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The Mechanism and strategy of Digital Logistics Park Cross Supply Chain Collaboration based on Evolutionary Game

Xingjian Zhou

School of management, Wuhan Textile University, China; Post Doctoral Research Station of Management Science and Engineering, Nanchang University, China, wuliuwtu@163.com

Lihua Cai

School of environment and Bioengineering, Wuhan Technology and Business University, China

Gechen Xu

School of management, Wuhan Textile University, China, 526392430@qq.com

Yingpei Huang

School of management, Wuhan Textile University, China

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Full Research Paper**The Mechanism and strategy of Digital Logistics Park Cross Supply Chain****Collaboration based on Evolutionary Game***Zhou Xingjian*^{1,2*}, *Cai Lihua*³, *Xu Gechen*^{1†}, *Huang Yingpei*¹¹School of management, Wuhan Textile University, China²Post Doctoral Research Station of Management Science and Engineering, Nanchang University, China³School of environment and Bioengineering, Wuhan Technology and Business University, China

Abstract: In order to overcome the disadvantages of "go-it-alone" in logistics parks, it is necessary to select appropriate horizontal collaboration strategies to promote cooperation among logistics parks. Considering a kind of horizontal collaboration cross supply chain between logistics parks under digital Cloud platform, there is a three-party composed of one Cloud platform and two logistics parks. According to the benefit function of each party, a dynamic replication equation is constructed to analyze the stability strategy of the three-party Evolutionary Game, and then a Jacobian matrix is constructed to analyze the stability of the equilibrium point of the three-party Evolutionary Game of the resource sharing strategy between logistics parks. Moreover, two gradually stable strategies (0,0,0) and (1,1,1) are formed, and the strategy is affected by the initial sharing proportion of resources between logistics parks, the risk of customer order loss and the proportion of Cloud platform subsidy. The simulation analysis shows that the higher the initial sharing proportion of resources among logistics parks, the more likely the logistics parks are to choose the horizontal collaboration strategy, and the more likely the Cloud platform are to choose the subsidy strategy; the higher the subsidy proportion, the more willing the logistics parks are to choose the horizontal collaboration strategy. Combined with the actual operation of the logistics park, it is suggested to strengthen the guiding effect of the core logistics park, strengthen the supervision and guiding ability of the Cloud platform, emphasize the risk sharing and revenue sharing among the logistics parks, and jointly promote the collaborative operation and development among the logistics parks.

Keywords: digital logistics park, horizontal cooperation, cross supply chain, Evolutionary Game

1. INTRODUCTION

With the development of digital transformation, the logistics park will become the key leverage fulcrum and the primary breakthrough of the digital transformation and intelligent transformation of logistics industry. Especially with the support of Cloud computing, big data, Internet of Things and other information technologies, the industry began to explore the construction of digital logistics park alliance through Cloud platform. For example, "China Logistics Park map" created by CFLP, interconnects more than five hundred logistics parks to form a public welfare national digital logistics park platform. During the period of COVID-19, it coordinated with government department to make a central dispatch, forming a synergy between five logistics parks in Wuhan, Ezhou and Xiangyang, which makes the transportation and delivery the emergency materials into Hubei Province more fast and efficient. The mode of sharing logistics resources through the Cloud platform provides the feasibility for the horizontal cooperation between logistics parks. However, the cooperation between logistics parks will lead to the loss of some customer orders and the leakage of trade secrets, and there are revenue damage and security risks. How do the Cloud platform and logistics parks choose the cooperation strategy and maximize the benefits of all parties? It is an urgent problem to be solved.

Considering that the cooperation strategy between logistics parks is evolved and developed from multi-party

* Corresponding author. Email: wuliuwtu@163.com(Zhou Xingjian)

† Corresponding author. Email: 526392430@qq.com(Xu Gechen)

competition and cooperation Game^[9], which is not only affected by the "bounded rationality" of logistics parks, but also constrained by the Cloud platform, the paper uses the Evolutionary Game method, takes the Cloud platform as an external effective constraint, constructs a three-party cooperation decision model, and analyzes the cross supply chain horizontal cooperation mechanism between logistics parks.

2. CONCLUSIONS

Through the strategy selection and simulation analysis of tripartite Evolutionary Game between Cloud platform and logistics parks, the main conclusions are as follows:

(1) There are two strategies for cross supply chain horizontal cooperation among logistics parks:①all logistics parks choose not to share resources and the Cloud platform party chooses not to subsidize strategy;② all logistics parks choose to share resources and the Cloud platform party chooses to implement subsidy strategy.

(2) The cross supply chain horizontal cooperation strategy among logistics parks is related to the initial share ratio of resources. At the same time, when the initial sharing ratio of resources among logistics parks gradually increases, the rate of Cloud platform's subsidy ratio converging to 1 will be significantly accelerated, and the Cloud platform finally chooses to implement the subsidy strategy.

(3) The cross supply chain horizontal cooperation strategy among logistics parks is promoted by the subsidy proportion of Cloud platform. For the sake of maximizing the interests, the willingness of the logistics park to choose the horizontal cooperation strategy will also increase.

Combined with the actual operation of logistics parks, the following suggestions are put forward. We should strengthen the guiding effect of core logistics parks, strengthen the supervision and guidance ability of Cloud platform, and emphasize risks sharing and revenues sharing among logistics parks.

Based on the Cloud platform there are other factors that will affect the Game process of resource sharing between logistics parks, such as the coordination of interests between logistics parks. In addition, considering the risk of resource sharing between logistics parks, whether the joint risk governance model with Cloud platform subsidies will have different effects on the resource sharing strategy between logistics parks is a feasible direction of future research.

3. ACKNOWLEDGEMENT

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