APEM journal

Advances in Production Engineering & Management
Volume 16 | Number 2 | June 2021 | pp 161–172
https://doi.org/10.14743/apem2021.2.391

ISSN 1854-6250
Journal home: apem-journal.org
Original scientific paper

A multi-objective optimal decision model for a green closed-loop supply chain under uncertainty: A real industrial case study

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ABSTRACT

Green closed-loop supply chain management is an important topic for business operations today because of increasing resource scarcity and environmental issues. Companies not only have to meet environmental regulations, but also must ensure high quality supply chain operation as a means to secure competitive advantages and increase profits. This study proposes a multi-objective mixed integer programming model for an integrated green closed-loop supply chain network designed to maximize profit, amicable production level (environmentally friendly materials and clean technology usage), and quality level. A scenario-based robust optimization method is used to deal with uncertain parameters such as the demand of new products, the return rates of returned products and the sale prices of remanufactured products. The proposed model is applied to a real industry case example of a manufacturing company to illustrate the applicability of the proposed model. The result shows a robust optimal resource allocation solution that considers multiple scenarios. This study can be a reference for closed-loop supply chain related academic research and also can be used to guide the development of a green closed-loop supply chain model for better decision making.

ARTICLE INFO

Keywords:
Green closed-loop supply chain;
Sustainability;
Modelling;
Robust optimization;
Mixed integer programming model;
Supply chain management;
Uncertainty;
LP-metric method

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Article history:
Received 5 June 2021
Revised 23 June 2021
Accepted 24 June 2021

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APEM journal

Advances in Production Engineering & Management
Letnik 16 | Številka 2 | Junij 2021 | Strani 161–172
https://doi.org/10.14743/apem2021.2.391

ISSN 1854-6250
Spletna stran: apem-journal.org
Izvirni znanstveni članek

Večkriterijski model za optimalno odločanje za zeleno krožno dobavno verigo z negotovostmi: Industrijska študija primera

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POVZETEK

Upravljanje zelene krožne dobavne verige je, zaradi vedno večjega pomanjkanja virov in okoljskih težav pomembna tema za današnje poslovanje. Podjetja morajo izpolnjevati okoljske predpise in hkrati zagotavljati visokokakovostno delovanje dobavne verige, kar jim zagotavlja konkurenčno prednost in povečanje dobička. Ta študija predlaga večkriterijski mešani celoštevilski model linearnega programiranja za integrirano omrežje zelene krožne dobavne verige, zasnovan za maksimiranje dobička, ravni sprejemljive proizvodnje (uporaba okolju prijaznih materialov in čiste tehnologije) in ravni kakovosti. Na scenariju temelječa metoda robustne optimizacije je bila uporabljena za obravnavanje negotovih parametrov, kot so povpraševanje po novih izdelkih, stopnja vračila izdelkov in prodajna cena predelanih izdelkov. Predlagani model je uporabljen na primeru resničnega proizvodnega podjetja, s čimer se ponazori uporabnost predlaganega modela. Rezultat prikazuje robustno optimalno rešitev za dodeljevanje virov, ki upošteva več scenarijev. Ta študija je lahko referenca za akademske raziskave, povezane s krožno dobavno verigo, lahko pa se uporablja tudi kot vodilo razvoja zelene krožne dobavne verige za boljše odločanje.

PODATKI O ČLANKU

Ključne besede:
Zelena krožna dobavna veriga;
Trajnost;
Modeliranje;
Robustna optimizacija;
Mešani celoštevilski model linearnega programiranja;
Upravljanje dobavne verige;
Negotovost;
Metoda LP-metrike

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Zgodovina članka:
Prejet 5. junija 2021
Popravljen 23. junija 2021
Sprejet 24. junija 2021