Analysis of the impact of COVID-19 on the coupling of the material flow and capital flow in a closed-loop supply chain

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ABSTRACT

The complex and changeable external social and economic environment has a significant impact on the sustainable development of the closed-loop supply chain. In particular, the occurrence of uncertain emergencies increases the risk of interruption of the closed-loop supply chain, making it insufficient to analyze its complex changes from the perspective of material flow alone. Based on this analysis, the paper constructs a closed-loop supply chain material flow and capital flow coupling system composed of manufacturers, sellers and recyclers to explore the impact of material flow sudden interruption on the closed-loop supply chain system when an uncertain emergency occurs. In this paper, based on the closed-loop supply chain system coupled with logistics and capital flow, a system dynamics simulation model was established by using Vensim simulation software to analyze the impact of COVID-19 epidemic on manufacturers, sellers and recyclers under five scenarios. The results show that when COVID-19 outbreaks occur, the material flow of each main enterprise in the closed-loop supply chain is more easily influenced than the capital flow. At the same time, it can be found that the recyclers in the main enterprises of the closed-loop supply chain are more easily influenced by the material flow. The model constructed in this paper has applicability and can be used for related studies of closed-loop supply chain under other emergencies, but the scene design should be carried out according to the characteristics of emergencies themselves.

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Analiza vpliva COVID-19 na povezana toka materiala in kapitala v krožni dobavni verigi

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POVZETEK

Kompleksno in spremenljivo družbeno in ekonomsko okolje pomembno vpliva na trajnostni razvoj krožne dobavne verige. Zlasti pojav izrednih razmer predstavlja pomembno negotovost in poveča tveganje za prekinitev krožne dobavne verige, zaradi česar je kompleksne spremembe krožne dobavne verige nezadostno analizirati samo z vidika toka materiala. Članek opisuje analizo toka materiala in toka kapitala v krožni dobavni verigi, ki ga sestavljajo proizvajalci, prodajalci in predelovalci. Cilj je raziskati vpliv nenadne prekinitve toka materiala zaradi pojava izrednih razmer na delovanje krožne dobavne verige. V raziskavi je bil na podlagi sistema krožne dobavne verige, skupaj z logistiko in tokom kapitala, z uporabo simulacijske programske opreme Vensim postavljen simulacijski model sistemske dinamike za analizo vpliva epidemije COVID-19 na proizvajalce, prodajalce in predelovalce po petih scenarijih. Rezultati kažejo, da je ob izbruhih COVID-19 v krožni dobavni verigi v glavnih podjetjih lažje vplivati na tok materiala kot na kapitalski tok. Obenem je mogoče ugotoviti, da so predelovalci v glavnih podjetjih v krožni dobavni verigi pod vplivom toka materiala. Model, predstavljen v tem članku, je uporaben in se lahko uporablja za sorodne raziskave krožne dobavne verige v drugačnih izrednih razmerah, vendar je treba okoliščine prilagoditi značilnostmi spremenjenih izrednih razmer.

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Ključne besede:

Epidemija COVID-19;
Dobavna veriga;
Krožna dobavna veriga;
Tok materiala;
Tok kapitala;
Povezani materialno-kapitalski tokovi;
Sistemska dinamika;
Simulacija;
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