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A closed loop Stackelberg game in multi-product supply chain considering information security: A case study

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A B S T R A C T

Realization of information security among supply chain components has always been one of the concerns of supply chain players. This research is the development of a mixed integer mathematical model for solving the problem of designing a multi-product network chain and balancing the separation line of parts in a closed loop supply chain. This model is responsive to market demand for finished products and spare parts simultaneously, and minimizes the transportation costs in forward and backward chains, product purchase costs in assembly section, costs of renewing collected products, and fixed costs of workplaces for the dividing the parts. This game consists of two players: the first player includes: Suppliers, assembly centers, retailers and customers, and the second player includes collection centers, renovation centers, separation centers and disposal centers. The payoff of each actor is minimizing their own objectives, and the objective of the model is the unawareness of the members of the chain from the objectives of other members (information security). The proposed model was solved in GAMS 24 software. Due to the nested model, the first model is solved first and the results of the model are entered into the second model. The results of the model solution show the good performance of the proposed model after implementation for the case study. Among the innovations of this research is the consideration of the Stackelberg game in multi-product closed loop supply chain along with the balance of the separation line of parts with the objective of minimizing all the cost elements.

A R T I C L E I N F O

Keywords:
Supply chain optimization;
Multi-product supply chain;
Closed-loop supply chain;
Game theory;
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