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

Babaeinesami, A.[a], **Tohidi, H.**[b,*], **Seyedaliakbar, S.M.**[c]

[a,b,c]Department of Industrial Engineering, South Tehran Branch, Islamic Azad University, Tehran, Iran

ABSTRACT

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.

ARTICLE INFO

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**Corresponding author:*
H_tohidi@azad.ac.ir
(Tohidi, H.)

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Izvirni znanstveni članek

Stackelbergova igra za krožno dobavno verigo z več izdelki glede na informacijsko varnost: Študija primera

Babaeinesami, A.[a], **Tohidi, H.**[b,*], **Seyedaliakbar, S.M.**[c]

[a,b,c]Department of Industrial Engineering, South Tehran Branch, Islamic Azad University, Tehran, Iran

POVZETEK

Uresničevanje informacijske varnosti med komponentami dobavne verige je bilo vedno eno od skrbi udeležencev v dobavni verigi. Ta raziskava opisuje razvoj mešanega celoštevilskega matematičnega modela za reševanje problema oblikovanja mrežne verige za več izdelkov in uravnoteženja ločevalne meje sestavnih delov v krožni dobavni verigi. Model se hkrati odziva na tržno povpraševanje po končnih izdelkih in rezervnih delih ter zmanjšuje stroške prevoza v prednjih in povratnih verigah, stroške nakupa izdelkov v montažnem delu, stroške obnove zbranih izdelkov in fiksne stroške delovnih mest za delitev sestavnih delov. Igra je sestavljena iz dveh igralcev: prvi igralec vključuje dobavitelje, montažne centre, prodajalce in kupce, drugi igralec pa zbirne centre, obnovitvene centre, ločevalne centre in odlagališča. Korist za vsakega člana se kaže v optimizaciji njegovih ciljev, cilj modela pa je, da člani verige ne poznajo ciljev drugih članov (informacijska varnost). Predlagani model je bil rešen v programski opremi GAMS 24. Zaradi ugnezdenega modela se najprej reši prvi model, rezultati modela pa se vnesejo v drugi model. Rezultati pridobljeni na podlagi študije primera kažejo dobro delovanje predlaganega modela. Med novostmi te raziskave je upoštevanje načel igre Stackelberg v krožni dobavni verigi z več izdelki, skupaj z uravnoteženjem ločevalne meje sestavnih delov, z namenom zmanjšanja vseh stroškovnih elementov.

PODATKI O ČLANKU

Ključne besede:
Optimizacija dobavne verige;
Dobavna veriga več izdelkov;
Krožna dobavna veriga;
Teorija iger;
Stackelbergova igra;
Informacijska varnost;
Prenova izdelkov;
Zbirka izdelkov

**Kontaktna oseba:*
H_tohidi@azad.ac.ir
(Tohidi, H.)

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