International Journal of Production Research

ISSN: 0020-7543 (Print) 1366-588X (Online) Journal homepage: https://www.tandfonline.com/loi/tprs20

Game theory applications in production research in the sharing and circular economy era

Tsan-Ming Choi, Ata Allah Taleizadeh & Xiaohang Yue

To cite this article: Tsan-Ming Choi, Ata Allah Taleizadeh & Xiaohang Yue (2020) Game theory applications in production research in the sharing and circular economy era, International Journal of Production Research, 58:1, 118-127, DOI: 10.1080/00207543.2019.1681137

To link to this article: https://doi.org/10.1080/00207543.2019.1681137

International Journal of Production Research, 2020
Vol. 58, No. 1, 118–127, https://doi.org/10.1080/00207543.2019.1681137

Game theory applications in production research in the sharing and circular economy era

Tsan-Ming Choi[a]*, Ata Allah Taleizadeh[b] and Xiaohang Yue[c]

[a]*Business Division, Institute of Textiles and Clothing, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong;* [b]*School of Industrial and Systems Engineering, College of Engineering, University of Tehran, Tehran, Iran;* [c]*Sheldon B. Lubar School of Business, University of Wisconsin Milwaukee, Milwaukee, WI, USA*

In recent years, topics such as sharing economy and circular supply chains have emerged in production research and operations management. To explore them and tackle the associated challenges, we need to acquire a full understanding of decision-makers' strategic behaviours as well as the deployment of sophisticated analytical methods such as game theory. In this article, we concisely examine the meanings of sharing economy and circular supply chains in production research. We then introduce the featured papers of the special issue and highlight the major insights developed. Future research directions are discussed.

Keywords: circular economy; sharing economy; game theory; production research; operations management

1. Research in the sharing and circular economy era

In recent years, with the advance of technologies and the growing awareness of environmental sustainability, topics such as circular economy and sharing economy operations have emerged in production research and operations management.

A circular economy (Govindan and Hasanagic 2018; Howard, Hopkinson, and Miemczyk 2018) commonly refers to an economy or economic system which aims to be environmentally sustainable (Li et al. 2019a, 2019b; Cai and Choi 2019; Guo, Choi, and Shen 2020) with the minimisation of wastage and maximisation of activities such as reuse, recycle and remanufacturing (3R). The circular economy has been used in district planning (Liu et al. 2012). In the circular economy, a few things are critical. First, technologies, which span from information technologies, material sciences, to product design technologies, are all important. Product design technologies and material sciences help to lengthen the life of products and enhance the reusability of products. Information technologies help to improve operational efficiency and hence reduce wastes and improve the 3R. Second, how to design the supply chain system to be circular and achieve optimality in both forward and reverse supply chain operations is crucial. Third, government's support and rules would help to entice companies to work for the good sake of the environment. In order to better establish the supply chain to be efficient in the circular economy, some major changes are needed. See Bressanelli, Perona, and Saccani (2018) for the review and discussions on how supply chain systems can be redesigned in order to be circular.

Figure 1 shows the publication trend over the past five years for the number of publications on circular economy every year. From the trend, we can clearly see that the topic is getting more and more popular. Compared to having only 180 publications in 2015, there are 889 publications in 2019, which means the number of publications grows to be almost 5 times over the past 5 years.[1]

A sharing economy (Choi et al. 2019a) relates to many concepts such as collaborative commerce, the sharing of resources (including channel sharing), and better and more sustainable operations (Choi, Cai, and Shen 2019). Thus, the sharing economy concept has some overlaps with the circular economy concept. The sharing economy is usually related to the use of platform (Cachon, Daniels, and Lobel 2017; Kung and Zhong 2017; Du et al. 2019) and network. In many cases, we have the peer-to-peer operations (Choi and He 2019) in which individuals rent (Yuan and Shen 2019), exchange or share their properties with one another. Uber, a car rental service, is probably one of the most well-known examples in practice for the sharing economy concept (Bellos, Ferguson, and Toktay 2017). The other examples include Airbnb, the example about home space sharing. Note that the sharing economy can relate to operations in both business-related companies or non-profit-making organisations. Similar to the case with the circular economy, Figure 2 shows the publication trend for the publications on the sharing economy. The pattern is also increasing but the trend tends to go to a steady state.

*Corresponding author. Email: jason.choi@polyu.edu.hk

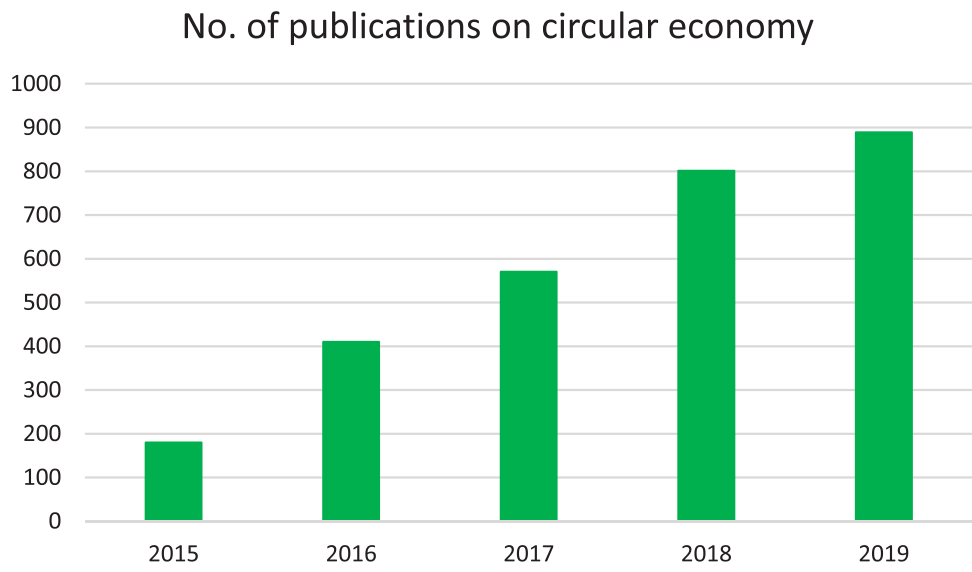

Figure 1. The no. of publications on 'circular economy'. Note: Searching using 'title word' in Google Scholar on 5 October 2019.

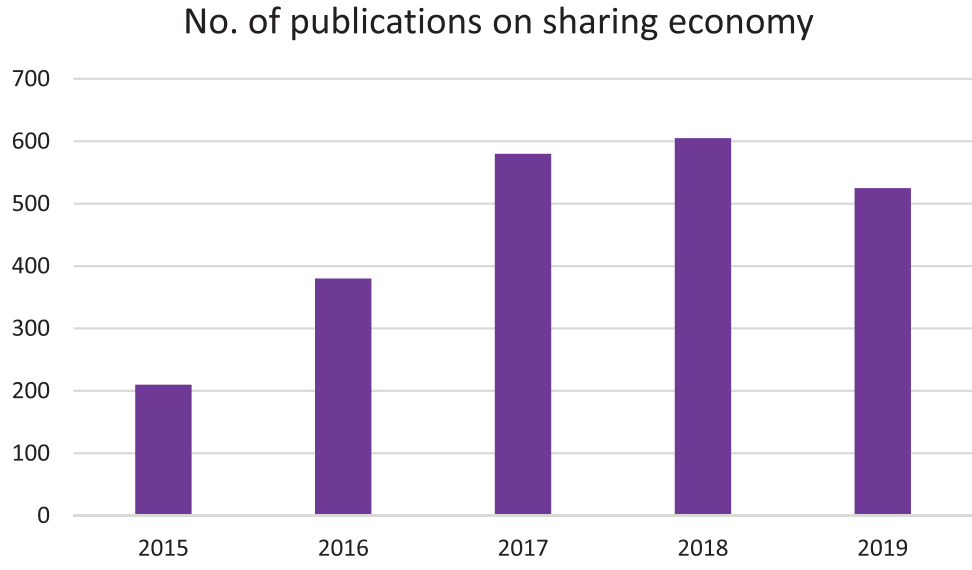

Figure 2. The no. of publications on 'sharing economy'. Note: This searching is not a sophisticated one while it does reflect the trend and popularity of the topic.

In both the circular economy and the sharing economy, many operational challenges are present. To tackle these problems, we need an understanding of human's decision-making behaviours as well as the use of sophisticated analytical methods to address them. Game theory is an applied mathematical discipline which studies situations involving cooperation and competition among several parties. Nowadays, with the advance of technologies, game theory has been used in many operations management studies with the support of computers and advanced analytical models. We will introduce some applications of game theory for studies on production research in Section 2.

2. Applications of game theory

It is commonly believed that game theory is an efficient and applicable method to model the mathematical behaviours of agents (e.g. firms, teams, or individuals) under different competition and collaborative circumstances. Both cooperative and non-cooperative scenarios capture good meanings and can reveal important insights. As a result, there is no doubt that game theory can help a lot in production research. Figure 3 shows the number of publications related to game theory in IJPR over the past five years.

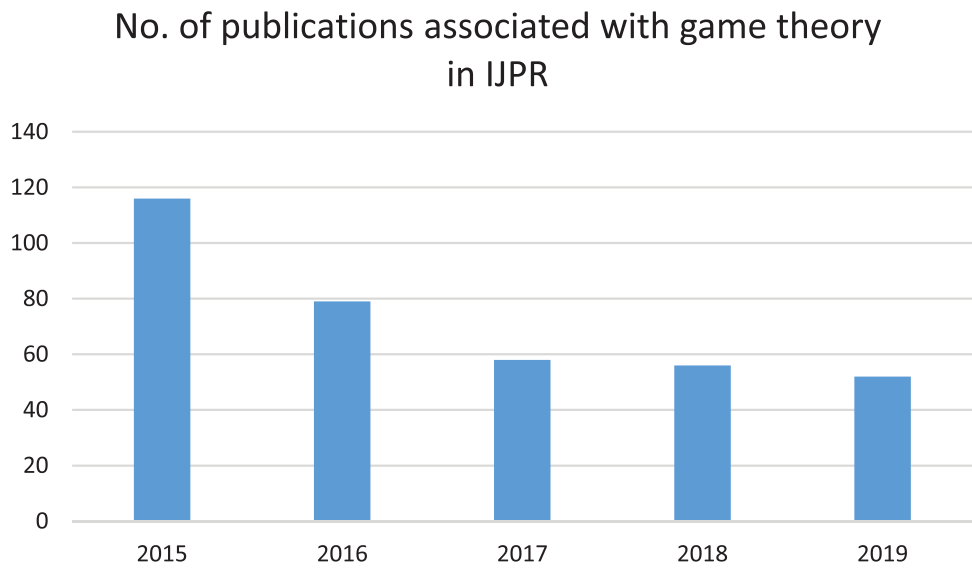

Figure 3. The no. of publications associated with 'game theory' in IJPR. Note: Searching using 'anywhere' for papers published in IJPR in Google Scholar on 5 October 2019.

To be specific, relevant applications of game theory include a vast area of industrial applications such as resources utilisation, social issues such as sharing economy and sustainable operations, economic games played by firms under cooperation and competition situations, social games of fair distribution of resources in competitive situations, psychological games played on personal level, supply chain games happened among various industries, etc.

In the production research literature, game theory has been widely adopted. We review some related works as follows. Adida and DeMiguel (2011) conduct a game-theoretical study on competitive multi-manufacturers and multi-retailers supply chains. In exploring the optimal consumer return policy under a competitive setting, Chen and Chen (2016) apply game theory to explore the Nash equilibrium. Choi (2016) study the supply chain coordination challenge with a single manufacturer and many risk averse (Chiu and Choi 2016; Chiu et al. 2018; Chiu, Chan, and Choi 2019; Choi et al. 2019b) retailers using the Stackelberg gaming scenario. Esmaeili, Allameh, and Tajvidi (2016) apply the game theory to study optimal pricing decisions in closed-loop supply chain systems. Wu, Li, and Shi (2017) explore the deployment of a two-part tariff contract for supply chain operations under information asymmetry. The authors apply game theory and explore the equilibrium. Shen, Choi, and Minner (2019) conduct a review for the supply chain contracts with the use of information. Most of the reviewed models employ game theory in the analyses. Chen, Chung, and Guo (2018) examine the use of franchising contracts in the fashion industry. They review the literature with game-theoretic studies as well as real-world case studies. Recently, Shen, Xu, and Choi (2019) apply the Stackelberg game theory to study the two-product supply chain coordination challenge. They aim at deriving the simplest coordination contracts. Nagurney, Salarpour, and Daniele (2019) study the humanitarian logistics system with the use of game theory. Hua, Lai, and Tang (2019) investigate via game theory the reverse-channel system. The authors focus on uncovering the respective advertising problem. For the older studies on using game theory for supply chain anlayses and coordination studies, refer to the review conducted by Chan and Chan (2010).

Motivated by the importance of game theory for production research studies and the current emerging trends of circular economy and sharing economy, this *International Journal of Production Research* (IJPR) special issue is organised. It aims to generate novel ideas and establish the foundations for further studies in the application of game theory for production research and operations in the sharing and circular economy era. After the open call for submissions was issued, we had received manuscripts covering a large variety of different topics, which include (but not limited to) the following:

- Collaborative commerce and sharing economy in production research.
- Platform operations in different industries.
- Sustainable operations and circular economy.
- Circular supply chain systems.
- Logistics and transportation planning with sharing.
- Network design, location and allocation problems in the sharing economy.
- Strategic, tactical and operational decision-making policies for circular production systems.
- Industrial and manufacturing systems in the circular economy.

- Operations under carbon emission rules and policies.
- Government policies on sustainability and circular economy.
- Revenue management, pricing and marketing in the sharing economy.
- Inventory control systems in the sharing economy.
- Maintenance planning and scheduling in the sharing economy.
- Production planning and control in the sharing economy.
- Uncertain and disruption situations in the sharing and circular economy era.
- Quality control and reliability in the sharing and circular economy era.
- Gray market in the sharing and circular economy era.
- Risk related operations in the sharing and circular economy era.
- Industry 4.0 in the sharing and circular economy era.

It is encouraging that we have received a lot of high-quality submissions. After a rigorous review process under the supervision and final editorial decisions of IJPR chief editor, we have accepted 10 good research papers to feature in this special issue. They are classified into two main areas, namely studies in the circular economy and sustainability, and research in the sharing economy. In the following, we introduce the papers in this IJPR Special Issue based on the aforementioned classification.

3. Circular economy and environmental sustainability

In the scope of circular economy and environmentally sustainable operations, Ji et al. (2019) explore the circular supply chain system with the paper entitled 'The Production Decisions and Cap Setting with Wholesale Price and Revenue Sharing Contracts under Cap-and-Trade Regulation'. The authors formulate an analytical model using the Stackelberg game theory. They study the optimal production decision and the optimal government carbon cap setting. In the supply chain, the agents trade with one another by using either (i) the revenue sharing contract or (ii) the pure wholesale pricing contract, and the cap-and-trade regulation is present. They study and compare analytically the amount of carbon emissions and the resulting social welfare under the two supply chain contracts. The authors uncover that if the government over-allocates 'carbon credits' to the supply chain, it will hurt the manufacturer's profitability. They further show that the optimal carbon cap under the two examined supply chain contracts is non-increasing in the 'environmental-concern parameter'. Counterintuitively, the authors find that using the 'green technology' may lead to a higher amount of 'total carbon emission'. Comparing between the pure wholesale pricing contract and the revenue sharing contract, the authors reveal that whether the social welfare under the revenue sharing contract is higher compared to the wholesale pricing contract depends on the value of the environmental-concern parameter. This highlights the fact that the environmental-concern parameter is a critical factor which determines whether a more sophisticated supply chain contract (i.e. the revenue sharing contract) outperforms the pure wholesale pricing contract for the society.

Shen, Cao, and Xu (2019) examine the circular supply chain system with the paper entitled 'Product Line Design and Quality Differentiation for Green and Non-Green Products in a Supply Chain'. The authors observe that in the circular economy era, the market includes both the green product and non-green product. They would like to determine the optimal product line design for both the green and non-green products, with a special focus on the differentiated product quality level. The authors analytically build a consumer choice model with decisions on pricing and quality. They explore the supply chain using the game theory. They find that irrespective of whether the product quality difference is high or low, the consumers' willingness to pay (WTP) for responsibility is critical because when the WTP for responsibility is sufficiently low, the 'single product line strategy' outperforms the 'two-product line strategy'. The opposite occurs if the WTP for responsibility is sufficiently high. The authors also uncover that lifting the quality level of the product quality is good in terms of increasing consumer surplus and reducing the negative environment influence. They interestingly show that if the product quality levels between the green and non-green products are sufficiently different, developing and selling the green product achieves all win, i.e. benefiting the consumer, the environment, and the social welfare. They finally develop a simplified supply chain contract to enhance the performance of the retailer as well as social welfare.

Li et al. (2019a) investigate the circular supply chain using game theory with the paper entitled the 'Green Product Design with Competition and Fairness Concerns in the Circular Economy Era'. Similar to Shen, Xu, and Choi (2019), the authors also explore the 'optimal green product design' decision. However, the supply chain structure is different. To be specific, Li et al. (2019a) explore a single manufacturer two-retailers supply chain system. The authors differentiate the two retailers by assuming one of them possesses the profit maximisation objective whereas the other retailer has a fairness concern in its objective. The authors consider two kinds of green products. The first one is called the 'marginal-intensive green product (MIGP)' and the second one is called the 'development-intensive green product (DIGP)'. For DIGP, the

authors model the respective green investment cost to be green level and production quantity dependent. For MIGP, the green investment cost only relates to the green level. By game theory, the impact brought by fairness concern of a retailer under competition is highlighted. One main finding is that, the retailer's fairness concern is always harmful to the manufacturer.

Cao, Xu, and Wang (2019) explore the circular operations with the paper entitled 'Optimal Trade-in and Warranty Period Strategies for New and Remanufactured Products under Carbon Tax Policy'. The authors consider the presence of the trade-in service in which old products can be used to trade-in for new products. The authors also consider the optimal warranty period decision in the presence of carbon footprint tax and 'trade-in subsidies'. They analytically build two models, namely

Table 1. Features and core findings of this SI's 'circular economy' papers.

Scope	Papers	Model features	Core insights and findings
Circular supply chain management	Ji et al. (2019)	(1) Supply chain contracts (2) Stackelberg game (3) Carbon emission	(1) If the government over-allocates 'carbon credits' to the supply chain, it will hurt the manufacturer's profit. (2) The optimal carbon cap is non-increasing in the 'environmental-concern parameter' (under the pure wholesale pricing contract, and the revenue sharing contract). (3) Using the 'green technology' may lead to a higher amount of 'total carbon emission'. (4) Comparing between the pure wholesale pricing contract and the revenue sharing contract, whether the social welfare under the revenue sharing contract is higher compared to the wholesale pricing contract depends on the value of the environmental-concern parameter. (5) The environmental-concern parameter is a critical factor which determines whether a more sophisticated supply chain contract (i.e. the revenue sharing contract) outperforms the pure wholesale pricing contract for the society.
Circular supply chain management	Shen, Cao, and Xu (2019)	(1) Green product development (2) Quality differentiation (3) Consumer choice model with WTP considerations (4) Supply chain contract	(1) Irrespective of whether the product quality difference is high or low, the consumers' willingness to pay (WTP) for responsibility is critical. (2) If the WTP for responsibility is sufficiently low, the 'single product line strategy' outperforms the 'two-product line strategy'. The opposite occurs if the WTP for responsibility is sufficiently high. (3) Lifting the product quality level helps increase consumer surplus and reduce the negative environment influence. (4) When the product quality levels between the green and non-green products are sufficiently different, developing and selling the green product achieves all win.
Circular supply chain management	Li et al. (2019a)	(1) Green product development (2) Two competing retailers (3) Fairness concerns of one retailer	(1) By game theory, the impact brought by fairness concern of a retailer under competition is always harmful to the manufacturer. (2) There are substantial differences between MIGP and DIGP.

(*Continued*).

Table 1. Continued.

Scope	Papers	Model features	Core insights and findings
Circular operations	Cao, Xu, and Wang (2019)	(1) Trade-in (2) Warranty period (3) Carbon emission	(1) The optimal trade-in model selection decision does not affect the optimal warranty period decision. (2) The optimal trade-in service choice decision for the seller needs not be beneficial to consumers. (3) The presence of trade-in subsidies may do more harm than good and need not help to reduce the total amount of 'carbon emissions' in some cases.
Circular operations	Qin et al. (2019)	(1) Capital constraint (2) Carbon emission	(1) The use of a mixed financing strategy surprisingly would increase the carbon reduction for the capital-constrained manufacturer, but not for the capital-unconstrained manufacturer.

the 'trade-in services are offered for all products' (TIA) model, and the 'trade-in service is only available to remanufactured products' (TIR) model. They show the conditions under which TIA or TIR is the optimal choice. In their model, the optimal trade-in model decision does not affect the optimal warranty period decision. They highlight the fact that the optimal trade-in service choice decision for the seller need not be beneficial to consumers. They further uncover that trade-in subsidies may do more harm than good and need not help to reduce the total amount of 'carbon emissions'.

Finally, the last paper belongs to the section of circular economy is by Qin et al. (2019) who study carbon emissions in a capital-constrained manufacturer in supply chains and the paper's title is 'The Value of Advance Payment Financing to Carbon Emission Reduction and Production in a Supply Chain with Game Theory Analysis'. The authors consider the presence of two kinds of manufacturers, namely the 'capital constrained (CC) manufacturer' and the 'capital unconstrained (CU) manufacturer'. They conduct game-theoretical analysis to uncover the properties and optimal decisions for each case. One critical finding is that, the use of a mixed financing strategy surprisingly would increase the carbon reduction for the capital-constrained manufacturer, but not for the CU manufacturer.

Table 1 provides a summary of the key features of the papers under the category of circular economy and environmental sustainability. From Table 1, we can easily find that these new findings provide many important managerial insights and implications to production and operations management.

4. Sharing economy

For the papers in the category of sharing economy, the first group of papers are devoted to the ones in channel sharing operations. To be specific, multi-channel operations, such as the omni-channel strategy, are getting more and more popular in the sharing economy as different channels share their strengths and help to overcome the weaknesses of one another to satisfy the market needs. Tao, Gou, and Zhang (2019) examine the multi-channel sharing operations with the paper entitled 'A Local Seller's App Channel Strategy Concerning Delivery'. The authors consider the scenario where a firm develops an 'app channel' and has two delivery strategies, namely 'delivery by itself' (DBI) or 'delivery by the third party' (DBT). Using the Hotelling model, the authors derive the optimal decisions in two cases. The first case captures the scenario where the firm is a 'price taker' whereas the second case refers to the scenario where the firm is a 'price setter'. The authors find that the firm's optimal channel strategy relies on the delivery choice. For instance, if DBI is adopted, the firm will give up the offline channel. The price taker firm and the price setter firm will in general adopt different optimal channel strategies. They conclude by saying that the JIT ('just-in-time') delivery is crucial for the app-offline multi-channel operations.

Wang et al. (2019) explore optimal advertising with different strategies in the sharing economy. Their paper's title is 'Optimal Avertising in Dual-Channel Supply Chains'. The authors note that in the 'sharing economy era', firms are interested to share resources for the purpose of advertising. They hence build game-theoretical models to examine several advertising models. In their model, the supply chain adopts the dual-channel operations model with one single manufacturer and 'two competing retailers'. The first model is called the 'brand advertising' (BA) model in which the manufacturer is responsible for the advertising by itself. The second model is called the 'emerging joint advertising' (EJA) model in which the advertising is a joint action by the online retailer and the manufacturer and they share the respective cost. The third model is called the 'brand advertising cost-sharing' (BACS) model in which the manufacturer promotes the product by itself while the retailer sponsors and shares partially the respective expense. The authors uncover that whether joint

advertising is an optimal strategy heavily relates to and relies on the 'consumer initial preference towards the channels', and the 'cost-efficiency of advertising'. They also prove that the popular EJA model may bring benefits to the manufacturer and the online retailer, but hurt the profit of the offline retailer. They also show that the BACS model may help to bring benefits to all agents in the supply chain.

He, Xu, and Wu (2019) study omni-channel operations in their paper entitled 'Omnichannel Retail Operations with Refurbished Consumer Returns'. In their model, the authors consider the situation where online consumers can return products to physical stores offline for a 'full refund'. Motivated by the 'store return' business operations, the authors investigate a newsvendor product based supply chain under the omni-channel system. The authors consider the situation where the returned products will be resold after being refurbished. The authors conduct a game-theoretic analysis and derive the optimal inventory and pricing decisions. They study the effects brought by the 'store return option' and uncover that (i) the new product's price is not affected but the refurbished product's price will decrease if an analytical condition is met; (ii) for the inventory, the online channel will order more but the offline channel will order less; (iii) the 'store return' model can lead to all-win with consumers enjoying higher service levels and retailer achieving a higher profit.

Gupta and Ivanov (2019) study the dual sourcing strategy in the sharing economy in their paper entitled 'Dual Sourcing under Supply Disruption with Risk-averse Suppliers in the Sharing Economy'. The authors witness that many big retail

Table 2. Features and core findings of this SI's 'sharing economy' papers.

Scope	Papers	Model features	Core insights and findings
Channel sharing	Tao, Gou, and Zhang (2019)	(1) Delivery option (2) Price taker (3) Price setter (4) App channel and offline channel	(1) The firm's optimal channel strategy relies on the delivery choice. For instance, if DBI is adopted, the firm will give up the offline channel. (2) The price taker firm and the price setter firm will adopt different optimal channel strategies. (3) The JIT delivery strategy is crucial for the app-offline multi-channel operations.
Channel and cost sharing	Wang et al. (2019)	(1) Joint advertisement (2) Cost sharing	(1) Whether joint advertising is an optimal strategy heavily relates to and relies on the 'consumer initial preference towards the channels', and the 'cost-efficiency of advertising'. (2) The EJA model may bring benefits to the manufacturer and the online retailer, but hurt the profit of the offline retailer. (3) The BACS model may help to bring benefits to all agents in the supply chain.
Channel sharing and integration	He, Xu, and Wu (2019)	(1) Omni-channel operations (2) Store return	(1) If the 'store return option' is provided, then: (i) The online channel will order more but the offline channel will order less; (ii) the 'store return' model will lead to all win with consumers enjoying higher service levels and retailer achieving a higher profit.
Channel sharing with different products	Gupta and Ivanov (2019)	(1) Dual sourcing (2) Supply disruption (3) Store brand products	(1) The suppliers' risk aversion in the market environment with supply disruptions is influential and critical.
Market sharing	Cao and Zhang (2019)	(1) Gray market (2) Product quality (3) Product quality differentiation	(1) When there is no gray market, product quality will be reduced if the 'consumer valuation' is higher. (2) In a 'unilateral gray market', in which products from HYM and LVM are separated can entice the manufacturer to enhance product quality. (3) When product quality 'can be differentiated across markets', the manufacturer has an incentive to increase 'product quality differentiation' as a strategy to cope with the 'gray market' challenge.

enterprises develop their own 'store brands' while also sell related products under the other national brands. This is a common operations model in many supply chains and this implies that different products share the channel's establishment to offer products to the market, which may affect consumers and the supply chain's profitability in the 'sharing economy era'. The authors apply game theory to study the topic. They study the impacts brought by the suppliers' risk aversion in the market environment with supply disruptions. They report findings based on 'numerical analysis' for the influence brought by supply disruption.

Cao and Zhang (2019) investigate quality of the gray market product in their paper entitled 'Gray Market's Product Quality in the Circular Economy Era'. The authors build game-theoretic models to explore the situation where the manufacturer sells a product in 'two markets' simultaneously. The market is called the 'high-value market' (HVM) and the 'low-value market' (LVM) respectively. Each market has an official 'authorized' reseller. The authors analytically uncover that when there is no gray market, product quality will be reduced if the 'consumer valuation' is higher. They further show that in a 'unilateral gray market', in which products from HYM and LVM are separated can entice the manufacturer to enhance product quality. They explore the situation where two gray markets may appear at the same time. Finally, the authors reveal an insight that when product quality 'can be differentiated across markets', the manufacturer has an incentive to increase 'product quality differentiation' as a strategy to cope with the 'gray market' challenge.

Table 2 provides a summary of the key features of the papers under the category of sharing economy with the use of game theory. From Table 2, it is crystal clear that channel sharing and the respective supply chain agreements (e.g. cost sharing) are very important for production research. Hopefully, more interesting related research will be conducted in the future.

5. Conclusion

In this paper, we have concisely examined production research and business operations in the sharing and circular economy era. There is no doubt that game theory is a powerful tool for researchers to explore many interesting and challenging topics under this big theme. We believe that the featured papers of this special issue will lay the solid foundations to stimulate more further studies in the area. In particular, for future research, we propose the following.

Multi-methodological analyses: We believe that it will be promising to apply the multi-methodological approach (Choi, Cheng, and Zhao 2016; Cai, Wang, and Zhang 2018; Chiu, Chan, and Choi 2019) to conduct rigorous analyses on the related issues. For instance, real-world case studies, with primary data collection, can be conducted to motivate the analytical studies. After having the theoretical results derived from the analytical modelling analyses, further checking and verifications are conducted with respect to the real-world cases.

Technologies driven studies: Many technologies have emerged as critical in the sharing economy as well as the circular supply chain operations. For example, blockchain (Choi 2019; Choi, Cai, and Shen 2019; Dolgui et al. 2019) and big data analytics (Choi 2018; Choi, Wallace, and Wang 2018) are both crucial to support platform operations, enhance supply chain transparency and achieve data-driven operations.

Systems engineering approach: It will also be interesting to apply the systems engineering approach to explore business operations in the sharing and circular economy era. For instance, more emphasis should be put on the whole supply chain system (Ivanov, Sokolov, and Dolgui 2014; Choi 2016; Ivanov et al. 2017; Dolgui, Ivanov, and Sokolov 2018) and even the whole society. This approach will uncover more insights from the operational analyses. For complex systems, we can even apply the system of systems (SoS) approach to study it (Choi, Cai, and Shen 2019).

Acknowledgements

The guest editors sincerely thank the Editor-in-Chief, Professor Alexandre Dolgui for his kindest support for the organisation of this very important and meaningful special issue. The guest editors are indebted to all ad-hoc referees for their helpful, timely, and critical review comments on the manuscripts. They also sincerely thank all authors for their hard work and high-quality contributions. Tsan-Ming Choi acknowledges Yingjia Wang for her assistance in proofreading the former draft of this editorial article.

Disclosure statement

No potential conflict of interest was reported by the authors.

Note

1. This searching is not a sophisticated one while it does reflect the trend and popularity of the topic.

References

Adida, E., and V. DeMiguel. 2011. "Supply Chain Competition with Multiple Manufacturers and Retailers." *Operations Research* 59 (1): 156–172.

Bellos, I., M. Ferguson, and L. B. Toktay. 2017. "The Car Sharing Economy: Interaction of Business Model Choice and Product Line Design." *Manufacturing and Service Operations Management* 19 (2): 185–201.

Bressanelli, G., M. Perona, and N. Saccani. 2018. "Challenges in Supply Chain Redesign for the Circular Economy: A Literature Review and a Multiple Case Study." *International Journal of Production Research*.

Cachon, G. P., K. M. Daniels, and R. Lobel. 2017. "The Role of Surge Pricing on a Service Platform with Self-Scheduling Capacity." *Manufacturing and Service Operations Management* 19 (3): 368–384.

Cai, Y., and T. M. Choi. 2019. "Extended Producer Responsibility: A Systematic Review and Innovative Proposals for Improving Sustainability." *IEEE Transactions on Engineering Management*.

Cai, Y., Y. Wang, and J. Zhang. 2018. "Enhancing E-Platform Business by Customer Service Systems: A Multi-Methodological Case Study on Ali Wangwang Instant Message's Impacts on TaoBao." *Annals of Operations Research*.

Cao, K., B. Xu, and J. Wang. 2019. "Optimal Trade-in and Warranty Period Strategies for New and Remanufactured Products Under Carbon Tax Policy." *International Journal of Production Research*. doi:10.1080/00207543.2019.1681137

Cao, Q., and J. Zhang. 2019. "Gray Market's Product Quality in the Circular Economy Era." *International Journal of Production Research*. doi:10.1080/00207543.2019.1638980

Chan, H. K., and F. T. S. Chan. 2010. "A Review of Coordination Studies in the Context of Supply Chain Dynamics." *International Journal of Production Research* 48: 2793–2819.

Chen, J., and B. Chen. 2016. "Competing with Customer Returns Policies." *International Journal of Production Research* 54 (7): 2093–2107.

Chen, Y., S. H. Chung, and S. Guo. 2018. "Franchising Contracts in Fashion Supply Chain Operations: Models, Practices, and Real Case Study." *Annals of Operations Research*.

Chiu, C.-H., H. L. Chan, and T. M. Choi. 2019. "Risk Minimizing Price-Rebate-Return Contracts in Supply Chains with Ordering and Pricing Decisions: A Multi-Methodological Analysis." *IEEE Transactions on Engineering Management*.

Chiu, C. H., and T. M. Choi. 2016. "Supply Chain Risk Analysis with Mean-Variance Models: A Technical Review." *Annals of Operations Research* 240 (2): 489–507.

Chiu, C. H., T. M. Choi, X. Dai, B. Shen, and J. H. Zheng. 2018. "Optimal Advertising Budget Allocation in Luxury Fashion Markets with Social Influences: A Mean-Variance Analysis." *Production and Operations Management* 27 (10): 1611–1629.

Choi, T. M. 2016. "Supply Chain Systems Coordination with Multiple Risk Sensitive Retail Buyers." *IEEE Transactions on Systems, Man, and Cybernetics: Systems* 46: 636–645.

Choi, T. M. 2018. "Incorporating Social Media Observations and Bounded Rationality into Fashion Quick Response Supply Chains in the Big Data Era." *Transportation Research Part E: Logistics and Transportation Review* 114: 386–397.

Choi, T. M., and Y. Y. He. 2019. "Peer-to-peer Collaborative Consumption for Fashion Products in the Sharing Economy: Platform Operations." *Transportation Research Part E: Logistics and Transportation Review* 126: 49–65.

Choi, T. M. 2019. "Blockchain-Technology-Supported Platforms for Diamond Authentication and Certification in Luxury Supply Chains." *Transportation Research Part E: Logistics and Transportation Review* 128: 17–29.

Choi, T. M., Y. Cai, and B. Shen. 2019. "Sustainable Fashion Supply Chain Management: A System of Systems Analysis." *IEEE Transactions on Engineering Management* 66 (4): 730–745.

Choi, T. M., T. C. E. Cheng, and X. Zhao. 2016. "Multi-Methodological Research in Operations Management." *Production and Operations Management* 25: 379–389.

Choi, T. M., S. Guo, N. Liu, and X. Shi. 2019a. "Values of Food Leftover Sharing Platforms in the Sharing Economy." *International Journal of Production Economics* 213: 23–31.

Choi, T. M., S. W. Wallace, and Y. Wang. 2018. "Big Data Analytics in Operations Management." *Production and Operations Management* 27 (10): 1868–1883.

Choi, T. M., X. Wen, X. Sun, and S.-H. Chung. 2019b. "The Mean-Variance Approach for Global Supply Chain Risk Analysis with Air Logistics in the Blockchain Technology Era." *Transportation Research Part E: Logistics and Transportation Review* 127: 178–191.

Dolgui, A., D. Ivanov, S. Potyasaev, B. Sokolov, F. Ivanov, and F. Werner. 2019. "Blockchain-Oriented Dynamic Modelling of Smart Contract Design and Execution in the Supply Chain." *International Journal of Production Research*.

Dolgui, A., D. Ivanov, and B. Sokolov. 2018. "Ripple Effect in the Supply Chain: An Analysis and Recent Literature." *International Journal of Production Research* 56 (1-2): 414–430.

Du, S., L. Wang, L. Hu, and Y. Zhu. 2019. "Platform-led Green Advertising: Promote the Best or Promote by Performance." *Transportation Research Part E: Logistics and Transportation Review* 128: 115–131.

Esmaeili, M., G. Allameh, and T. Tajvidi. 2016. "Using Game Theory for Analysing Pricing Models in Closed-Loop Supply Chain From Short- and Long-Term Perspectives." *International Journal of Production Research* 54 (7): 2152–2169.

Govindan, K., and M. Hasanagic. 2018. "A Systematic Review on Drivers, Barriers, and Practices Towards Circular Economy: A Supply Chain Perspective." *International Journal of Production Research* 56 (1-2): 278–311.

Guo, S., T. M. Choi, and B. Shen. 2020. "Green Product Development Under Competition: A Study of the Fashion Apparel Industry." *European Journal of Operational Research* 280 (2): 523–538.

Gupta, V., and D. Ivanov. 2019. "Dual Sourcing Under Supply Disruption with Risk-Averse Suppliers in the Sharing Economy." *International Journal of Production Research*.

He, Y., Q. Xu, and P. Wu. 2019. "Omnichannel Retail Operations with Refurbished Consumer Returns." *International Journal of Production Research*. doi:10.1080/00207543.2019.1629672

Howard, M., P. Hopkinson, and J. Miemczyk. 2018. "The Regenerative Supply Chain: A Framework for Developing Circular Economy Indicators." *International Journal of Production Research*.

Hua, M., L. K. W. Lai, and H. Tang. 2019. "Analysis of Advertising and a Points-Exchange Incentive in a Reverse Supply Chain for Unwanted Medications in Households Based on Game Theory." *International Journal of Production Economics*.

Ivanov, D., A. Dolgui, B. Sokolov, and M. Ivanova. 2017. "Literature Review on Disruption Recovery in the Supply Chain." *International Journal of Production Research* 55 (20): 6158–6174.

Ivanov, D., B. Sokolov, and A. Dolgui. 2014. "The Ripple Effect in Supply Chains: Trade-Off 'Efficiency-Flexibility-Resilience' in Disruption Management." *International Journal of Production Research* 52 (7): 2154–2172.

Ji, T., X. Xu, X. Yan, and Y. Yu. 2019. "The Production Decisions and Cap Setting with Wholesale Price and Revenue Sharing Contracts Under Cap-and-Trade Regulation." *International Journal of Production Research*. doi:10.1080/00207543.2019.1641239

Kung, L. C., and G. Y. Zhong. 2017. "The Optimal Pricing Strategy for Two-Sided Platform Delivery in the Sharing Economy." *Transportation Research Part E: Logistics and Transportation Review* 101: 1–12.

Li, Q., X. Guan, T. Shi, and W. Jiao. 2019a. "Green Product Design with Competition and Fairness Concerns in the Circular Economy Era." *International Journal of Production Research*. doi:10.1080/00207543.2019.1657249

Li, G., L. Li, T. M. Choi, and S. P. Sethi. 2019b. "Green Supply Chain Management in Chinese Firms: Innovative Measures and the Moderating Role of Quick Response Technology." *Journal of Operations Management*.

Liu, D., H. Li, W. Wang, and Y. Dong. 2012. "Constructivism Scenario Evolutionary Analysis of Zero Emission Regional Planning: A Case of Qaidam Circular Economy Pilot Area in China." *International Journal of Production Economics* 140 (1): 341–356.

Nagurney, A., M. Salarpour, and P. Daniele. 2019. "An Integrated Financial and Logistical Game Theory Model for Humanitarian Organizations with Purchasing Costs, Multiple Freight Service Providers, and Budget Capacity." *International Journal of Production Economics*.

Qin, J., Y. Han, G. Wei, and L. Xia. 2019. "The Value of Advance Payment Financing to Carbon Emission Reduction and Production in a Supply Chain with Game Theory Analysis." *International Journal of Production Research*. doi:10.1080/00207543.2019.1671626

Shen, B., Y. Cao, and X. Xu. 2019. "Product Line Design and Quality Differentiation for Green and Non-green Products in a Supply Chain." *International Journal of Production Research*.

Shen, B., T. M. Choi, and S. Minner. 2019. "A Review on Supply Chain Contracting with Information Considerations: Information Updating and Information Asymmetry." *International Journal of Production Research* 57 (15-16): 4898–4936.

Shen, B., X. Xu, and T. M. Choi. 2019. "Simplicity is Beauty: Pricing Coordination in Two-Product Supply Chains with Simplest Contracts Under Voluntary Compliance." *International Journal of Production Research* 57 (9): 2769–2787.

Tao, Z., Q. Gou, and J. Zhang. 2019. "A Local Seller's App Channel Strategy Concerning Delivery." *International Journal of Production Research*. doi:10.1080/00207543.2019.1535725

Wang, N., T. Zhang, X. Fan, and X. Zhu. 2019. "Game Theoretic Analysis for Advertising in Dual-Channel Supply Chains." *International Journal of Production Research*. doi:10.1080/00207543.2019.1540894

Wu, C., K. Li, and T. Shi. 2017. "Supply Chain Coordination with Two-Part Tariffs Under Information Asymmetry." *International Journal of Production Research* 55 (9): 275–2589.

Yuan, Q., and B. Shen. 2019. "Renting Fashion with Strategic Customers in the Sharing Economy." *International Journal of Production Economics* 218: 185–195.