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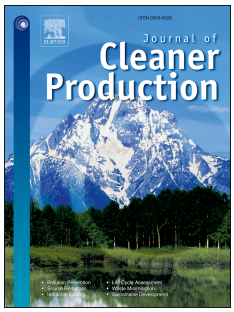

Designing supply contracts for the sustainable supply chain using game theory

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Designing supply contracts for the sustainable supply chain using game theory

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Abstract

The importance of sustainable operations in supply chains has been widely recognised in practice and the extant literature. In this paper, we study coordination issues of a sustainable supply chain that arise due to simultaneous consideration of greening and corporate social responsibility (CSR) initiatives undertaken by supply chain agents. We specifically consider the scenario where the supplier is responsible for greening and the buyer is accountable for social responsibility. We analyse our model using two-stage Stackelberg game-theoretic approach where the supplier acts as a Stackelberg leader. In this context, we analyse the decentralised supply chain setting using five different contract types, namely wholesale price, linear two-part tariff (LTT), greening-cost sharing, revenue sharing, and revenue and greening-cost sharing contracts. We demonstrate how optimal greening level, CSR level, retail price and profits of supply chain agents are influenced by different contract types. Our analytical results show that greening and social efforts undertaken by supply chain agents are beneficial for the overall supply chain as long as consumer awareness towards greening and CSR exists. Our results show that channel coordinating mechanisms between supplier and buyer is conducive to improve greening and CSR level. LTT perfectly coordinates the supply chain. Through a numerical example with several key parameters we present the effectiveness of different contracts. The results reveal that as a profit maximising agent the supplier prefers LTT contract and the buyer prefers RGCS contract. This paper extends the understanding of supply chain coordination in the context of sustainability.

Keywords: sustainable supply chain; Stackelberg game; coordination; greening-cost sharing; revenue and greening-cost sharing

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