article ID: 132422, 2022. https://doi.org/10.1016/j.jclepro.2022.132422.
[42] H. Kaur, S. P. Singh, J. A. Garza-Reyes, and N. Mishra, "Sustainable stochastic production and procurement problem for resilient supply chain," *Comput. Ind. Eng.*, vol. 139, Article ID: 105560, 2020. https://doi.org/10.1016/j.cie.2018.12.007.
[43] S. Shi, J. Sun, and T. C. E. Cheng, "Wholesale or drop-shipping: Contract choices of the online retailer and the manufacturer in a dual-channel supply chain," *Int. J. Prod. Econ.*, vol. 226, Article ID: 107618, 2020. https://doi.org/10.1016/j.ijpe.2020.107618.
[44] H. M. Dolat-Abadi, "Optimizing decisions of fresh-product members in daily and bourse markets considering the quantity and quality deterioration: A waste-reduction approach," *J. Clean. Prod.*, vol. 283, Article ID: 124647, 2021. https://doi.org/10.1016/j.jclepro.2020.124647.

[45] M. Gong, Z. Lian, and H. Xiao, "Inventory control policy for perishable products under a buyback contract and Brownian demands," *Int. J. Prod. Econ.*, vol. 251, Article ID: 108522, 2022. https://doi.org/10.1016/j.ijpe.2022.108522.
[46] C. Lee, X. Xu, and C. Lin, "Maximizing middlemen's profit through a two-stage ordering strategy," *Comput. Ind. Eng.*, vol. 155, Article ID: 107197, 2021. https://doi.org/10.1016/j.cie.2021.107197.
[47] N. T. M. Hanh, J. M. Chen, and N. Van Hop, "Pricing strategy and order quantity allocation with price-sensitive demand in three-echelon supply chain," *Expert Syst. Appl.*, vol. 206, Article ID: 117873, 2022. https://doi.org/10.1016/j.eswa.2022.117873.
[48] C. Y. Dye, "Optimal joint dynamic pricing, advertising and inventory control model for perishable items with psychic stock effect," *Eur. J. Oper. Res.*, vol. 283, no. 2, pp. 576-587, 2020. https://doi.org/10.1016/j.ejor.2019.11.008.
[49] M. Sebatjane, "The impact of preservation technology investments on lot-sizing and shipment strategies in a three-echelon food supply chain involving growing and deteriorating items," *Oper. Res. Perspect.*, vol. 9, Article ID: 100241, 2022. https://doi.org/10.1016/j.orp.2022.100241.
[50] C. Liu, J. Lv, P. Hou, and D. Lu, "Disclosing products' freshness level as a non-contractible quality: Optimal logistics service contracts in the fresh products supply chain," *Eur. J. Oper. Res.*, vol. 2022, 2022. https://doi.org/10.1016/j.ejor.2022.09.024.
[51] S. Pratap, S. K. Jauhar, S. K. Paul, and F. Zhou, "Stochastic optimization approach for green routing and planning in perishable food production," *J. Clean. Prod.*, vol. 333, Article ID: 130063, 2022. https://doi.org/10.1016/j.jclepro.2021.130063.
[52] L. Song and Z. Wu, "An integrated approach for optimizing location-inventory and location-inventory-routing problem for perishable products," *Int. J. Transp. Sci. Technol.*, vol. 2022, 2022. https://doi.org/10.1016/j.ijtst.2022.02.002.
[53] M. Nematollahi, S. M. Hosseini-Motlagh, L. E. Cárdenas-Barrón, and S. Tiwari, "Coordinating visit interval and safety stock decisions in a two-level supply chain with shelf-life considerations," *Comput. Oper. Res.*, vol. 139, Article ID: 105651, 2022. https://doi.org/10.1016/j.cor.2021.105651.
[54] M. Ketzenberg, R. Oliva, Y. Wang, and S. Webster, "Retailer inventory data sharing in a fresh product supply chain," *Eur. J. Oper. Res.*, vol. 2022, 2022. https://doi.org/10.1016/j.ejor.2022.08.043.
[55] L. Yang and R. Tang, "Comparisons of sales modes for a fresh product supply chain with freshness-keeping effort," *Transp. Res. Part E Logist. Transp. Rev.*, vol. 125, pp. 425-448, 2019. https://doi.org/10.1016/j.tre.2019.03.020.
[56] X. Chen, J. Luo, X. Wang, and D. Yang, "Supply chain risk management considering put options and service level constraints," *Comput. Ind. Eng.*, vol. 140, Article ID: 106228, 2020. https://doi.org/10.1016/j.cie.2019.106228.
[57] L. Wang, Y. Wu, and S. Hu, "Make-to-order supply chain coordination through option contract with random yields and overconfidence," *Int. J. Prod. Econ*., vol. 242, Article ID: 108299, 2021. https://doi.org/10.1016/j.ijpe.2021.108299.
[58] T. Li, W. Fang, and M. Baykal-Gürsoy, "Two-stage inventory management with financing under demand updates," *Int. J. Prod. Econ*., vol. 232, Article ID: 107915, 2021. https://doi.org/10.1016/j.ijpe.2020.107915.
[59] A. Sharma, G. Dwivedi, and A. Singh, "Game-theoretic analysis of a two-echelon supply chain with option contract under fairness concerns," *Comput. Ind. Eng.*, vol. 137, Article ID: 106096, 2019. https://doi.org/10.1016/j.cie.2019.106096.
[60] Y. Guo, X. Yu, C. Zhou, and G. Lyu, "Government subsidies for preventing supply disruption when the supplier has an outside option under competition," *Transp. Res. Part E Logist. Transp. Rev*., vol. 147, Article ID: 102218, 2021. https://doi.org/10.1016/j.tre.2020.102218.
[61] D. Besik, A. Nagurney, and P. Dutta, "An integrated multitiered supply chain network model of competing agricultural firms and processing firms: The case of fresh produce and quality," *Eur. J. Oper. Res.*, vol. 2022, 2022. https://doi.org/10.1016/j.ejor.2022.07.053.
[62] M. Lezoche, J. E. Hernandez, M. M. E. Alemany Díaz, H. Panetto, and J. Kacprzyk, "Agri-food 4.0: A survey of the supply chains and technologies for the future agriculture," *Comput. Ind*., vol. 117, Article ID: 103187, 2020. https://doi.org/10.1016/j.compind.2020.103187.
[63] V. S. Yadav, A. R. Singh, R. D. Raut, S. K. Mangla, S. Luthra, and A. Kumar, "Exploring the application of Industry 4.0 technologies in the agricultural food supply chain: A systematic literature review," *Comput. Ind. Eng*., vol. 169, Article ID: 108304, 2022. https://doi.org/10.1016/j.cie.2022.108304.
[64] X. Han, H. Zhang, and X. Liu, "Optimal decisions for the innovative enterprise considering brand goodwill and consumers' quality expectation," *Comput. Ind. Eng*., vol. 172, Article ID: 108498, 2022. https://doi.org/10.1016/j.cie.2022.108498.
[65] X. Guan and Y. Wang, "Quality disclosure in a competitive environment with consumer's elation and disappointment," *Omega*, vol. 108, Article ID: 102586, 2022. https://doi.org/10.1016/j.omega.2021.102586.

[66] F. D. Li, K. J. Zhang, P. Yang, J. Jiao, Y. S. Yin, Y. N. Zhang, and C. B. Yin, “Information exposure incentivizes consumers to pay a premium for emerging pro-environmental food: Evidence from China,” *J. Clean. Prod*., vol. 363, Article ID: 132412, 2022. https://doi.org/10.1016/j.jclepro.2022.132412.
[67] C. T. Zhang and Z. Wang, “Production mode and pricing coordination strategy of sustainable products considering consumers’ preference,” *J. Clean. Prod*., vol. 296, Article ID: 126476, 2021. https://doi.org/10.1016/j.jclepro.2021.126476.
[68] J. Wang, S. Shum, and G. Feng, “Supplier’s pricing strategy in the presence of consumer reviews,” *Eur. J. Oper. Res.,* vol. 296, no. 2, pp. 570-586, 2022. https://doi.org/10.1016/j.ejor.2021.04.008.
[69] B. Niu, H. Xu, and L. Chen, “Creating all-win by blockchain in a remanufacturing supply chain with consumer risk-aversion and quality untrust,” *Transp. Res. Part E Logist. Transp. Rev.*, vol. 163, Article ID: 102778, 2022. https://doi.org/10.1016/j.tre.2022.102778.
[70] A. Farshbaf-Geranmayeh and G. Zaccour, “Pricing and advertising in a supply chain in the presence of strategic consumers,” *Omega*, vol. 101, Article ID: 102239, 2021. https://doi.org/10.1016/j.omega.2020.102239.
[71] D. Wen, T. Xiao, and M. Dastani, “Channel choice for an independent remanufacturer considering environmentally responsible consumers,” *Int. J. Prod. Econ*., vol. 232, Article ID: 107941, 2021. https://doi.org/10.1016/j.ijpe.2020.107941.
[72] Q. Zhang and Y. Zheng, “Pricing strategies for bundled products considering consumers’ green preference,” *J. Clean. Prod*., vol. 344, Article ID: 130962, 2022. https://doi.org/10.1016/j.jclepro.2022.130962.
[73] Y. Yi, Y. Wang, C. Fu, and Y. Li, “Taxes or subsidies to promote investment in green technologies for a supply chain considering consumer preferences for green products,” *Comput. Ind. Eng*., vol. 171, Article ID: 108371, 2022. https://doi.org/10.1016/j.cie.2022.108371.