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EVALUATING SUPPLY CHAIN RISKS UNDER DUAL-CARBON TARGETS: AN INTEGRATED CLOUD-VIKOR-TOPSIS-DEMATEL FRAMEWORK

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Abstract

Achieving carbon peaking and neutrality ("dual-carbon" targets) has reshaped modern supply chain risks, especially in carbon-intensive industries. Traditional risk evaluations often overlook fuzzy uncertainty and dual-carbon indicators. To address this, we propose a dual-dimensional framework integrating the Cloud model with VIKOR (VlseKriterijumska Optimizacija I Kompromisno Resenje), TOPSIS (Technique for Order Preference by Similarity to Ideal Solution), and DEMATEL (Decision-Making Trial and Evaluation Laboratory), capturing external correlations between dual-carbon indicators and risk factors, as well as internal causal relationships, while accommodating expert uncertainty. A case study of Geely's Lynk & Co. Chengdu plant demonstrates its applicability. Results show that dual-carbon indicators gained 89% more weight in the risk system, expert disagreement decreased by 57%, and key risks include carbon policy changes and unstable clean energy supply, both significantly impacting supply chain resilience. The framework enhances robustness and transparency in risk assessment under low-carbon transition, providing actionable guidance for carbon-resilient supply chains.

Key words: Cloud-VIKOR-TOPSIS-DEMATEL, dual-carbon targets, fuzzy evaluation, supply chain risk, sustainable supply chains

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