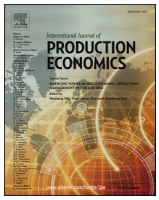
Int. J. Production Economics 263 (2023) 108922

Contents lists available at ScienceDirect

International Journal of Production Economics

journal homepage: www.elsevier.com/locate/ijpe



Collaborative-commerce in supply chains: A review and classification of analytical models☆

Xiaoyan Xu [a], Tsan-Ming Choi [b,*], Sai-Ho Chung [a], Shu Guo [c]

[a] Department of Industrial and Systems Engineering, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong
[b] Centre for Supply Chain Research, University of Liverpool Management School, Chatham Street, Liverpool, United Kingdom
[c] School of Management, University of Liverpool, Chatham Street, Liverpool, United Kingdom

ARTICLE INFO

Keywords:
Collaborative commerce (C-Commerce)
Production economics
Supply chains
Analytical models

ABSTRACT

In the sharing economy era with the development of Industry 4.0, collaborative-commerce (C-Commerce) is getting increasingly important in supply chain management (SCM). However, there is currently a lack of consolidated view on the topic. This paper aspires to fill this gap by conducting a comprehensive review of analytical modeling SCM studies in C-Commerce, aiming at providing guidance on "what it is", "what to do", and "how to do", collectively called the 2W1H framework, for this topic. Based on a deep systematic survey of the literature, we establish a novel classification framework for SCM C-Commerce in two dimensions, i.e., research domains and supply chain (SC) structure. We examine the critical research issues and analytical models following this classification framework. We specifically include the relevant works which highlight (i) collaborative innovation in product development, (ii) collaborative branding and promotion, and (iii) collaborative planning, forecasting and replenishment (CPFR). Based on our review findings, we uncover the important supply chain operational issues in C-Commerce and highlight key modeling elements. We further present the evolution of the C-Commerce related studies in the SCM literature and propose a future research agenda that can fill the gaps between the current state of research and real-world needs in business operations.

1. Introduction

1.1. Background

Over the past decade, supply chain management (SCM) have been confronted with significant transformations and challenges. The high-speed development of information and digital technologies under Industry 4.0 (e.g., big data, blockchain technology (Choi 2019), 5G, etc.), high market and financial turbulence, and complexity of multicultural workforces are all bring tremendous changes to SCM (Appio et al., 2016; Lee et al., 2021). To gain a competitive edge, companies along the supply chain have to consider innovation and establish different kinds of collaborations (e.g., horizontal collaboration, vertical collaboration) in the sharing economy era.

By collaboration, firms in supply chains could get more resources (including expertise) and information from their collaborators to improve their own performance as well as share risks. In fact, firms participating in collaborative commerce (C-Commerce) can reduce operations expenses, increase "useable" capacity, expand markets and improve their operational capabilities (Ma et al., 2019; Eirinakis et al., 2022). The collaboration between *Wal-Mart* and its supplier *P&G* is a classic case to illustrate the benefits derive from C-Commerce (Sebenius and Knebel, 2007). By adopting collaborative planning, forecasting and replenishment (CPFR), the operating costs and inventory level of *Wal-Mart* and *P&G* have reduced significantly, which results in significant improvements of *Wal-Mart*'s inventory fill rate (increased from 87% to 98%), and *P&G*'s sales revenue (increased by 48%) (Min, 2015, p.112). *Nike* is keen on collaboration, especially on the collaborative innovation with its suppliers (e.g., *Flex*, *Esquel*, etc.) during product development, which not only reduces unit product cost, but also enhances product quality. It is believed that *Nike*'s huge success (as the number one industrial leader in functional apparel and sportswear) is partly due to its

☆ This paper is a part of the first author's doctoral dissertation research, under the advice of the three co-authors. Xiaoyan Xu's research was fully supported by The Hong Kong Polytechnic University under the account code RK38. Tsan-Ming Choi is the corresponding author.

* Corresponding author.
E-mail addresses: xiaoyan.xu@connect.polyu.hk (X. Xu), tmjchoi@gmail.com, t.m.choi@liverpool.ac.uk (T.-M. Choi), nick.sh.chung@polyu.edu.hk (S.-H. Chung), eunice.guo@liverpool.ac.uk (S. Guo).

https://doi.org/10.1016/j.ijpe.2023.108922
Received 3 June 2022; Received in revised form 2 March 2023; Accepted 17 May 2023
Available online 19 May 2023

effective C-commerce chain (Shen et al., 2021). Recently, in March of 2022, the fashion branding collaboration between *Supreme* and *Burberry* was a big success[1][2], which indicates that the C-Commerce could obtain the result of "*1 + 1>2*". In particular, today, in the Industry 4.0 era, the well development and adoption of technologies have created more possibilities to firms' operations. For instance, blockchain technology has been well adopted by numerous firms, including *Walmart*, *Ford*, *Unilever*, etc.[3], and it is regarded as an efficient technological tool to enhance collaborative operations as it can facilitate trustworthy information sharing between supply chain partners (Choi et al., 2020). Thus, we are now in an era where the implementation of C-Commerce can make a real difference. This is in line with the development of many operations management theories, including SCM where the emphasis is on collaboration among supply chain agents. Consequently, studies on C-Commerce have emerged over the recent years.

1.2. Literature and classification

As C-Commerce is critically important, there are a few papers which review different perspectives related to C-Commerce. For example, Li and Qiu (2006) review the C-Commerce papers focusing on products, providing an overview about the evolution of collaborative product development systems. From another perspective, Chong et al. (2010) discuss the influence of total quality management and knowledge management on C-Commerce adoption. Rather recently, sustainable supply chain management has got great attentions, and hence Chen et al. (2017) review related studies which explore the links between sustainability collaboration and company performance on the classic economic, environmental, and social metrics. Despite providing insights in the respective domains, these studies do not present a holistic view regarding the state of development as well as theoretical advances of C-Commerce in the literature. As the development of C-Commerce is pertinent in business operations, this paper hence aims to bridge this gap.

Before we proceed further, it is important to have a formal definition of C-Commerce (i.e., to explain "what it is"). We first list different existing definitions of C-Commerce in Table 1. Observing from Table 1, we can clearly find that the definition for C-Commerce has been evolving over the past years. To be specific, the definition given by Ward (1999) reveals that C-Commerce is related to management science using "real time collaboration tools". In Li et al. (2007), more details about the specific research domains of C-Commerce are revealed. Afterwards, in Chong et al. (2013), the definition highlights the pre-requisite of conducting C-Commerce: information and idea exchanges. Although the definition is evolving, we identify some "common grounds", which are underlined in Table 1.

Table 1
Definitions of C-Commerce.

Definitions	Sources
"Collaborative commerce occurs when *organizations* employ real-time collaboration tools to *sell or support their products and services* to other businesses, or directly to consumers."	Ward (1999)
"Collaborative commerce links *organizations* together to improve the efficiency of *sales, procurement, manufacturing, distribution, replenishment, and other activities*."	Li et al. (2007)
"Collaborative commerce concerns information and idea exchanges between the *supply chain members*, and allows them to *design, develop, and manage products and services* collaboratively."	Chong et al. (2013)

Remarks: The contents *underlined* are the common grounds of the examined definitions.

To further propose a more comprehensive and up-to-date definition as well as provide the classification framework of C-Commerce, we summarize common features of the definitions in two dimensions:

1. Research domain dimension of C-Commerce —— collaborative innovation, promotion, and operations;
2. Supply chain (SC) structure dimension of C-Commerce—— all supply chain members (i.e., the "organizations").

The first dimension provides the research topical areas for C-Commerce. To be specific, the collaborative innovation is related to the topics on product design and development; the collaborative promotion is present in marketing related activities and strategies such as co-branding (or called brand alliance), which aims at improving the efficiency of sales; and the collaborative operations cover many well-known measures such as collaborative planning, forecasting and replenishment (CPFR). Examples under these three domains can be checked in Table A1 in Appendix. The second dimension focuses on "SC structure" which captures different collaborative relationships in C-Commerce. Based on real practices and the reviewed literature, we focus on supply chain systems with "upstream (material) suppliers, manufacturers, downstream retailers and consumers", and highlight three types of relationships in this paper[4]: i) collaboration between a retailer[5] and consumers, ii) (vertical) collaboration between sellers and buyers[6], and iii) (horizontal) collaboration between multiple manufacturers. These two dimensions can be closely integrated and synthesized in different studies reported in the literature. For instance, for topics on collaborative innovation in product development, the collaborative relationships can cover the collaboration between sellers and buyers, and also the collaboration between a retailer and consumers. Different combinations may lead to distinct research issues and results. With the above discussions, therefore, we define C-Commerce as follows by combining both dimensions (*underlined*).

Definition 1. Collaborative commerce (C-Commerce) is an operational strategy which allows members in different supply chain (SC) structures to exchange information and work together, usually with the use of information technologies, to improve the effectiveness and efficiency of supply chain operations for physical or service products, which include product innovation, promotion, and operations.

Definition 1 includes and highlights the key properties, conditions, research domains and SC structure of C-Commerce. It provides an integrated definition for C-Commerce in business operations and production economics. After that, based on our definition, we classify the C-Commerce articles accordingly. Fig. 1 depicts the structure of our paper which also provides a clear classification of C-Commerce articles. We review the literature based on this classification in Sections 2, 3 and 4. Both academics and industrialists could refer to our proposed classification, which is a novel proposal and has never been studied before in the literature.

[1] We sincerely thank the editor and reviewers for their kind and critical comments on this paper.

[2] See details at: https://www.wmagazine.com/fashion/best-spring-fashion-2022-collaborations-launches-capsule-collections.

[3] More companies adopting blockchain can be checked at: https://101blockchains.com/companies-using-blockchain-technology/.

[4] As our searching reveals that mainly these three types are present.

[5] The term "retailer" here can also be a "manufacturer" if the firm produces the products and sells them to the consumers directly.

[6] The terms "sellers and buyers" here refer to either"suppliers and manufacturers" or "manufacturers and retailers", which depends on the specific issues that we will discuss later in each section.

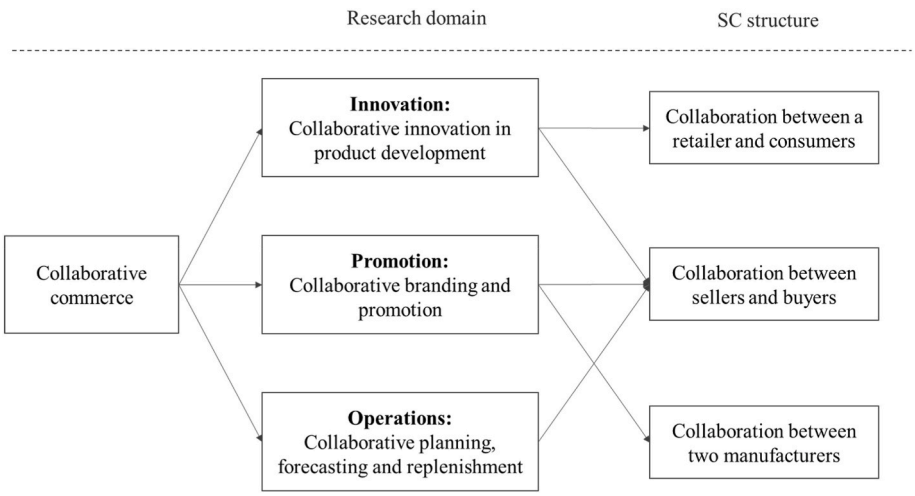


Fig. 1. Classification of C-Commerce in supply chain operations based on two dimensions (research domain and SC structure).

1.3. Review methodology

Aiming at providing a comprehensive review on recent advances in C-Commerce, we follow the approach adopted by a recent influential review paper (Tippong et al., 2022) and develop this paper by systematically reviewing relevant papers published in the recent decades (1995–2021). To be specific, our review process starts at an identification of search terms with a resulting database (Google Scholar, ScienceDirect, Web of Science) search and abstract evaluation. Since we have already classified C-Commerce in three research domains, the selected keywords can be also divided into three categories, with words related to: (i) collaborative innovation, (ii) promotion, and (iii) collaborative operations. In order to list all the relevant keywords in these three domains, we follow the method adopted by Weitzel and Glock (2017), which also defines a list of keywords based on three elements. We show the overview of search strings used for searching in Table 2. As the topic of C-Commerce is positioned in the operations-marketing interfaces (Tang 2010), we concentrate our search scope on (i) the mainstream management science and operations research (MS/OR) journals (including International Journal of Production Economics, Management Science, Operations Research, etc.) following the list in Wang et al. (2015) and Wen et al. (2019b), and (ii) several well-established leading marketing journals[7], such like Journal of Marketing Research, Journal of Marketing, Journal of Consumer Research, Marketing Science, International Journal of Research in Marketing. We supplement the searching results with a few additional research papers found based on our own knowledge in the field as well as others' recommendations. During the searching process, we notice that there are a multitude of studies and topics on collaboration in different research areas; meanwhile, a variety of approaches are adopted, including empirical studies, case studies, analytical modeling, etc. In this paper, we only focus on the published research contributions which employ analytical operational models to investigate C-Commerce problems[8]. The major purpose of this study is to identify the modeling techniques of C-Commerce research, summarizing the details of operational models (including model settings, market structure, objective, and decisions) for critical issues. This is our focal point. By referring to our paper, researchers can better understand "what to do" and "how to do" in terms of optimizing the company's collaborative decisions. For empirical/case studies, there are other related studies and we refer readers to them (e.g., Chong et al., 2010; Chen et al., 2017). Note that our classification is consistent with Chen et al. (2017)'s categorization while listing more possible SC structures. With this approach, 76 relevant papers from 27 different academic journals are included in our review.

Table 2
Overview of search strings used for the literature review.

		Collaborative innovation	Collaborative promotion	Collaborative operations
	SC structure	"collaborative" OR "collaboration" OR "process and product" OR "buyer-supplier" OR "supplier-consumer"	OR "alliance" OR "cooperative"	/
AND	Research domain	"innovation" OR "product development" OR "customized product" OR "customization"	"brand" OR "branding" OR "advertising"	"planning" OR "forecasting" OR "replenishment" OR "CPFR"

The organization of this review paper is stated below. Following the classification of C-Commerce as shown in Fig. 1, we first examine the research issues mostly related to collaborative innovation in Section 2. We explore the frequently concerned problems in terms of collaborative branding and promotion in Section 3. Next, we review prior research on CPFR in Section 4, with the topics and insights around collaborative operations. We uncover the evolution pattern and future research agenda of C-Commerce in Section 5. Finally, we conclude this paper in Section 6. For all the technical tables, please check them in the Appendix.

1.4. Contribution statement

To the best of our knowledge, this is the first paper which establishes a classification of C-Commerce literature and comprehensively examines the related analytical modeling research. The findings also provide guidance on 2W1H (i.e., what it is, what to do, and how to do). Specifically, in order to identify the research gaps and propose future directions, we first classify the relevant research of C-Commerce into 5 categories based on 2 dimensions, trying to present a comprehensive and valid framework of C-Commerce in business operations (i.e., to show

[7] All these marketing journals are listed in "FT50" and/or the "UTD list".

[8] Since we intend to provide useful knowledges and guidance to industrialists, who are more interested in the collaborations among enterprises, we exclude some trivial issues like peer-to-peer consumer exchange of products in our review.

"what it is"). The classification of C-Commerce is innovative and supported by industrial practices. Second, we review the relevant research in each category and show the operational models adopted. More specifically, we summarize 17 important C-Commerce issues with modeling features (including modeling technique, model setting, market structure, objective, and decisions) in the 5 proposed categories. This helps us better understand the various research approaches and modeling techniques adopted in the respective studies. This can explain "what to do" and "how to do". This is a major contribution of our study and differentiate it from prior studies. Last but not least, we organize the evolution of C-Commerce as well as propose seven future research directions, which are critical in terms of real-world needs while still underexplored. In short, we believe that paper lays the solid foundation for research in C-Commerce and helps motivate further studies in the area. To facilitate reading, we construct Table 3 to show the related parts for 2W1H.

2. Collaborative innovation in product development

As we discussed in Section 1.2, channel collaboration on innovation is a critically important topic (Kavadias and Ulrich 2020; Yu et al., 2021b). Collaborative innovation could drive the growth of marketplace demand, create additional value for companies and consumers, and increase each channel member's productivity. That is the reason why 81% of respondents in KPMG's 2015 Global Manufacturing Outlook Survey were adopting collaborative innovation models with manufacturers and customers[9]. So it is believed that both the manufacturers and consumers are willing to participate in the collaborative innovation with the retailers during the new product development (Choi 2020). In this section, we include 25 relevant papers and classify the topics of collaborative innovation into two categories based on different partnerships: (i) collaboration between manufacturers and retailers, and (ii) collaboration between a retailer and consumers. Then, in each category, the most important and commonly discussed issues and models will be further explored.

2.1. Collaboration between manufacturers and retailers

Generally speaking, manufacturers and retailers play different roles in collaborative innovation during the new product development process. To be specific, the manufacturer implements process innovation to improve speed, efficiency and reliability of production processes, while the retailer is responsible for product innovation which relates to the use of new components, new materials and new product features in product design. For instance, the well-known sports fashion brand Nike designs the new footwear with the latest fashion trend. One of its suppliers, Flex, produces the sports shoes for Nike with a special knitting machine, which not only can enhance product quality but also reduce labor inputs and materials usage significantly (Shen et al., 2021). The innovation performance of the collaboration between manufacturers and retailers relies on the diverse actions and strategies employed by them (Jayaram et al., 2014). To be specific, the following 4 issues, which focus on operational related activities and strategies that can improve innovation performance of firms, are most frequently considered in the relevant literature that we have reviewed: (i) Coordination, (ii) Resource/information sharing, (iii) Consumer preferences, and (iv) Pricing decision.

Table 3
Related parts for 2WIH.

2W1H for C-Commerce	Related parts
What it is	Definition 1, Fig. 1 (in Section 1)
What to do	Sections 5.1 and 5.3
How to do	Section 5.2, Tables A5 - A7 (in Appendix)

2.1.1. Coordination

Channel coordination is a kind of collaboration between the manufacturer and retailer. In most cases, the manufacturer and retailer belong to different firms and are responsible for distinct aspects in collaborative innovation. It is necessary to develop various incentive mechanisms to entice the firms to cooperate with each other so as to achieve channel coordination (Tang 2010). In the literature, to understand the strategic introduction of a premium store brand (PSB), Hara and Matsubayashi (2017) build a Hotelling's linear city model to depict the strategic interactions of a retailer and a national brand manufacturer (NBM). The authors indicate the difficulty of channel coordination in providing a PSB, while highlighting the value of multiple PSBs, which can ensure a successful collaboration between an NBM and a retailer. Yan et al. (2018) and Bhaskaran and Krishnan (2009) separately explore a case where a retailer and a manufacturer work together to create an innovative new product under a revenue sharing mechanism. To be specific, Yan et al. (2018) examine three decisions in the contract: the investment level, a fixed payment fee, and the fraction of revenue that the retailer receives. The authors compare the optimal contracting mechanism derived from an analytical model and draw the conclusion that the actual contract design is very much sensitive to changes in project uncertainty. Different from Yan et al. (2018), Bhaskaran and Krishnan (2009) include the sharing of development cost and effort in their model formulation. They interestingly find that the investment and innovation sharing scheme is more appropriate for collaboration and can help product development firms coordinate their investment decisions.

Some other works are devoted to exploring *contractual behaviors*, which have impacts on the degree of coordination. Various contracts, such as wholesale price contract (Gilbert and Cvsa, 2003), cost and revenue sharing contracts (Yenipazarli, 2017), reward and residual claimant contracts (Shalpegin, 2020), are examined in the literature. Specifically, Gilbert and Cvsa (2003) consider a bilateral monopoly where the downstream firm has an opportunity to invest in innovation that could either enhance market demand or reduce marginal production costs. Three wholesale pricing mechanisms with respect to this trade-off are then considered: (i) complete wholesale pricing flexibility, (ii) complete wholesale price commitment, and (iii) ceiling wholesale price. The authors assume that by investing $I\theta^2$ the buyer can reduce his marginal costs (shift demand) by θr. The comparison results indicate that commitment to wholesale price is always preferred for the buyer and supply chain in collaborative innovation. Yenipazarli (2017) examines the collaborative eco-efficient innovation between a supplier and a retailer. Two types of contracts are considered to coordinate the supply chain: cost sharing contract and revenue sharing contract, which is chosen by the retailer. From the results, the positive effect of collaborative eco-efficient innovation can be observed under both contracts, and particularly, revenue-sharing contract is more appropriate for supporting collaboration. Shalpegin (2020) tests the effectiveness of reward and residual claimant contracts to improve the manufacturer's incentive of component testing in the collaborative product development. Since there exists failure probability of the component, under which both supply chain members will incur loss because of the bad quality. Hence the manufacturer may have incentive to test the component, and the retailer may use contract to encourage the testing. The results interestingly show that the higher reward does not necessarily lead to higher incentive of testing. Mandal et al. (2021) study the efficiency of quality collaboration contract between a manufacturer and a retailer. Their analytical findings reveal that compared with the traditional revenue sharing contract, the quality collaboration contract is superior when the supplier is highly efficient in collaboration.

[9] Collaborative innovation: You can't do it alone and win. Available at: https://www.huffpost.com/entry/collaborative-innovation_b_8333456.

2.1.2. Resource/information sharing

Despite the growing requirement and utilization of collaboration, the collaborative innovation in new product development still presents a new challenge for the partnering firms in sharing of information, resources and technology (Bhaskaran and Krishnan 2009; Jha et al., 2017; Yan et al., 2018, etc.). To our best knowledge, Bhaskaran and Krishnan (2009) is the first study to conceptualize and formulate the collaborative innovation involving two firms with different product development capabilities. The authors model the total development cost comprised of a fixed cost and a variable cost. Aiming to find out the critical interactions of investment and innovation sharing mechanisms, the authors assume that a fraction of development costs is borne by the focal firm, and let $C(\theta_F, \theta_P) = K(\theta_F^2 + \theta_P^2)$ be the integration cost for both firms, where K is the integration cost parameter, θ_F and θ_P denote the part of the development work conducted by the focal firm and partner firm, respectively. Finally, the complementary role of revenue, cost, and innovative effort sharing mechanisms for new product development are unearthed according to the analytical results. Following the innovation model set up by Bhaskaran and Krishnan (2009), Jha et al. (2017) consider the case where a product development company (PDC) and a technology development company (TDC) co-develop new products. In particular, the effects of sharing innovation work and forecast information are evaluated in their paper. The authors broadly enlist and analyze all the possible scenarios where the two firms can develop a new product collaboratively. Shalpegin et al. (2017) study information sharing focusing on the costs associated with collaboration. The authors study a "collaborative prototyping scenario" in which the manufacturer can choose to reveal the costs, and the supplier can make detailed design choices for their components and obtain prototypes for testing from a manufacturer. They prove that the manufacturer's optimal decisions are significantly affected by the "collaborative prototyping" mechanism.

In addition to the influence on profit performance, the resource/information sharing in collaborative innovation would also have an impact on firms' strategies and decisions. Yan et al. (2018) examine how retailer's effort sharing influences contractual decisions. Their findings prove that the actual contract design is sensitive to changes in retailer's effort sharing. Agrawal and Oraiopoulos (2020) provide three principles to design the governance structure and explore the optimal choice of governance structures for co-development projects. The authors assume that the manufacturer and retailer share the co-development efforts' information, which could influence the product market potential collaboratively. Shalpegin (2020) studies the manufacturer's component testing decision under product development collaboration. In the extension part, the author proves the necessity of information sharing between different manufacturers under collaboration, without which the first-best outcome can never be achieved.

2.1.3. Consumer preferences

Consumer preferences typically play a vital role in product and process innovation (Saha 2007). The majority of research pays attention to the consumer preferences during the product co-development decision making by using the utility-based modeling approach (e.g., Adner and Levinthal 2001; Chen et al., 2013; Hara and Matsubayashi 2017). Adner and Levinthal (2001) develop a formal computer simulation model that explicitly considers the presence of consumers with various needs and requirements. To better understand how firms trade off the development of process and product technologies, the authors characterize consumers by two attributes: consumer i's minimum performance requirements for product j (F_{ij}) and minimum utility deriving from product j (U_{ij}). The utility U_{ij} is specified as a Cobb-Douglas utility function which trades off price P_{ij} and functionality B_{ij} as $U_i(F_j, P_j) = (B_i(F_j))^{\alpha}(1/P_i)^{1-\alpha}$, where $0 < \alpha < 1$. The analytical results highlight the role of "technologically satisfied" consumers in shaping collaborative innovation incentives. Chen et al. (2013) construct a single-period model to analyze the optimal product line design and production policy for a firm adopting a vertical coproduct technology. The consumer preferences are modeled as a marginal willingness to pay for quality. Most recently, Hara and Matsubayashi (2017) employ the well-known Hotelling model (see Adler et al., 2021) to measure consumers' preferences (i.e., consumers' preferences are uniformly distributed on the unit line [0,1]) in the case when a retailer and a national brand manufacturer collaboratively introduce a new premium store brand (PSB).

Besides, a series of studies assume that the consumers vary in their willingness to pay and their concern for product quality. For instance, Chenavaz (2012) models the product and process investment policies in an optimal control setting, where market demand depends jointly on the product price and the quality. Afterwards, aiming at presenting a dynamic optimal control model of process-product innovation with "learning by doing", Pan and Li (2015) extend the model of Chenavaz (2012) to a more general one with time t. The authors investigate the model's optimal conditions and characteristics to analyze the connections between the product price and the state variable product quality.

2.1.4. Pricing decision

In operations and production economics, the optimal pricing decision is of prime importance (Yang et al., 2021; Li et al., 2021), and the related research for collaborative innovation is no exception. On the supply side, the firm sets prices to maximize its profit. Gilbert and Cvsa (2003) pay attention to single-part pricing mechanisms, trying to find out the trade-off that the upstream firm faces between pricing flexibility and strategic commitment. Mandal et al. (2021) investigate quality collaboration contracts under product pricing, in which the manufacturer aims at maximizing its own profit in the collaboration. In their model setting, the manufacturer should first determine its effort level for product quality improvement, followed by the decision of the optimal market price. On the demand side, market demand depends on price and other factors. As early as 1995, Bayus (1995) analytically examines the product and process innovation activities considering the pricing problem. The author models new product demand as a dynamic function of price and incremental product innovation. Particularly, he formulates the new product sales with a multiplicative price function. Similarly, in order to investigate the implication of eco-efficient innovation on firms' pricing decision under supplier-retailer collaboration, a linear demand function (related to price and innovation effort level) is adopted by Yenipazarli (2017). The analytical results reveal that the eco-efficient innovation effort level would impact the pricing decisions of the retailer and supplier.

Furthermore, when considering a heterogeneous demand environment, the firms' pricing decision would be significantly affected by consumers' marginal utility (e.g., Adner and Levinthal 2001; Hara and Matsubayashi 2017). Specifically, Adner and Levinthal (2001) pay attention to the price evolution under demand heterogeneity when examining the dynamics of product and process innovation. The result provides an important operational implication that firms should improve the performance at a stable price in the technology life cycle. Hara and Matsubayashi (2017) study the one-retailer-two-manufacturer collaboration in new product strategic introduction. In addition to considering the pricing decisions influenced by consumer utilities, the authors adopt the sequential pricing strategy to reflect the difference in the flexibility of decision making. That is, a national brand manufacturer (NBM) first charges for the wholesale price as the leader, and then another NBM decides his product selection along with the wholesale price as the follower. The authors find that the follower is likely to be more flexible in making pricing decision.

Dynamic pricing is another important pricing strategy (Li et al., 2015). Chenavaz (2012) adopts both additive separable demand function and multiplicative separable demand function to explore the implications of process and product innovation on dynamic pricing. The results indicate that both product innovation and process innovation impact the pricing policy under additive separable demand function,

while only process innovation influence firm's pricing policy under multiplicative separable demand function. Similarly, Pan and Li (2015) focus on a monopolistic market where the firm prices a product dynamically and invests in both product and process innovation. The authors provide analytical results of the optimal price, product and process innovation policies and demonstrates the interactions between them.

2.2. Collaboration between a retailer and consumers

Traditionally, the new product development process, including design, production, and distribution, is mainly managed by the firms in the supply chain. Consumers, on the other hand, are supposed to make choices for products, without directly participating in these processes. While with the advance of information technology, a number of innovating retailers try to equip the consumers to design and develop their own products with tools, ranging from minor modifications to major new innovations, to better fulfill consumers' needs (Thomke 2002). Note that, the "retailer" here can also be a "manufacturer" if it both produces the products and sells them to the consumers directly. This kind of collaboration is common to see in real practices. For instance, numerous fashion brands, such like Adidas, Nike, Vans, Uniqlo, etc., all provide customized products which allow the consumers to design the products by themselves. Consequently, retailer-consumer collaboration has become an increasingly popular topic no matter in academia or in real-world application. In order to better understand this collaboration strategy, we classify the relevant works into the following three categories, which are the most commonly considered issues in the literature, and summarize the analytical models adopted: (i) Pricing decision, (ii) Information disclosure, and (iii) Consumer choices.

2.2.1. Pricing decision

The procurement of consumer collaborative products can be regarded as a transaction problem with an embedded design problem, and pricing is one of the most imperative decisions in terms of transactions (Chen and Tseng, 2010). Dewan et al. (2003) first highlight the significance of price discrimination and construct a "second-degree discriminatory pricing scheme" in both monopoly and duopoly markets. Terwiesch and Loch (2004) verify that the collaborative prototypes should be priced relative to their costs. Then, in order to find the trade-off between price and customization level, Aron et al. (2006) pay attention to the preference-based pricing software agent, which determines the optimal price dynamically based on consumers' product preference. Differently, based on the observation on the current video game market, Arakji and Lang (2007) assume the retail price of a consumer collaborative video game is fixed and exogenous at price point. The analytical results reveal the potential benefits and risks of producer-consumer collaboration in the video game industry. Chen and Tseng (2010) model the transaction decisions between consumers and the manufacturer as two interrelated mathematical programming problems. An agreement on price is sought to maximize the consumer utility and the manufacturer's profit, respectively. A similar pricing approach is adopted by Syam and Kumar (2006) and Takagoshi and Matsubayashi (2013), in which the authors study a competition of product customization between two firms by a game-theoretic approach. They consider a two-stage game, where at the first stage, both firms simultaneously determine their degree of customizations, and at the second stage, they simultaneously set their prices.

2.2.2. Information disclosure

Retailer-consumer collaboration contributes to higher value creation by matching customers' specific requirements with retailers' capabilities. However, information asymmetry is one of the key challenges in this kind of collaboration, which prevents both firms and customers from effectively obtaining information during the production and transaction processes. A substantial number of studies hence work on exploring the value of information disclosure under collaboration. The information here can be the producer's design capability (Terwiesch and Loch, 2004), solution and need information (Chen and Tseng 2010), customer reviews (Liu et al., 2020), etc. Specifically, Terwiesch and Loch (2004) derive two separating equilibria to show how the producer will use prototype pricing as a signal of his capability. Chen and Tseng (2010) reveal that the supplier would truthfully reveal its solution information in the NCA mechanism, while the consumers may strategically distort their need information in some cases. Liu et al. (2020) propose that firms should carefully utilize the consumer reviews in new product development as long as the cost is not too high.

Except for the information disclosure between customer and supplier, two competing customizing suppliers are also confronted with this challenging issue. Mendelson and Parlaktürk (2008) analyze the Stackelberg competition between two customization firms, which have an asymmetric property regarding customizing cost and reservation price. The authors find that whether the firms would adopt customization depends on the asymmetric property. Takagoshi and Matsubayashi (2013) is the first study attempting to analyze the customization competition between firms with asymmetric positions of products by using the Hotelling model. The results reveal that the position of the product could create the competitive advantage.

2.2.3. Consumer choices

Facing with customized products, heterogeneous consumers make choices about whether to buy and which product to buy. A substantial number of papers adopt the utility function approach to describe the consumer choice in the model. For instance, collaborative prototyping is one of the most common forms of supplier-consumer collaboration in the early years (e.g., Terwiesch and Loch 2004, Aron et al., 2006), which allows suppliers to create several selectable prototypes presenting to the consumers. Under this kind of collaboration, the consumer's selection process will significantly influence their utility. Then, when considering the transaction between a customer with individual-specific needs and multiple competing manufacturers, Chen and Tseng (2010) model the customer utility as a quasi-linear function of product specification and price. Then, in order to investigate the advantages of collaboration between strategic consumers in "name-your-own-price channel", Levina et al. (2015) use a consumer utility-based model to capture consumers' willingness-to-pay and also capture their attitudes to risk. The authors propose three different possible forms of consumer collaboration, namely the "exchange of bid result information", "coordinated bidding" and "coordinated bidding with risk pooling".

To capture consumer preference on spatial product differentiation, Dewan et al. (2003) adopt a circular model (i.e., Salop model) to describe the product space when evaluating firms' product customization strategies in an electronic market, which allows the authors to ignore firms' location decisions in the analysis. Hotelling model is another approach capturing consumer preference when taking product attributes into consideration. To examine firms' incentive to offer customized products, Syam and Kumar (2006) develop a model with two competing firms and distinguish them by the degree of customization. The firm which provides more product attributes options to the consumers will have a greater degree of customization. All the consumers in the market have a common reservation price for their ideal products, while their preferences are heterogeneous in two dimensions: (i) their ideal points, which are distributed uniformly on the line AB, and (ii) the intensity of preference, which is independent of the location of their ideal point. Furthermore, Mendelson and Parlaktürk (2008) and Takagoshi and Matsubayashi (2013) employ Hotelling model to reflect the product attributes such like the size, color or function, and analyze the competition between the two firms. Specifically, Mendelson and Parlaktürk (2008) model the product space using the Hotelling model, with each product located on the unit line segment. Takagoshi and Matsubayashi (2013) further consider a two-attribute space in the Hotelling model, which can jointly present the product "function'' and

the consumers' "taste" preferences.

From the above review in Section 2, we summarize the key issues for collaborative innovation in Table A2 in Appendix. From the table, we notice that consumer choice and pricing decision are the common topic irrespective of the SC structure. As a remark, resource sharing and coordination are the unique issues for the collaboration between manufacturers and retailers[10], while information disclosure is widely considered in terms of the retailer-consumer collaboration. A structured review of the operational models applied in this section is shown in Table A5 (Appendix). Researchers can refer to the table to better understand the unique modeling elements (e.g., modeling technique, objective, decisions) and features of collaborative innovation (e.g., product setting, market structure) in C-Commerce. The results in the table also indicate that collaboration with pricing decision for the single product in a monopoly market has been well explored in the prior literature. The research gaps identified from the table will be further discussed in Section 5.

3. Collaborative branding and promotion

Advertising strategies have been widely explored in the operations-marketing interface literature for a long time (Chiu et al., 2018). In particular, cooperative advertising is one of the commonly used advertising strategies which requires the cooperation between manufacturers and retailers. Under this type of collaboration, the manufacturer offers to bear either a certain part or the entire advertising expenditure of its retail partner (Bergen and John 1997). This entices the retailer to work harder to advertise products and stimulate demands. In addition, co-branding is a brand alliance strategy in which two or more brands collaborate and launch their co-brand (Blackett and Russell 2000). Since the co-branding strategy can bring numerous benefits including signaling the unobservable quality (Rao et al., 1999), enlarging the market size (Cai and Raju 2016), and gaining access to a new market (Bengtsson 2005), it has been extensively used in food market (Geylani et al., 2008), fashion brands (Shen et al., 2017), aerospace industry (Erevelles et al., 2008), etc. Generally, co-branding includes two major types: ingredient co-branding, and composite co-branding. The former one refers to the case of using a renowned brand as an element in the production of products under another renowned brand. This is usually adopted between suppliers and manufacturers along a supply chain. For example, the computer firm Dell always shows the logo of Intel (its chip supplier) on their products. The latter one refers to the use of two renowned brand names in a way that they can collectively offer a distinct product/service, which is widely used in the case with two manufacturers[11]. Such as the co-branding between the fashion brand GU and the drink company Coca-Cola. Thus, in the following subsections, we would classify the topics of collaborative branding and promotion into three categories based on different partnerships.

3.1. Collaboration between manufacturers and retailers

As we mentioned above, cooperative advertising is a frequently-used advertising strategy which requires the cooperation between a manufacturer and a retailer. The analytical studies on cooperative advertising can be roughly divided into two groups (Aust and Buscher 2012).

The first group refers to the ones that put strong emphasis on advertising solely. For instance, a series of studies divide advertising into national and local advertising, and explore the role of cooperative advertising in a manufacturer-retailer supply chain through these two kinds of advertising expenditures (e.g., Huang and Li, 2001, Li et al., 2002; Huang et al., 2002). In order to reflect the impact of two advertising investments a and q on collaboration analytically, Huang and Li (2001) first model the demand function as $V = (\alpha - \beta p_R)\left(A - \frac{B}{a^{\gamma}q^{\delta}}\right)$, where a, β, B, γ, δ are positive constants, p_R is the retail price, and $A > 0$ reflects the sales. The former part refers to the demand influenced by the price and the latter part indicates the implication of advertising investments. Similar modeling approaches with slight modifications on demand functions can be found in Huang et al. (2002) and Li et al. (2002). Besides, He et al. (2010) study a stochastic Stackelberg differential game between a manufacturer and a retailer, considering that the advertising expenditure is quadratic in the advertising effort, and the manufacturer would support the retailer's advertising activities by sharing portion of the retailer's advertising expenditures. Then, He et al. (2011) further extend the model to include the competition between two symmetric retailers and find that a higher support will be provided by the manufacturer under a competitive retail environment.

The papers in the second group are the extended studies of the first group, which include some other decision variables like pricing, retailer margin, participation rate, etc. For example, Bergen and John (1997) consider the impacts of price and distance from consumer's ideal point in the market competition between two retailers. Yue et al. (2006) extend the model of Huang and Li (2001) to consider that the manufacturer offers price deductions to customers to enhance competitiveness and stimulate the market. The local advertisement, brand name investments and price deduction percentage are integrated together in the market demand. Karray and Zaccour (2006) propose a bilateral duopoly model to explore the value of cooperative advertising in a setting with manufacturer competition. The authors put emphasis on investigating the implication of the price and retailer's local advertising in the collaboration. Szmerekovsky and Zhang (2009) employ a similar demand function in their research, replacing the price discount with the resulting retail price. Another form of demand function is utilized by Xie and Wei (2009), SeyedEsfahani et al. (2011), and Aust and Buscher (2012) to reflect the joint influence of price and advertising level. Furthermore, an innovative study combining cooperative advertising, pricing and collection decisions is conducted by Hong et al. (2015), in which the Stackelberg gaming models are built to investigate the optimal decisions in centralized and decentralized closed-loop supply chains. Lu et al. (2018) develop a differential game in a two-player supply chain with sticky price, in which the manufacturer and the retailer has two behavioral choices, namely myopia or farsightedness. Recently, Ma et al. (2021) and Kennedy et al. (2021) extend the prior literature by using advertising subsidy schemes for cooperative advertising, where the manufacturer shares a certain percentage of the retailer's advertising cost.

3.2. Collaboration between suppliers and manufacturers

Ingredient co-branding is the most commonly used co-branding strategy between suppliers and manufacturers, in which the end product of the supplier (e.g., raw materials; semi-finished parts/components) becomes one of the components of the manufacturer's offering. Although this strategy has been broadly adopted in practice, there is very limited analytical research on the ingredient co-branding except Venkatesh and Mahajan (1997), Erevelles et al. (2008) and Zhang et al. (2013). Venkatesh and Mahajan (1997) is the first research using an analytical modeling approach to study the ingredient co-branding strategy. By utilizing the operational model, the authors provide the optimal pricing and partner selection decisions for the manufacturers during the ingredient co-branding. Erevelles et al. (2008) discuss the use of ingredient co-branding and adopt an econometric modeling approach to offer a rationale for why it occurs. The results indicate that the co-branding arrangement benefits both the incumbent supplier and the downstream manufacturer. Recently, Zhang et al. (2013) further consider an additional cooperative advertising programme in the

[10] Levina et al. (2015) is an exception, which considers the information sharing between consumers.

[11] Co-branding - Meaning, Types and Advantages and Disadvantages. Available at: https://www.managementstudyguide.com/co-branding.htm.

ingredient branding strategy between an original equipment manufacturer and a key component supplier. By considering three different scenarios of supplier interaction, the authors demonstrate how the channel members' advertising efforts, goodwill levels and their profits would be affected.

3.3. Collaboration between two manufacturers

It is well recognized that the co-branding strategy can be taken between two complementary manufacturers, which is known as composite co-branding. The literature related to composite co-branding has been well explored from different aspects. For example, competition among co-branding alliance (Venkatesh et al., 2000; Cai and Raju 2016; Yu et al., 2021a), composite co-branding on the firm's image (Geylani et al., 2008) and brand loyalties (Shen et al., 2017) are all analytically studied. Findings from both Cai and Raju (2016) and Yu et al. (2021a) interestingly indicate that co-branding with the competitors can be more profitable under certain conditions. Shen et al. (2017) evaluate three different schemes and manifest that only the mergers scheme could coordinate the alliance and maximize firms' profits under co-branding strategy. Most recently, Zhang et al. (2022) examine the impacts of social influences and risk aversion in the co-branding strategy between a fast fashion brand and a luxury brand by using a profit-sharing contract. Their analytical findings suggest that it is not always beneficial for the fast fashion brand to collaborate with the luxury brand; the firm should carefully make co-branding decisions based on risk attitudes of the two brands.

To provide a clear overview of the major issues in this section, we construct Table A3 (Appendix) and present a summary for relevant papers. We find that in terms of collaborative branding and promotion, consumer choice is scarcely investigated when modeling the market demand. Moreover, it is crystal clear that the pricing decision and bargain power are critically important in the collaboration between manufacturers and retailers, while they are relatively under-explored in the two-manufacturer collaboration. It is understandable as both issues are crucial and they affect channel coordination. However, considering them together makes the analyses challenging and may even be intractable. Additionally, Table A6 in Appendix provides a structured overview of the operational models in the literature introduced in this section. We find that regarding collaborative branding and promotion, supply chain structure (centralized or decentralized supply chain) should be carefully considered in modelling. Besides, advertising level/cost is one of the most critical decisions for the firms, which is different from other collaborations.

4. Collaborative planning, forecasting and replenishment

Supply chain collaboration means two or more autonomous firms working jointly to plan and execute supply chain operations (Cao and Zhang 2011), which aims at enhancing competitiveness through information sharing, partnership, and benefits sharing (Sethi et al., 2006; Hu et al., 2013; Choudhary et al., 2014; Ramanathan and Gunasekaran 2014). Generally, this kind of collaboration is always conducted between manufacturers and retailers in the supply chain. Over the past decades, quick response partnerships have been explored which focused on cutting lead time by responding quickly to market changes (Choi et al., 2018). However, quick response does not put strong emphasis on collaboration and hence problems such as supply shortage still exists. The insufficiency of quick response thus motivated some deeper collaboration schemes to be established, which include collaborative planning, forecasting, and replenishment (CPFR). The concept of CPFR was first proposed by the Voluntary Inter-industry Commerce Standards in 1998, which defined it as a "three-stage and nine-step procedure" for companies which would like to implement a collaborative project (VICS 1998). Attributing to the success story of Wal-Mart's collaboration with its upstream manufacturers by using CPFR system, CPFR has been extensively used all around the world and became a common norm in terms of collaborative operations in supply chains (Aviv 2001; Ramanathan and Gunasekaran 2014). Motivated by the rapid development and the attendant problems of CPFR, a substantial number of researchers investigate the potential influence of CPFR in supply chains via a theoretical modeling approach. As we mentioned before, the information-sharing between manufacturers and retailers is identified as prerequisite for CPFR. In this section, we summarize the relevant papers by further classifying the research topics based on the three stages of CPFR: (i) Collaborative planning, (ii) collaborative forecasting, and (iii) collaborative replenishment.

4.1. Collaborative planning

Collaborative planning and control of operations is a central element of SCM (Dudek and Stadtler 2007). Interested in the possibilities of a closer collaboration of supplier and buyer, Vaart and Wijngaard (2007) explore the influence of set-up time on the effect of pooling in a make-to-order situation (Shi et al., 2014) with two machines and an even number of identical product families. The authors draw the conclusion that set-up time reduces the positive effects of pooling. Due to the complexity, optimization models were widely considered to address collaborative planning problems in the early years, e.g., mixed integer-programming model (Gaonkar and Viswanadham 2005) and multi-objective linear programming model (Selim et al., 2008). The complexity of collaborative planning is related to two main reasons. First, it is a multi-problem. For example, Selim et al. (2008) and Yahia et al. (2015) regard it as a multi-objective problem, Dudek and Stadtler (2007) consider it as a multi-level capacitated lot-sizing problem, Zhang et al. (2011) develop a multi-echelon, multi-product supply chain production planning model with transport and production capacity constraints. Second, uncertainty creates complexity. To capture the features of uncertainty, Pibernik et al. (2011) implement the well-known "Joint Economic Lot Size Model" with a stochastic benefit sharing rule, and assess the conditions under which "stochastic benefit sharing" can guarantee secure collaboration. Zhang et al. (2011) explore the stochastic demands of products and the price uncertainty of raw materials when addressing the collaborative production planning issue. Their numerical results prove that the method of combining the "scatter evolutionary algorithm", fuzzy optimization, and stochastic chance-constrained programming is effective.

4.2. Collaborative forecasting

The potential benefits of collaborative forecasting (CF) are well explored in the "single retailer and single supplier system". We notice that Aviv (2001,2002,2007) makes great contributions to the exploration and evolution of CF. Aviv (2001) pioneers the first research using a theoretical model to study CF, in which the author considers a cooperative, two-stage supply chain composed of single retailer and single manufacturer. In the model, it is assumed that the demands realized during period are independent and identically distributed. Meanwhile, the manufacturer and the retailer can dynamically update their forecasts, so that they can replenish their inventories accordingly. The analytical results show that the CF can benefit the supply chain by reducing the supply chain's system-wide variance. Aviv (2002) extends Aviv (2001) by further examining the joint forecasting and replenishment processes with auto-correlated demand. The author conducts the comparisons between CPFR and another important supply chain configuration, which is known as vendor-managed inventory (VMI), trying to provide operational implications into the value of CF. Afterwards, Aviv (2007) proceeds to investigate the potential benefits of CF in a two-echelon single-manufacturer single-retailer supply chain, where the manufacturer adopts a prescriptive convex-cost production planning model, and the retailer is characterized by a replenishment model. The findings show that the relative explanatory power of the supply chain

partners, the supply side agility, and the internal service rate are the key influence factors of CF. More importantly, Aviv (2007) shows that the supply side needs to be "sufficiently agile" in order to implement CF well. Similarly, Kurtulus et al. (2013) also explore the potential benefits associated with the implementation of CF by considering a two-stage supply chain with a single manufacturer and a single retailer. However, different with Aviv (2001, 2002, 2007), Kurtulus et al. (2013) focus on examining the inventory decision under the newsvendor model setting. Furthermore, two variations of the simple wholesale price contract and the buyback contract are adopted to study the value of CF. Their results indicate that CF tends to be more valuable under the buyback contract than the wholesale price contract. Most recently, Karimi and Zaerpour (2022) identify the research gap of CF mechanism and propose the "cost-function based prediction markets" as an innovative approach of CF. The analytical findings show that the proposed mechanism is effective in reaching Pareto improvement in supply chains. Interestingly, not all the studies show the superiority of CF. For instance, Galbreth et al. (2015), which explore the case where the central decision maker can select to form a single "shared demand forecast" during the collaboration, prove that the forecast accuracy in a collaborative supply chain tends to be lower than in a non-collaborative one.

As the basis of CPFR, "Collaborative Forecasting and Replenishment" (CFAR) is studied by Raghunathan (1999), who builds a supply chain model consisting of a manufacturer selling its product through two independent identical retailers. In the case of CFAR, the site(s) of the participant retailer(s) would share the demand information with the manufacturer before production scheduling. The author shows that the costs of the manufacturer can be decreased when the retailers join CFAR. Generally, CFAR studies aim to examine and analyze different collaboration policies for forecasting. For example, Özen et al. (2012) study a multi-retailer distribution system, where the cooperating retailers can reallocate ordered quantities after observing a "demand updating signal". Two collaboration possibilities are considered: (i) "cooperation with forecast sharing", and (ii) "cooperation with joint forecasting". Their analytical results show that the former collaboration with asymmetric retailers' forecasting capabilities would reduce the profit. Similarly, Shamir and Shin (2018) consider the case when a group of retailers can exchange and share their own private forecast information with a single manufacturer under two collaboration policies: (i) "exclusionary information exchange", and (ii) "on-exclusionary information exchange". The authors highlight the crucial role of the "optimal timing at which the manufacturer sets the wholesale price". Most recently, Jiang et al. (2018) investigate whether it is wise to share "demand forecast information" in the supply chain channel. Their findings suggest the upstream seller not to share its forecast information if the retailer is risk averse.

4.3. Collaborative replenishment

Acting as the third stage of CPFR, collaborative replenishment is conducted to fulfill orders and facilitate collaborative inventory management in operations. Generally, central planner plays an important role in collaborative replenishment. Aviv (2002) considers a two-level supply chain system in which the inventory replenishment process is managed centrally. Chakravarty and Zhang (2007) explore a setting in which two firms are managed by a central planner, who would choose an investment level to maximize the expected profit under the newsvendor problem. Their findings prove that the systems efficiency can always be improved by setting the contract optimally. Besides, it is worth noting that, collaborative replenishment strategy is always accompanied with the consideration of "cost". For example, Aviv (2002) and Hezarkhani et al. (2018) develop the optimal collaborative replenishment policy minimizing the total systems cost. Zhang (2009) explores the cost-allocation problem during collaborative replenishment process. Lyu et al. (2010) explore the implications of "cost-saving effect" among different collaborative replenishment mechanisms. We hence conclude that cost saving should be given the priority in collaborative replenishment processes. Finally, from the findings derived in the extant literature, the advantages of collaborative replenishment are straightforward. It can strengthen the stabilizing effect, improve the service level of a supply chain (Fu and Piplani 2004), cause cost/price reduction, especially in the "hi-tech" industries (Yang et al., 2007), and allow multiple retailers to pool their purchasing power and obtain lower prices (Yang et al., 2007), etc.

Table A4 (Appendix) presents a concise view regarding the major research issues in different stages of CPFR. We uncover that supply chain coordination and information sharing are the most prevalent issues in CPFR, especially in the "collaborative forecasting" stage. We also notice that the negotiation scheme is more widely applied in "collaborative planning" than in "collaborative forecasting and replenishment". In addition, it is worth noting that cost sharing/discount strategy is only investigated in the research of "collaborative replenishment". We further depict in Table A7 (Appendix) a summary of the operational models reviewed in this section. We interestingly observe that in CPFR, the main objective is no longer to maximize the total profit; instead, minimizing cost is given the priority. Due to the technical complexity, it is relatively hard to conduct closed-form analysis. Hence, most studies draw their conclusion by conducting computational based analyses.

5. Evolution and research gaps of collaborative commerce

From the reviews in Sections 2, 3, and 4, we find that various aspects of C-Commerce in business operations have been examined in current research. Based on the review findings, we conduct a deeper analysis to reveal the research trends in C-Commerce related topics (i.e., "what to do") and summarize the evolution of research with C-Commerce operational models in this section (i.e., "how to do"). More importantly, we identify some important research gaps, which are based on our review findings and real-world observations.

5.1. Trends in topics

1. **SC structure of C-Commerce:** Three different SC structures are identified in our proposed C-Commerce classification (i.e., Fig. 1), while the review results clearly show that the "collaborations between sellers and buyers" are more popularly investigated than any other structures (i.e., collaboration between two manufacturers or collaboration between a retailer and consumers). This finding is intuitive, as the traditional literature in management science mainly focuses on the relationship between upstream sellers and downstream buyers. While attributing to the rapid development of information and communication technologies under Industry 4.0, an increasingly number of firms are confronted with the opportunities and challenges brought by the emergence of customization and co-branding. Thus, it is understandable that various kinds of collaboration structures have emerged and been studied in recent years.
2. **Operations versus marketing:** The topic of C-Commerce is positioned in the operations-marketing interfaces (Tang 2010). The related research issues on C-Commerce would span across different disciplines in business operations and marketing. This can also be verified by our proposed C-Commerce classification scheme in Fig. 1, where three research domains with respect to operations and marketing (i.e., innovation, promotion, and operations) are illustrated. However, the review results uncover that the number of marketing research is significantly less than the ones from operations. This is especially true in terms of the collaborative branding and promotion domain, where a substantial number of studies examine cooperative advertising from an operations perspective while very few studies focusing on co-branding, which is a typical marketing topic. The above observation implies that analytical research on C-Commerce in the marketing-oriented area remains highly underdeveloped.

3. **Coordination:** Channel coordination is the classical topic in marketing and a hot topic in supply chain management (Minner and Silver 2007; Wei and Choi 2010). Since the manufacturer and the retailer usually belong to different firms, various "incentive alignment" mechanisms need to be developed in order to entice supply chain members to act in a way which is optimal to the whole channel (Tang 2010). Thus, it is no wonder that numerous of C-Commerce studies all pay attention to channel coordination, especially when investigating the collaboration between manufacturers and retailers in collaborative innovation and CPFR.
4. **Consumer behaviors:** Being an indispensable part of supply chain, consumers and their behaviors are crucial in SCM. In particular, the behavior of strategic consumer has been regarded as critical (Minner, 2016; Yuan and Shen 2019), which would affect the firm's pricing decision significantly (Caldentey et al., 2017). Our review findings interestingly show that in "collaborative innovation", it is common to consider consumer preferences towards price, quality, brand, etc. during the modeling analysis; while in "collaborative branding and promotion" and "CPFR", only few studies focus on it.
5. **Game theoretic analysis:** Driven by the Nobel Prize-winning theories in economics, the game theoretic approach has become very popular in business operations (Wang et al., 2015). This trend also applies to C-Commerce analysis, as the majority of studies adopt game theory (both cooperative and non-cooperative games) in conducting their analyses.

5.2. Evolution of C-commerce models

To better present the development of operational models in C-Commerce research, we summarize the evolution of modeling approach in Figure A1 (Appendix), and highlight the core findings as follows.

1. **Collaborative innovation:** The analytical research of collaborative innovation between "manufacturers and retailers" started with the use of "diffusion model", which was adopted by Bayus (1995). Then, since 2001, researchers have started to pay attention to game theoretic models (including Nash game, and Stackelberg game) and further considered the optimal control theory and Bayesian updating in their research in 2012 and 2017, respectively. Meanwhile, research on collaborative innovation between "a retailer and consumers" has been conducted using the game theoretic modelling approach since 2003. Afterwards, to further capture the consumer behaviors in analytical models, the "search model", "Bayesian updating model", and Markov decision process have been used in the analysis. For future research, we expect that more interesting theories (e.g., signaling theory, network effect) can be combined with the game theoretic models to investigate the collaborative innovation challenges in production.
2. **Collaborative branding and promotion:** The same with the development tendency of collaborative innovation, research of collaborative branding and promotion started under the "seller-buyer" setting. Starting from 1997, both the integral transform theory and game theoretic models have been considered in related studies. More recently, stochastic models and optimal control theory have been applied since 2010, and the dynamic optimization model has been proposed since 2013 to study more complex multi-period problems. In terms of the collaboration between two manufacturers, the analytical research started in 2000 with the use of the Bass diffusion model to reflect the influence of collaborative branding. Then, the categorization theory and Stackelberg game have been adopted since 2008 and 2017, respectively. As we can see, methodologies used for collaborative branding and promotion are multiple, which means scholars should carefully select the suitable one based on their research purpose.
3. **CPFR:** Modeling research on CPFR has been flourished over last two decades. To begin with, the collaborative forecasting was investigated through the newsvendor model in 1999. In 2001, Viva constructed a stylized model to study the collaborative forecasting through theoretical analyses and simulation-based methods, and further improved the model by combining the collaborative forecasting and collaborative replenishment together in 2002. Then, in 2005, the research of collaborative planning came into people's sight, in which the authors conducted analysis by using the mixed integer-programming approach. After that, since 2007, the research of CPFR have developed synchronously. Various kinds of modeling techniques for collaborative planning have also been adopted over the recent few years, including fuzzy goal programming, joint economic lot sizing model, stochastic programming, genetic algorithm, etc. Meanwhile, for collaborative forecasting and replenishment, the approaches like lot size model, nonlinear and linear programming, game theoretic mode have been utilized in the analytical C-Commerce research over a five-year period. However, the findings indicate that the development of operational models in CPFR seems to have reached a plateau, in which no more innovative models and methods emerge in recent years. Therefore, alternative methods and techniques, e.g., data analytics, and machine learning, may be applied to conduct CPFR research, especially with the use of real data.

5.3. Research gaps with references to real-world practices

Based on above review findings, we discuss seven important future research directions that can fill the gaps between the current state of research and real-world needs in business operations. The discussion results are summarized in Table 4.

Table 4
Summary of research gaps.

Research gaps	Research question examples	Real-world practices
Horizontal collaboration in a supply chain	- What is the optimal collaboration mode for the two competing retailers/manufacturers?	- Collaboration between the retailers *Tesco* and *Next.* - Collaboration for vaccine development between medical firms *Pfizer* and *BioNTech.*
Collaborative innovation with competition	- What are the influences of competition in a duopoly setting for collaborative innovation?	- *Ford* collaborate with *Changan* and *Volkswagen* simultaneously. - *Uniqlo* and *Nike* collaborate with numerous partners at the same time.
Consumer choice in C-Commerce	- How would the consumer choices be affected by lead time?	/
Consumer (or social) welfare in C-Commerce	- What are the decisive factors influencing the consumer/social welfare in C-Commerce?	- *Macao International Environmental Co-operation Forum & Exhibition* is hosted every year, providing opportunities for firms to reach environmental co-operation.
Technology related issues	- What is the value of blockchain adoption in C-Commerce? - What is the optimal collaboration mechanism for information technology service?	- *Walmart*, *Ford*, *Unilever* implement blockchain through collaborations with their partners.
Multi-methodological research	- Are the major findings consistent with the real-world cases?	/

1. **Horizontal collaboration in a supply chain:** Channel structure can systematically influence the entire supply chain system, which can be shown as integration at vertical and horizontal levels (Sim et al., 2019). Observing from our review findings, it is obvious that vertical collaboration (i.e., collaboration between sellers and buyers) has already been well explored in C-Commerce, while horizontal collaboration (i.e., collaboration between two manufacturers or retailers) is still under-explored. While in real practices, due to the threat of e-tailers, the traditional retailers have been seeking cooperation in both promotion and operations sides to survive. For example, in 2017, the largest retail company in Britain *Tesco* announced to cooperate with the British fashion retailer *Next*, to follow an in-depth horizontal collaboration. Besides, in recent years, the COVID-19 pandemic urges the collaboration in vaccine supply chains (Lin et al., 2022). The horizontal collaboration between medical firms *Pfizer* and *BioNTech* is a good example for vaccine development, which is worthy of further investigating. Thus, we believe that the research question such as "what is the optimal collaboration mode for the two competing retailers/manufacturers?" can be theoretically studied in the future. Note that horizontal cooperation also relates to co-opetition. In C-Commerce, how production economics theories on co-opetition may apply deserves deep explorations.
2. **Collaborative innovation with competition:** Competition is an essential issue in operations analyses (Wen et al., 2019a; Zhou et al., 2021). Here, competition includes price competition, quality competition, service competition, etc. Nevertheless, we notice that the game theoretic studies with horizontal competition are not yet well-explored in C-Commerce research. This is especially true in "collaborative innovation" domain, as there is currently no prior study investigating the influence of competition in a duopoly setting. However, when paying attention to real industry practices, we can easily recognize the existence of competition in collaborative innovation. In automobile industry, *Ford* has collaborated with *Changan* and *Volkswagen* simultaneously and competed with each other since 2018; in fashion industry, it is common practices for the firms (e.g., *Uniqlo*, *Nike*) to collaborate with numerous partners at the same time. Future research could hence be conducted to examine "what are the influences of competition in a duopoly setting for collaborative innovation" to fill this gap. This proposal is consistent with the one we derived from the first point, which is related to co-opetition.
3. **Consumer choice in C-Commerce:** As we mentioned in Section 5.1, consumer choice is also a critically important topic, which can be further examined in "collaborative branding and promotion" and "CPFR". Since the consumer preference can directly affect the market demand, it may influence the firms' collaboration decisions significantly. For example, in "collaborative branding and promotion", the heterogeneous consumer valuation can be considered. In "CPFR", it is interesting to investigate "how would the consumer choices be affected by lead time?". Thus, more consumer behaviors (e.g., not only strategic behaviors, but also green preference, regret behaviors, etc.) and consumer choice-based modeling analyses (e.g., utility-based model, Hotelling model, representative consumer model) could be considered in the future.
4. **Consumer (or social) welfare in C-Commerce:** Consumer (or social) welfare has drawn increasing attention in SCM (e.g., Choi et al., 2019; Shen et al., 2022). In reality, governments have taken various measures to promote corporate social responsibility and sustainable development for C-Commerce. For example, the government of Macao hosts *Macao International Environmental Co-operation Forum & Exhibition* every year, aiming at providing opportunities for firms in supply chains to reach environmental co-operation[12]. In analytical models, consumer (or social) welfare can be quantified by various factors like price, quality and some societal influence measures (Wang et al., 2015). Nevertheless, we notice that the majority of current C-Commerce studies only focus on the benefits of the firms, ignoring the consumers' interests and societal impacts. Thus, in future research, there is a need for scholars to incorporate consumer welfare and social welfare into the optimization models as well as to answer the research question such as "what are the decisive factors influencing the consumer/social welfare in C-Commerce?" so as to derive more novel insights in C-Commerce.
5. **Cross-discipline research in C-Commerce:** In reality, operations and other functional areas can co-exist in harmony within a firm. For instance, it is a good practice for firms to form an alliance in both production and promotion side. Specifically, co-branding strategy (marketing issue) always exists along with collaborative innovation (operational issue) in the real world; while in the current literature, the issues tend to be "isolated" and investigated separately. Consequently, more cross-discipline research (e.g., operations& marketing, operations& financing, operations& information science) should be considered in the future. For example, the problem on "how should the company allocate its budget between co-branding and collaborative innovation?" can be a topic worth exploring. This will generate many interesting and novel insights.
6. **Technology related issues:** C-Commerce has great opportunities to achieve breakthrough under the era of Industry 4.0. It is believed that the well-developed technologies can offer alternative forms of C-Commerce engagement (Yearworth and White 2018). For example, the blockchain implementation can not only offer trustworthy information during collaboration but also provide smart ways to collaborate (Choi et al., 2020). In real-word cases, a multitude of companies have implemented blockchain technology through collaborations with their partners, e.g., *Walmart*, *Ford*, *Unilever*, etc., while the details haven't been theoretically studied in the production economics literature yet. Hence, "what is the value of blockchain adoption in C-Commerce?" can be a good research question for exploration. Besides, the collaboration of "information technology service" develops rapidly in recent years (Awasthy and Hazra 2020), which motivates us to examine "what is the optimal collaboration mechanism for information technology service?".
7. **Multi-methodological research:** Multi-methodological approach is becoming increasingly popular in recent years (Choi et al., 2016). This approach aims to enhance research rigor and is especially useful to address complex operations issues. C-Commerce, as a topic relevant to the real industry practices, investigating the interactions and decisions in various entities, is definitely an intricate issue for the researchers. More importantly, the proposed findings for collaborative companies derived from the analytical models are based on specific assumptions that may not be realistic as compared to real world practices. Thus, it is necessary to test the analytically proven policies by conducting empirical studies using real data. While we notice that in C-Commerce research, multi-methodological approach is still unconsidered. So, in the future, combining the analytical modelling approach with quantitative empirical method or case study will yield more scientifically sound and comprehensive insights; meanwhile, it can help answer the research question like "are the major findings consistent with the real-world cases?".

6. Conclusion

SCM has entered the sharing economy and Industry 4.0 era (Yuan and Shen 2019; De Sousa Jabbour et al., 2018). Driven by the proliferation of information and communication technologies as well as the fierce competition in the market, collaborative commerce (C-Commerce) is crucial for firms' development. However, the current literature does not show any hints of a consolidated view on the topic, especially on the details of research models. This paper hence bridges this gap in

[12] Detailed information is available at: http://www.macaomiecf.com/2020/temp.html.

the literature by conducting a systematic review of analytical modeling studies in C-Commerce and related operations. Based on a comprehensive review of the related literature, we have established a novel classification framework for C-Commerce studies. Then, following this classification framework, we have examined the associated issues and major operational models. We have specifically included the relevant works which highlight (i) collaborative innovation in product development, (ii) collaborative branding and promotion, and (iii) collaborative planning, forecasting and replenishment. We have revealed the key modeling elements in prior studies. We have also discussed the evolution of the C-Commerce literature. All these would help show the current state-of-the-arts literature on C-Commerce and provide guidance on 2W1H (i.e., what it is, what to do, and how to do) for this topic. Most importantly, we identify seven future research directions for C-Commerce that can fill the research gaps between the current research and real-world needs in business operations. They include horizontal collaboration, collaborative innovation with competition, consumer choice in C-Commerce, consumer (or social) welfare in C-Commerce, cross-discipline research in C-Commerce, technology related issues, and multi-methodological research.

In conclusion, analytical research on C-Commerce has certainly developed and flourished over the last two decades. Various issues and methodologies are raised to solve the operational problems in C-Commerce area. Despite that, there are still lots of rooms for further development and exploration. I hope this review paper will lay the foundation to stimulate more future research on C-Commerce.

We admit that this research has limitations. First, we only focus on reviewing the analytical modeling studies in C-Commerce as we aim to identify the unique modeling features, while this may narrow the research scope. In the future, empirical and case studies can be also included for a systematic review, which may provide a more comprehensive research framework and enrich the research findings. Second, we classify the literature based on a subjective method. It may be a good idea if an alternative method (e.g., using the software "CitNetExplorer" or "VOS viewer") can be used to testify our classification. Finally, conducting a case study to supplement the findings with real-world practices can also be a feasible future research direction.[13]

Data availability

Data will be made available on request.

Appendix

Table A1
Examples in the research domain dimension of C-Commerce.

Research Domains	Details
Collaborative innovation	Collaborative innovation in new product development: A business strategy focusing on interactive relationships and customer experience in new product development.
Collaborative promotion	Multiple firms working closely together to market a product or service, such as co-branding.
Collaborative operations	CPFR: A strategic alliance in which both buyer and supplier share information (e.g., sales data, demand forecasts) to integrate their plans, forecasts, and delivery schedules to establish a responsive and efficient supply chain.

Table A2
Major issues in collaborative innovation.

	Consumer choice	Pricing decision	Resource/Information sharing	Coordination	Information disclosure
Collaboration between manufacturers and retailers					
Bayus (1995)		√			
Adner and Levinthal (2001), Chenavaz (2012), Chen et al. (2013), Pan and Li (2015)	√	√			
Gilbert and Cvsa (2003), Mandal et al. (2021)		√		√	
Bhaskaran and Krishnan (2009), Yan et al. (2018), Shalpegin (2020)			√	√	
Jha et al. (2017)		√	√		
Hara and Matsubayashi (2017)	√	√		√	
Shalpegin et al. (2017)			√		√
Yenipazarli (2017)		√		√	
Agrawal and Oraiopoulos (2020)			√		
Collaboration between a retailer and consumers					
Dewan et al. (2003), Arakji and Lang (2007)		√			
Takagoshi and Matsubayashi (2013)	√	√			√
Aron et al. (2006), Syam and Kumar (2006)	√	√			
Mendelson and Parlaktürk (2008)	√				√
Levina et al. (2015)	√		√		
Liu et al. (2020)					√

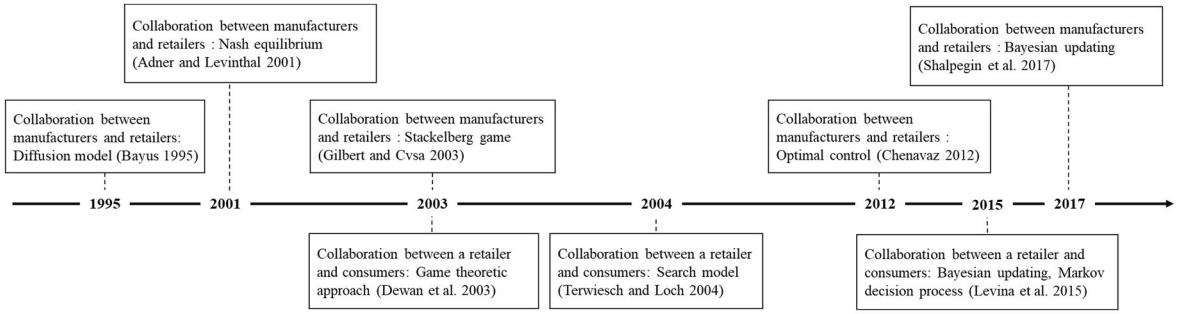
[13] The details can be found in BusinessDictionary website. Available at: http://www.businessdictionary.com/.

Table A3
Major issues in collaborative branding and promotion.

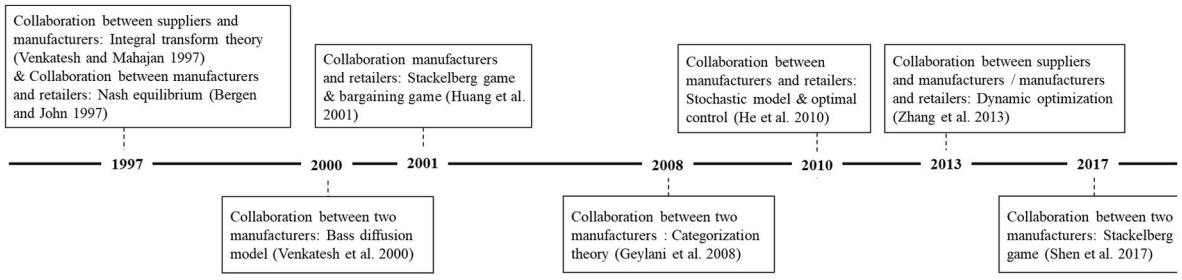
	Consumer choice	Pricing decision	Spillover effect	Bargain power	Competition
Collaboration between manufacturers and retailers					
Bergen and John (1997)	√		√		√
Huang and Li (2001), Huang et al. (2002), Li et al. (2002)				√	
Karray and Zaccour (2006)		√			√
Yue et al. (2006), Xie and Wei (2009), SeyedEsfahani et al. (2011), Aust and Buscher (2012), Lu et al. (2018)		√		√	
Szmerekovsky and Zhang (2009), He et al. (2010), Hong et al. (2015), Kennedy et al. (2021)		√			
He et al. (2011), Ma et al. (2021)					√
Collaboration between suppliers and manufacturers					
Venkatesh and Mahajan (1997)	√	√			
Erevelles et al. (2008)		√			√
Zhang et al. (2013)	√				
Collaboration between two manufacturers					
Venkatesh et al. (2000)	√				
Geylani et al. (2008), Shen et al. (2017)			√		
Cai and Raju (2016)					√
Yu et al. (2021)		√			√
Zhang et al. (2022)		√			

Table A4
Major issues in CPFR.

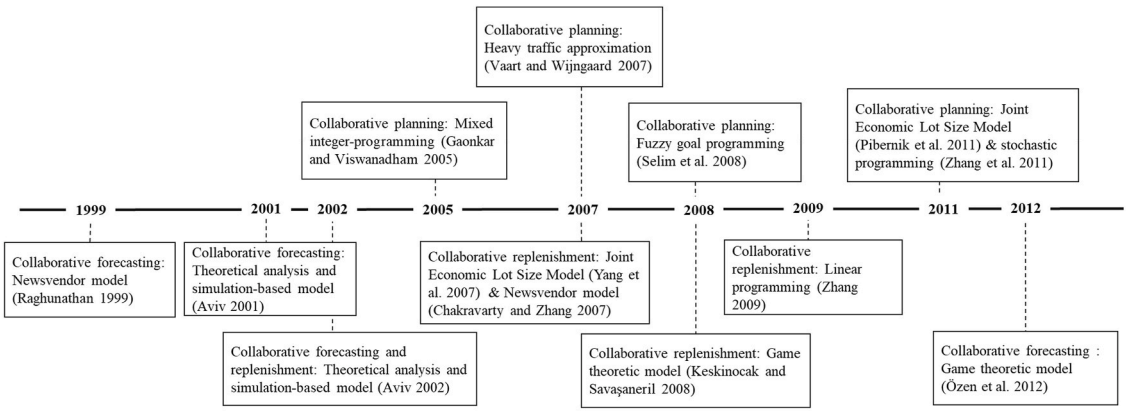
	Coordination	Negotiation	Information sharing	Uncertainty	Cost sharing/discount
Collaborative Planning					
Gaonkar and Viswanadham (2005)	√		√	√	
Vaart and Wijngaard (2007)					
Dudek and Stadtler (2007), Yahia et al. (2015)	√	√	√		
Selim et al. (2008)		√			
Pibernik et al. (2011)		√	√		
Zhang et al. (2011)				√	
Collaborative Forecasting					
Raghunathan (1999), Aviv (2002), Kurtulus et al. (2013)	√		√	√	
Aviv (2001), Özen et al. (2012)	√		√		
Aviv (2007), Jiang et al. (2018)			√	√	
Galbreth et al. (2015)	√	√	√	√	
Shamir and Shin (2018), Karimi and Zaerpour (2022)	√		√	√	
Collaborative Replenishment					
Aviv (2002)	√		√	√	
Fu and Piplani (2004)			√	√	
Yang et al. (2007)		√			√
Chakravarty and Zhang (2007)	√			√	
Keskinocak and Savas;aneril (2008), Zhang (2009)					√
Lyu et al. (2010)	√		√		
Hezarkhani et al. (2018)	√				√



(a) Collaborative innovation.



(b) Collaborative branding and promotion.



(c) CPFR.

Fig. A1. Evolution of C-Commerce models.

Table A5
Major features of the operational models in collaborative innovation.

Reference	Modeling technique	Model setting		Market structure		Objective		Decisions
		Single-product	Multi-product	Monopoly	Duopoly	Maximize profit	Others	
Collaboration between manufacturers and retailers								
Bayus (1995)	Diffusion model	√		√		√		Price, innovation investments
Adner and Levinthal (2001)	Nash equilibrium		√	√		√	Maximize consumer utility	Price, innovative activity
Gilbert and Cvsa (2003)	Stackelberg game	√		√		√		Order quantity, price, fraction cost reduction
Bhaskaran and Krishnan (2009)	Nash equilibrium			√		√		Investment level, cost/revenue sharing terms
Chenavaz (2012)	Optimal control	√		√		√		Price, innovation level
Chen et al. (2013)	Game theoretic approach	√		√		√	Maximize consumer utility	Price, production quantity, grade specification
Pan and Li (2015)	Optimal control	√		√		√		Price, innovation investments
Jha et al. (2017)	Stackelberg game	√		√		√		Price, innovation level
Hara and Matsubayashi (2017)	Stackelberg game, Nash equilibrium	√	√	√		√	Maximize consumer utility	Price
Shalpegin et al. (2017)	Bayesian updating	√		√		√		Design, target cost
Yenipazarli (2017)	Stackelberg game	√		√		√		Price, innovation level
Yan et al. (2018)	Stackelberg game	√		√			Maximize mean-variance utility function	Fixed payment fee, innovation investment, fraction of revenue
Agrawal and Oraiopoulos (2020)	Game theoretic approach	√		√			Maximize firm's the total surplus	Innovation efforts
Shalpegin (2020)	Game theoretic approach	√		√	√	√		Whether to test and release the component
Mandal et al. (2021)	Game theoretic approach	√		√		√		Price, quality improvement effort levels
Collaboration between a retailer and consumers								
Dewan et al. (2003)	Game theoretic approach		√	√	√	√	Maximize consumer surplus	Price, customization scope
Terwiesch and Loch (2004)	Search model		√	√		√	Maximize consumer utility	Price, number of prototypes
Aron et al. (2006)	Game theoretic approach	√		√			Maximize consumer surplus	Price, customization level, interval width
Syam and Kumar (2006)	Game theoretic approach		√		√	√	Maximize consumer utility	Price, customization level
Arakji and Lang. (2007)	Game theoretic approach	√		√		√	Minimize the costs	Compensation rate, content openness level
Mendelson and Parlaktürk (2008)	Game theoretic approach		√	√	√	√	Maximize consumer utility	Price, order quantity,
Chen and Tseng (2010)	General decision model	√			√	√	Maximize consumer utility	Price, product specification
Takagoshi and Matsubayashi (2013)	Game theoretic approach		√		√	√	Maximize consumer utility	Price, range of customizations
Levina et al. (2015)	Bayesian updating, Markov decision process	√		√			Maximize egalitarian total utility	Bidding strategy
Liu et al. (2020)	Game theoretic approach	√		√		√		R&D effort levels

Table A6
Major features of the operational models in collaborative promotion.

Reference	Modeling technique	Model setting		Market structure		Supply chain structure		Objective		Decisions
		Single-product	Multi-product	Monopoly	Duopoly	Centralized	Decentralized	Maximize profit	Others	
Collaboration between manufacturers and retailers										
Bergen and John (1997)	Nash equilibrium	√			√	√	√	√	Maximize consumer utility	Price, advertising level, participation rate, franchise fee
Huang and Li (2001)	Stackelberg game, Nash equilibrium, bargaining game	√		√			√	√		Advertising cost, fraction level, reimbursement rate
Huang et al. (2002)	Stackelberg game, bargaining game	√		√		√	√	√		Advertising cost, fraction level, reimbursement rate
Li et al. (2002)	Stackelberg game, bargaining game	√		√			√	√		Advertising cost, fraction level, order quantity
Karray and Zaccour (2006)	Stackelberg game		√	√			√	√		Price, advertising cost, participation rate
Yue et al. (2006)	Stackelberg game, bargaining game	√		√			√	√		Advertising cost, advertising allowance
Szmerekovsky and Zhang (2009)	Stackelberg game	√		√			√	√		Price, advertising cost, reimbursement rate
Xie and Wei (2009)	Stackelberg game, bargaining game	√		√		√	√	√		Price, advertising cost, participation rate
He et al. (2010)	Stochastic Stackelberg differential game, optimal control	√		√			√		Maximize Hamilton equation	Price, participation rate, advertising effort
He et al. (2011)	Stochastic Stackelberg differential game, Nash equilibrium, optimal control	√			√		√		Maximize Hamilton equation	subsidy rate, advertising effort
SeyedEsfahani et al. (2011)	Stackelberg game, Nash equilibrium, bargaining game	√		√			√	√		Price, advertising cost, participation rate
Aust and Buscher (2012)	Stackelberg game, Nash equilibrium, bargaining game	√		√			√	√		Price, advertising cost, participation rate
Zhang et al. (2013)	Stackelberg game, Nash equilibrium, dynamic optimization	√	√		√		√		Maximize Hamilton equation	Subsidy rate, advertising effort

(*continued on next page*)

Table A6 (*continued*)

Reference	Modeling technique	Model setting		Market structure		Supply chain structure		Objective		Decisions
		Single-product	Multi-product	Monopoly	Duopoly	Centralized	Decentralized	Maximize profit	Others	
Hong et al. (2015)	Stackelberg game,	√		√		√	√	√		Price, advertising cost, collection rate
Lu et al. (2018)	Stackelberg game, optimal control, bargaining game	√		√		√	√	√	Maximize Hamilton equation	Price, order quantity, advertising level, participation rate
Ma et al. (2021)	Stackelberg game	√		√		√			Maximize value function	Advertising efforts, subsidy rate
Kennedy et al. (2021)	Stackelberg game, the Sethi advertising model	√				√	√		Maximize advertising coverage	Price, advertising efforts, subsidy rate
Collaboration between suppliers and manufacturers										
Venkatesh and Mahajan (1997)	Integral transform theory	√		√				√		Price, partner selection
Erevelles et al. (2008)	Stackelberg game	√			√		√	√		Price, penalty
Zhang et al. (2013)	Stackelberg game, Nash equilibrium, dynamic optimization	√	√		√		√		Maximize Hamilton equation	Subsidy rate, advertising effort
Collaboration between two manufacturers										
Venkatesh et al. (2000)	Bass diffusion model		√		√			√		Partner selection
Geylani et al. (2008)	Categorization theory, updating mechanism		√		√				Minimize posterior variances	Partner selection
Cai and Raju (2016)	Game theoretic model	√			√			√		Investment into market
Shen et al. (2017)	Stackelberg game	√			√	√	√	√		Brand loyalty level
Yu et al. (2021)	Game theoretic model	√	√	√	√			√		Price, advertising levels
Zhang et al. (2022)	Stackelberg game	√		√					Maximize mean-risk utilities	Price, quality investment, quality investment support proportion

Table A7
Major features of the operational models in collaborative operations (CPFR).

Reference	Modeling technique	Model setting		Market structure		Objective		Supply chain structure		Analysis approach	
		Single-product	Multi-product	Monopoly	Duopoly	Maximize profit	Others	Centralized	Decentralized	Close form analysis	Computational based analysis
Collaborative planning											
Gaonkar and Viswanadham (2005)	Mixed integer-programming	√			√	√		√			√
Vaart and Wijngaard (2007)	Heavy traffic approximation		√	√			Maximize utilization rate				√
Dudek and Stadtler (2007)	Mathematical programming		√	√			Minimize cost	√			√
Selim et al. (2008)	Fuzzy goal programming		√	√			Maximize weighted sum of achievement levels of fuzzy goals, maximize overall satisfactory level	√	√		√
Pibernik et al. (2011)	Joint Economic Lot Size Model	√		√			Minimize the size of circuit		√	√	√
Zhang et al. (2011)	Scatter evolutionary algorithm, fuzzy programming, stochastic programming		√		√	√	Maximize service level	√			√
Yahia et al. (2015)	Genetic algorithm, fuzzy goal approach	√			√		Minimize storage capacity, Minimize cost	√	√		√
Collaborative forecasting											
Raghunathan (1999)	Newsvendor model	√			√		Minimize cost		√	√	
Aviv (2001)	Theoretical analysis, simulation model	√		√			Minimize cost		√	√	√
Aviv (2002)	Theoretical analysis, simulation model	√		√			Minimize cost		√	√	√
Aviv (2007)	Theoretical analysis, simulation model	√		√			Minimize cost		√	√	√
Özen et al. (2012)	Game theoretic model	√			√	√		√	√	√	
Kurtulus et al. (2013)	Nash equilibrium	√		√		√			√	√	
Galbreth et al. (2015)	Game theoretic model	√		√		√		√	√	√	
Shamir and Shin (2018)	Newsvendor model	√		√		√		√	√	√	
Jiang et al. (2018)	Game theoretic model	√		√		√			√	√	
Collaborative replenishment											
Aviv (2002)	Theoretical analysis, simulation model	√		√			Minimize cost		√	√	√
Fu and Piplani (2004)	Simulation model	√		√			Improve stabilizing effect and service level		√		√
Aviv (2007)	Theoretical analysis, simulation model	√		√			Minimize cost		√	√	√
Yang et al. (2007)	Joint Economic Lot Size Mod l, nonlinear programming	√		√		√					√

(*continued on next page*)

Table A7 (*continued*)

Reference	Modeling technique	Model setting		Market structure		Objective		Supply chain structure		Analysis approach	
		Single-product	Multi-product	Monopoly	Duopoly	Maximize profit	Others	Centralized	Decentralized	Close form analysis	Computational based analysis
Chakravarty and Zhang (2007)	Newsvendor model, Bayesian Nash equilibrium		√		√	√			√	√	
Keskinocak and Savas;aneril (2008)	Game theoretic model	√			√	√			√	√	
Zhang (2009)	Linear programming, Lagrangian duality	√			√		Minimize cost			√	
Lyu et al. (2010)	Inventory control policy		√		√		Minimize cost	√	√		√
Hezarkhani et al. (2018)	Nash equilibrium		√		√		Minimize cost	√	√	√	

References

Adler, N., Brudner, A., Proost, S., 2021. A review of transport market modeling using game-theoretic principles. Eur. J. Oper. Res. 291 (3), 808–829.

Adner, R., Levinthal, D., 2001. Demand heterogeneity and technology evolution: implications for product and process innovation. Manag. Sci. 47 (5), 611–628.

Agrawal, V., Oraiopoulos, N., 2020. The role of decision rights in codevelopment initiatives. Manuf. Serv. Oper. Manag. 22 (4), 832–849.

Appio, F.P., Martini, A., Massa, S., Testa, S., 2016. Collaborative network of firms: antecedents and state-of-the-art properties. Int. J. Prod. Res. 55 (7), 2121–2134.

Arakji, R.Y., Lang, K.R., 2007. Digital consumer networks and producer-consumer collaboration: innovation and product development in the video game industry. J. Manag. Inf. Syst. 24 (2), 195–219.

Aron, R., Sundararajan, A., Viswanathan, S., 2006. Intelligent agents in electronic markets for information goods: customization, preference revelation and pricing. Decis. Support Syst. 41 (4), 764–786.

Aust, G., Buscher, U., 2012. Vertical cooperative advertising and pricing decisions in a manufacturer-retailer supply chain: a game-theoretic approach. Eur. J. Oper. Res. 223, 473–482.

Aviv, Y., 2001. The effect of collaborative forecasting on supply chain performance. Manag. Sci. 47 (10), 1326–1343.

Aviv, Y., 2002. Gaining benefits from joint forecasting and replenishment processes: the case of auto-correlated demand. Manuf. Serv. Oper. Manag. 4, 55–74.

Aviv, Y., 2007. On the benefits of collaborative forecasting partnerships between retailers and manufacturers. Manag. Sci. 53, 777–794.

Awasthy, P., Hazra, J., 2020. Collaboration under outcome-based contracts for information technology services. Eur. J. Oper. Res. 286 (1), 350–359.

Bayus, B.L., 1995. Optimal dynamic policies for product and process innovation. J. Oper. Manag. 12 (3–4), 173–185.

Bengtsson, A., Servais, P., 2005. Co-branding on industrial markets. Ind. Market. Manag. 34 (7), 706–713.

Bergen, M., John, G., 1997. Understanding cooperative advertising participation rates in conventional channels. J. Market. Res. 34 (3), 357–369.

Bhaskaran, S.R., Krishnan, V., 2009. Effort, revenue, and cost sharing mechanisms for collaborative new product development. Manag. Sci. 55 (7), 1152–1169.

Blackett, T., Russell, N., 2000. Co-branding — the science of alliance. J. Brand Manag. 7 (3), 161–170.

Cai, C.J., Raju, J.S., 2016. Keeping your enemies closer: when market entry as an alliance with your competitor makes sense. Market. Sci. 35 (5), 743–755.

Caldentey, R., Liu, Y., Lobel, I., 2017. Intertemporal pricing under minimax regret. Oper. Res. 65 (1), 104–129.

Cao, M., Zhang, Q., 2011. Supply chain collaboration: impact on collaborative advantage and firm performance. J. Oper. Manag. 29 (3), 163–180.

Chakravarty, A.K., Zhang, J., 2007. Collaboration in contingent capacities with information asymmetry. Nav. Res. Logist. 54 (4), 421–432.

Chen, L., Zhao, X., Tang, O., Price, L., Zhang, S., Zhu, W., 2017. Supply chain collaboration for sustainability: a literature review and future research agenda. Int. J. Prod. Econ. 194, 73–87.

Chen, S., Tseng, M.M., 2010. A negotiation-credit-auction mechanism for procuring customized products. Int. J. Prod. Econ. 127 (1), 203–210.

Chen, Y.J., Tomlin, B., Wang, Y., 2013. Coproduct technologies: product line design and process innovation. Manag. Sci. 59 (12), 2772–2789.

Chenavaz, R., 2012. Dynamic pricing, product and process innovation. Eur. J. Oper. Res. 222 (3), 553–557.

Chiu, C.H., Choi, T.M., Dai, X., Shen, B., Zheng, J.H., 2018. Optimal advertising budget allocation in luxury fashion markets with social influences: a mean-variance analysis. Prod. Oper. Manag. 27 (8), 1611–1629.

Choi, T.M., 2019. Blockchain-technology-supported platforms for diamond authentication and certification in luxury supply chains. Transport. Res. E Logist. Transport. Rev. 128, 17–29.

Choi, T.M., 2020. Financing product development projects in the blockchain era: initial coin offerings versus traditional bank loans. IEEE Trans. Eng. Manag. 69 (6), 3184–3196.

Choi, T.M., Cheng, T.C.E., Zhao, X., 2016. Multi-methodological research in operations management. Prod. Oper. Manag. 25 (3), 379–389.

Choi, T.M., Guo, S., Liu, N., Shi, X., 2019. Values of food leftover sharing platforms in the sharing economy. Int. J. Prod. Econ. 213, 23–31.

Choi, T.M., Guo, S., Liu, N., Shi, X., 2020. Optimal pricing in on-demand-service-platform-operations with hired agents and risk-sensitive customers in the blockchain era. Eur. J. Oper. Res. 284 (3), 1031–1042.

Choi, T.M., Zhang, J., Cheng, T.C.E., 2018. Quick response in supply chains with stochastically risk sensitive retailers. Decis. Sci. J. 49 (5), 932–957.

Chong, A.Y.L., Chan, F.T.S., Goh, M., Tiwari, M.K., 2013. Do interorganisational relationships and knowledge-management practices enhance collaborative commerce adoption? Int. J. Prod. Res. 51 (7), 2006–2018.

Chong, Y.L., Ooi, K.B., Lin, B., The, P.L., 2010. TQM, knowledge management and collaborative commerce adoption: a literature review and research framework. Total Qual. Manag. Bus. Excel. 21 (5), 457–473.

Choudhary, D., Shankar, R., Dey, P.K., Chaudhary, H., Thakur, L.S., 2014. Benefits of retailer–supplier partnership initiatives under time-varying demand: a comparative analytical study. Int. J. Prod. Res. 52 (14), 4279–4298.

De Sousa Jabbour, A.B.L., Jabbour, C.J.C., Godinho Filho, M., Roubaud, D., 2018. Industry 4.0 and the circular economy: a proposed research agenda and original roadmap for sustainable operations. Ann. Oper. Res. 270 (1–2), 273–286.

Dewan, R., Jing, B., Seidmann, A., 2003. Product customization and price competition on the internet. Manag. Sci. 49 (8), 1055–1070.

Dudek, G., Stadtler, H., 2007. Negotiation-based collaborative planning in divergent two-tier supply chains. Int. J. Prod. Res. 45 (2), 465–484.
Eirinakis, P., Mourtos, I., Zampou, E., 2022. Random serial dictatorship for horizontal collaboration in logistics. Omega 111, 102662.
Erevelles, S., Stevenson, T.H., Srinivasan, & S., Fukawa, N., 2008. An analysis of B2B ingredient co-branding relationships. Ind. Market. Manag. 37 (8), 940–952.
Fu, Y., Piplani, R., 2004. Supply-side collaboration and its value in supply chains. Eur. J. Oper. Res. 152 (1), 281–288.
Galbreth, M.R., Kurtulu, M., Shor, M., 2015. How collaborative forecasting can reduce forecast accuracy. Oper. Res. Lett. 43 (4), 349–353.
Gaonkar, R.S., Viswanadham, N., 2005. Strategic sourcing and collaborative planning in internet-enabled supply chain networks producing multigeneration products. IEEE Trans. Autom. Sci. Eng. 2 (1), 54–66.
Geylani, T., Inman, J.J., Hofstede, F.T., 2008. Image reinforcement or impairment: the effects of co-branding on attribute uncertainty. Market. Sci. 27 (4), 730–744.
Gilbert, S.M., Cvsa, V., 2003. Strategic commitment to price to stimulate downstream innovation in a supply chain. Eur. J. Oper. Res. 150 (3), 617–639.
Hara, R., Matsubayashi, N., 2017. Premium store brand: product development collaboration between retailers and national brand manufacturers. Int. J. Prod. Econ. 185, 128–138.
He, X., Krishnamoorthy, A., Prasad, A., Sethi, S.P., 2011. Retail competition and cooperative advertising. Oper. Res. Lett. 39 (1), 11–16.
He, X., Prasad, A., Sethi, S.P., 2010. Cooperative advertising and pricing in a dynamic stochastic supply chain: feedback stackelberg strategies. Prod. Oper. Manag. 18 (1), 78–94.
Hezarkhani, B., Slikker, M., Van Woensel, T., 2018. Collaborative replenishment in the presence of intermediaries. Eur. J. Oper. Res. 266 (1), 135–146.
Hong, X., Xu, L., Du, P., Wang, W., 2015. Joint advertising, pricing and collection decisions in a closed-loop supply chain. Int. J. Prod. Econ. 167, 12–22.
Hu, X., Caldentey, R., Vulcano, G., 2013. Revenue sharing in airline alliances. Manag. Sci. 59 (5), 1177–1195.
Huang, Z., Li, S.X., 2001. Co-op advertising models in manufacturer–retailer supply chains: a game theory approach. Eur. J. Oper. Res. 135 (3), 527–544.
Huang, Z., Li, S, X., Mahajan, V., 2002. An analysis of manufacturer-retailer supply chain coordination in cooperative advertising. Decis. Sci. J. 33 (3), 469–494.
Jayaram, J., Oke, A., Prajogo, D., 2014. The antecedents and consequences of product and process innovation strategy implementation in Australian manufacturing firms. Int. J. Prod. Res. 52 (15), 4424–4439.
Jha, A., Fernandes, K., Xiong, Y., Nie, J., Agarwal, N., Tiwari, M.K., 2017. Effects of demand forecast and resource sharing on collaborative new product development in supply chain. Int. J. Prod. Econ. 193, 207–221.
Jiang, B., Tian, L., Xu, Y., Zhang, F., 2018. To share or not to share: demand forecast sharing in a distribution channel. Market. Sci. 35 (5), 800–809.
Kavadias, S., Ulrich, K.T., 2020. Innovation and new product development: reflections and insights from the research published in the first 20 years of manufacturing & service operations management. Manuf. Serv. Oper. Manag. 22 (1), 84–92.
Karray, S., Zaccour, G., 2006. Could co-op advertising be a manufacturer's counterstrategy to store brands? J. Bus. Res. 59 (9), 1008–1015.
Karimi, M., Zaerpour, N., 2022. Put your money where your forecast is: supply chain collaborative forecasting with cost-function-based prediction markets. Eur. J. Oper. Res. 300 (3), 1035–1049.
Kennedy, A.P., Sethi, S.P., Siu, C.C., Yam, S.C.P., 2021. Cooperative advertising in a dynamic three-echelon supply chain. Prod. Oper. Manag. 30 (11), 3881–3905.
Keskinocak, P., Savasaneril, S., 2008. Collaborative procurement among competing buyers. Nav. Res. Logist. 55 (6), 516–540.
Kurtulus, M., Ulku, S., Toktay, B., 2013. The value of collaborative forecasting in supply chains. Manuf. Serv. Oper. Manag. 14 (1), 82–98.
Lee, C.C., Nagpal, P., Lim, H.S., Dutil, L., Lee, R., Kim, Y., 2021. A variation of the delone and mclean model for collaborative commerce services: a structural equation model. Journal of International Technology and Information Management 29 (3), 81–101.
Levina, T., Levin, Y., Mcgill, J., Nediak, M., 2015. Strategic consumer cooperation in a name-your-own-price channel. Prod. Oper. Manag. 24 (12), 1883–1900.
Li, E.Y., Du, T.C., Wong, J.W., 2007. Access control in collaborative commerce. Decis. Support Syst. 43 (2), 675–685.
Li, S., Huang, Z., Zhu, J., Chau, P., 2002. Cooperative advertising, game theory and manufacturer-retailer supply chains. Omega 30 (5), 347–357.
Li, Y., Jiang, S., Shi, J., Wei, Y., 2021. Pricing strategies for blockchain payment service under customer heterogeneity. Int. J. Prod. Econ. 242, 108282.
Li, T., Sethi, S.P., He, X., 2015. Dynamic pricing, production, and channel coordination with stochastic learning. Prod. Oper. Manag. 24 (6), 857–882.
Li, W.D., Qiu, Z.M., 2006. State-of-the-art technologies and methodologies for collaborative product development systems. Int. J. Prod. Res. 44 (13), 2525–2559.
Lin, Q., Zhao, Q., Lev, B., 2022. Influenza vaccine supply chain coordination under uncertain supply and demand. Eur. J. Oper. Res. 297 (3), 930–948.
Liu, W., Xu, K., Chai, R., Fang, X., 2020. Leveraging online customer reviews in new product development: a differential game approach. Ann. Oper. Res. 1–24.
Lu, F., Tang, W., Liu, G., Zhang, J., 2018. Cooperative advertising: a way escaping from the prisoner's dilemma in a supply chain with sticky price. Omega 86, 87–106.
Lyu, J.J., Ding, J.H., Chen, P.S., 2010. Coordinating replenishment mechanisms in supply chain: from the collaborative supplier and store-level retailer perspective. Int. J. Prod. Econ. 123 (1), 221–234.
Ma, S., He, Y., Gu, R., 2021. Dynamic generic and brand advertising decisions under supply disruption. Int. J. Prod. Res. 59 (1), 188–212.
Ma, H.L., Wong, C.W.H., Leung, L.C., Chung, S.H., 2019. Facility sharing in business-to-business model: a real case study for container terminal operators in Hong Kong port. Int. J. Prod. Econ. 27 (8), 1611–1629.
Mandal, P., Jain, T., Chakraborty, A., 2021. Quality collaboration contracts under product pricing strategies. Ann. Oper. Res. 302 (1), 231–264.
Mendelson, H., Parlaktürk, A.K., 2008. Product-line competition: customization vs. proliferation. Manag. Sci. 54 (12), 2039–2053.
Min, H., 2015. The Essentials of Supply Chain Management: New Business Concepts and Applications. FT Press.
Minner, S., Silver, E.A., 2007. Replenishment policies for multiple products with compound-Poisson demand that share a common warehouse. Int. J. Prod. Econ. 108 (1–2), 388–398.
Minner, S., 2016. Dynamic pricing under economic ordering and strategic customers with forward buying and postponement. Dynamic Perspectives on Managerial Decision Making 22, 301–311.
Özen, U., Sošić, G., Slikker, M., 2012. A collaborative decentralized distribution system with demand forecast updates. Eur. J. Oper. Res. 216 (3), 573–583.
Pan, X., Li, S., 2015. Dynamic optimal control of process-product innovation with learning by doing. Eur. J. Oper. Res. 248 (1), 136–145.
Pibernik, R., Zhang, Y., Kerschbaum, F., Schröpfer, A., 2011. Secure collaborative supply chain planning and inverse optimization – the JELS model. Eur. J. Oper. Res. 208 (1), 75–85.
Raghunathan, S., 1999. Interorganizational collaborative forecasting and replenishment systems and supply chain implications. Decis. Sci. J. 30 (4), 1053–1071.
Ramanathan, U., Gunasekaran, A., 2014. Supply chain collaboration: impact of success in long-term partnerships. Int. J. Prod. Econ. 147, 252–259.
Rao, A.R., Qu, L., Ruekert, R.W., 1999. Signaling unobservable product quality through a brand ally. J. Market. Res. 36 (2), 258–268.
Saha, S., 2007. Consumer preferences and product and process R&D. Rand J. Econ. 38 (1), 250–268.
Sebenius, J.K., Knebel, E., 2007. Lou pritchett: negotiating the P&G relationship with wal-mart. Harv. Bus. Rev. available at: https://store.hbr.org/product/lou-pritchett-negotiating-the-p-g-relationship-with-wal-mart/907011.
Selim, H., Araz, C., Ozkarahan, I., 2008. Collaborative production–distribution planning in supply chain: a fuzzy goal programming approach. Transport. Res. E Logist. Transport. Rev. 44 (3), 396–419.
Sethi, S.P., Yan, H., Zhang, H., 2006. Inventory and supply chain management with forecast updates. In: Series *International Series In Operations Research & Management Science*. Springer, New York, NY.
SeyedEsfahani, M.M., Biazaran, M., Gharakhani, M., 2011. A game theoretic approach to coordinate pricing and vertical co-op advertising in manufacturer–retailer supply chains. Eur. J. Oper. Res. 211 (2), 263–273.
Shalpegin, T., 2020. Collaborative product development: managing supplier incentives for key component testing. Eur. J. Oper. Res. 285 (2), 553–565.
Shalpegin, T., Sommer, S., Wan, Z., 2017. Collaborative prototyping of alternative designs under a target costing scheme. Prod. Oper. Manag. 27 (3), 496–515.
Shamir, N., Shin, H., 2018. The perils of sharing information in a trade association under a strategic wholesale price. Prod. Oper. Manag. 27 (11), 1978–1995.
Shen, B., Choi, T.M., Chow, P.S., 2017. Brand loyalties in designer luxury and fast fashion co-branding alliances. J. Bus. Res. 81, 173–180.
Shen, B., Dong, C., Minner, S., 2022. Combating copycats in the supply chain with permissioned blockchain technology. Prod. Oper. Manag. 31 (1), 138–154.
Shen, B., Xu, X., Chan, H.L., Choi, T.M., 2021. Collaborative innovation in supply chain systems: value creation and leadership structure. Int. J. Prod. Econ. 235, 108068.
Shi, X., Shen, H., Wu, T., Cheng, T.C.E., 2014. Production planning and pricing policy in a make-to-stock system with uncertain demand subject to machine breakdowns. Eur. J. Oper. Res. 238 (1), 122–129.
Sim, J., Ouardighi, F.E., Kim, B., 2019. Economic and environmental impacts of vertical and horizontal competition and integration. Nav. Res. Logist. 66 (2), 133–153.
Syam, N.B., Kumar, N., 2006. On customized goods, standard goods, and competition. Market. Sci. 25 (5), 525–537.
Szmerekovsky, J.G., Zhang, J., 2009. Pricing and two-tier advertising with one manufacturer and one retailer. Eur. J. Oper. Res. 192 (3), 904–917.
Takagoshi, N., Matsubayashi, N., 2013. Customization competition between branded firms: continuous extension of product line from core product. Eur. J. Oper. Res. 225 (2), 337–352.
Tang, C.S., 2010. A review of marketing–operations interface models: from co-existence to coordination and collaboration. Int. J. Prod. Econ. 125 (1), 22–40.
Terwiesch, C., Loch, C.H., 2004. Collaborative prototyping and the pricing of custom-designed products. Manag. Sci. 50 (2), 145–158.
Thomke, S., 2002. Customers as innovators: a new way to create value. Harv. Bus. Rev. 80 (4), 74–81.
Tippong, D., Petrovic, S., Akbari, V., 2022. A review of applications of operational research in healthcare coordination in disaster management. Eur. J. Oper. Res. 301 (1), 1–17.
Vaart, T.V.D., Wijngaard, J., 2007. The contribution of focus in collaborative planning for make-to-order production situation with large set-up times. Int. J. Prod. Econ. 108 (1–2), 436–443.
Venkatesh, R., Mahajan, V., 1997. Products with branded components: an approach for premium pricing and partner selection. Market. Sci. 16 (2), 146–165.
Venkatesh, R., Mahajan, V., Muller, E., 2000. Dynamic co-marketing alliances: when and why do they succeed or fail? Int. J. Res. Market. 17 (1), 3–31.
CPFR Guidelines. *Voluntary Inter-industry Commerce Standards*, 1998. VICS, Lawrenceville, NJ available at: www.cpfr.org.
Wang, Y., Wallace, S.W., Shen, B., Choi, T.M., 2015. Service supply chain management: a review of operational models. Eur. J. Oper. Res. 247 (3), 685–698.
Ward, L., 1999. Collaborative Commerce at Cisco: a Case Study and Interview. Collaborative Strategies Inc available at: http://www.collaborate.com/publications/casestudy6.html. (Accessed 12 December 1999).

Weitzel, T., Glock, C.H., 2017. Energy management for stationary electric energy storage systems: a systematic literature review. Eur. J. Oper. Res. 264 (2), 582–606.
Wei, Y., Choi, T.M., 2010. Mean-variance analysis of supply chains under wholesale pricing and profit sharing scheme. Eur. J. Oper. Res. 204 (2010), 255–262.
Wen, X., Choi, T.M., Chung, S.H., 2019a. Fashion retail supply chain management: a review of operational models. Int. J. Prod. Econ. 207, 34–55.
Wen, X., Xu, X., Choi, T.M., Chung, S.H., 2019b. Optimal pricing decisions of competing air-cargo-carrier systems — impacts of risk aversion, demand, and cost uncertainties. IEEE Transactions on Systems, Man, and Cybernetics: Systems 50 (12), 4933–4947.
Xie, J., Wei, J.C., 2009. Coordinating advertising and pricing in a manufacturer–retailer channel. Eur. J. Oper. Res. 197 (2), 785–791.
Yahia, W.B., Ayadi, O., Masmoudi, F., 2015. A fuzzy-based negotiation approach for collaborative planning in manufacturing supply chains. J. Intell. Manuf. 28 (8), 1987–2006.
Yan, T., Ribbink, D., Pun, H., 2018. Incentivizing supplier participation in buyer innovation: experimental evidence of non-optimal contractual behaviors. J. Oper. Manag. 57, 36–53.
Yang, R., Tang, W., Dou, M., Zhang, J., 2021. Pricing and investing in co-creation with customers for a duopoly. Int. J. Prod. Econ. 237, 108145.
Yang, P.C., Wee, H.M., Yu, J.C.P., 2007. Collaborative pricing and replenishment policy for hi-tech industry. J. Oper. Res. Soc. 58 (7), 894–900.
Yearworth, M., White, L., 2018. Spontaneous emergence of Community OR: self-initiating, self-organising problem structuring mediated by social media. Eur. J. Oper. Res. 268 (3), 809–824.
Yenipazarli, A., 2017. To collaborate or not to collaborate: prompting upstream eco-efficient innovation in a supply chain. Eur. J. Oper. Res. 260 (2), 571–587.
Yu, L., He, X., Zhang, J., Xu, C., 2021a. Horizontal cooperative advertising with advertising threshold effects. Omega 98, 102104.
Yu, X., Lan, Y., Zhao, R., 2021b. Strategic green technology innovation in a two-stage alliance: vertical collaboration or co-development? Omega 98, 102116.
Yuan, Q., Shen, B., 2019. Renting fashion with strategic customers in the sharing economy. Int. J. Prod. Econ. 218, 185–195.
Yue, J., Austin, J., Wang, M.C., Huang, Z., 2006. Coordination of cooperative advertising in a two-level supply chain when manufacturer offers discount. Eur. J. Oper. Res. 168 (1), 65–85.
Zhang, G., Shang, J., Li, W., 2011. Collaborative production planning of supply chain under price and demand uncertainty. Eur. J. Oper. Res. 215 (3), 590–603.
Zhang, J., 2009. Cost allocation for joint replenishment models. Oper. Res. 57 (1), 146–156.
Zhang, Q., Chen, J., Lin, J., 2022. Market targeting with social influences and risk aversion in a co-branding alliance. Eur. J. Oper. Res. 297 (1), 301–318.
Zhang, J., Gou, Q., Liang, L., He, X., 2013. Ingredient branding strategies in an assembly supply chain: models and analysis. Int. J. Prod. Res. 51 (23–24), 6923–6949.
Zhou, Q., Meng, C., Yuen, K.F., Sheu, J.B., 2021. Remanufacturing authorization strategy for an original equipment manufacturer-contract manufacturer supply chain: cooperation or competition? Int. J. Prod. Econ. 240, 108238.