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Multi-criteria decision making in supply chain management based on inventory levels, environmental impact and costs

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ABSTRACT

Supply chains in a global business environment operate within conflicting aspects. This research analyses correlation and interdependencies between inventory levels, costs and greenhouse gas emissions from replenishments within supply chain echelon. A simulation-based inventory optimisation conducted on 4000 experiments assumes the conditions of stochastic market demand, (*R*, *s*, *S*) inventory policy, target fill rates, predefined lead times and closing days constraint. It verifies the influence of operational and logistic decisions such as frequency of inventory replenishments or vehicle size selection on management objectives. Besides determining the best individual results for the objectives of minimum inventory levels, total costs and emissions, the overall best solutions in terms of three decision models – uniformly valued, cost-oriented and environmentally responsible model, were determined using multi-criteria decision-making methodology. These models are relevant for both scientific and practical managerial settings due to the evident lack of research simultaneously analysing inventory, cost and environmental performances of (*R*, *s*, *S*) policy. This study confirms that it is crucial in practice to perform an extensive simulation experiment analysis for each product to be able to determine its optimal settings. Inventory management software should have a direct influence on operational decisions in order to reduce costs or emissions within the same fill rate.

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Izvirni znanstveni članek

Večkriterijsko odločanje pri upravljanju dobavne verige na podlagi ravni zalog, vpliva na okolje in stroškov

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POVZETEK

Dobavne verige v globalnem poslovnem okolju delujejo v nasprotujočih si vidikih. Ta raziskava analizira korelacije in soodvisnosti med ravnmi zalog, stroški in emisijami toplogrednih plinov, zaradi dopolnitev v delih dobavne verige. Simulacija optimizacije zalog, izvedena na 4000 eksperimentih, predpostavlja pogoje stohastičnega povpraševanja na trgu, (*R, s, S*) politiko zalog, ciljne stopnje polnjenja, vnaprej določene roke in omejitve zaključnih dni. Preveri se vpliv operativnih in logističnih odločitev, kot sta pogostost dopolnjevanja zalog ali izbira velikosti vozila na cilje upravljanja. Poleg določanja najboljših posameznih rezultatov za zagotovitev minimalnih zalog, skupnih stroškov in emisij so bile z uporabo večkriterijske metodologije odločanja določene tudi skupne najboljše rešitve v smislu treh modelov odločanja: enotnega vrednotenja, stroškovno naravnanega in okoljsko odgovornega modela. Ti modeli so pomembni iz vidika znanstvene in praktične vodstvene orientacije, zaradi očitnega pomanjkanja raziskav, ki hkrati analizirajo zaloge, stroške in okoljske učinke politike (*R, s, S*). Ta študija potrjuje, da je v praksi ključnega pomena izvesti obsežno analizo simulacijskega eksperimenta za vsak izdelek, da lahko določimo njegove optimalne nastavitve. Programska oprema za upravljanje zalog mora imeti neposreden vpliv na operativne odločitve, da se znižajo stroški ali emisije znotraj iste stopnje polnjenja.

PODATKI O ČLANKU

Ključne besede:
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