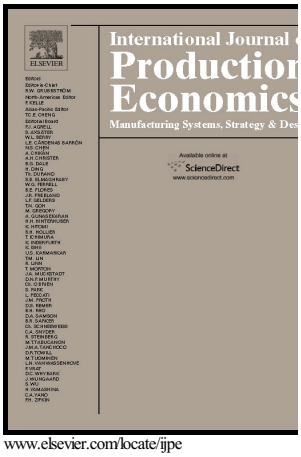

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Coalitional Game Theory Approach to Modeling Suppliers' Collaboration in Supply Networks

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Abstract

Suppliers' collaboration is a new paradigm to improve the utilization of collective intelligence in supply networks. Although existing literature advocates the notion of cooperation in supply networks, there is a dearth of studies quantitatively analyzing cost and benefit of cooperation. In this study, we first develop a model for suppliers' dynamic coalition formation using coalitional game theory. The proposed cost structure influences the utility of each possible coalition and restricts the coalition size and search space for finding possible coalitions. To distribute the profit earned by cooperation in a fair manner, a criterion named *Shared Capacity Index* is developed according to suppliers' capacity share in the corresponding coalition. A suppliers' cooperation algorithm is then proposed to resolve possible conflicts among network members whereby each supplier is able to explore coalitional structures autonomously. The efficiency of the proposed approach is evaluated through simulation studies and compared to other solution methods, including Shapley value and Proportional Fairness. Results demonstrate that long-term cooperation among suppliers leads to enhanced average individual profit in the network.

Keywords: Collective intelligence, Game theory, Dynamic coalition formation, Stable coalitions

1. Introduction

Strategic partnership among competing members of supply networks (SNs) to benefit from collaborative synergy has altered the functionality of supply networks. The idea is that competing parties, individuals or organizations, being mindful of potential retaliatory actions of their counterparts in future interactions, are willing to engage in collaboration and such relationships can induce optimal gains for both parties [30].