

Blockchain Features for Facilitating Circular Economy Adoption in the Palm Oil Industry: A DEMATEL Approach

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Abstract

This study delves into the convergence of Circular Economy (CE) principles and Blockchain Technology (BCT) within Malaysia's pivotal palm oil sector. It emphasizes the potential of BCT to catalyze sustainability efforts, focusing on the significance of key BCT features in motivating palm oil industry stakeholders towards a more environmentally-conscious supply chain. This study employed the Decision-Making Trial and Evaluation Laboratory (DEMATEL) to dissect its attributes' influence. The analysis revealed transparency, immutability, and irreversibility as pivotal drivers, significantly enhancing traceability, integrity, and accountability within the sector. Decentralization, peer-to-peer networking, and distributed ledgers were identified as playing supportive roles, holding transformative potential in reshaping the industry's dynamics. The findings underscore the paramount importance of transparency, immutability, and irreversibility attributes in fostering a reliable palm oil ecosystem. This study not only provides a framework for strategic integration but also highlights the transformative potential of BCT features. This research offers valuable insights for palm oil business owners, emphasizing the benefits of adopting BCT for a more sustainable and efficient supply chain.

Keywords: Circular Economy, Blockchain Technology, Sustainability, Palm Oil Sector, Supply Chain Management

1. Introduction

The palm oil sector, a dominant player in Malaysia's economy, has secured its position as the globe's second-largest producer and exporter (MPOB, 2022). Spanning an expansive 4.49 million hectares, Malaysia's palm oil cultivation yields an impressive annual output of 17.73 million tons, constituting a significant proportion of the world's oils and fats production (The Star, 2021). Propelled by ecological stewardship, Malaysia leads the charge in promoting sustainable practices within the palm oil industry.

In alignment with this commitment to sustainability, Malaysia has embraced the principles of the CE as a catalyst for transforming palm oil production (MIDA, 2021). The CE model, an innovative departure from linear economies, centers on resource efficiency and waste minimization (Cheah, Pahri, Leng, Er, & Show, 2023). This paradigm shift emphasizes extending product lifecycles, minimizing reliance on virgin materials, and reintegrating repurposed resources into successive cycles (Liu, Chen, Kuo, & Lin, 2022). Amidst this transition, Industry 4.0 technologies, particularly BCT, stand poised to reshape supply chain management, traceability, and collaborative

engagement (Basile, D'Adamo, Goretti, & Rosa, 2023; Ferreira, Godina, Pinto, Pinto, & Carvalho, 2023; Pai & Chandra, 2022).

Navigating the transition to a CE entail surmounting intricate challenges, encompassing intricate supply chain orchestration, traceability verification, and cooperative frameworks (Abdul-Hamid, Ali, Osman, & Tseng, 2021). The emergence of Industry 4.0 offers an opportune juncture for harnessing advanced technologies to drive the circular economy transformation within established business models (Agrawal, Wankhede, Kumar, Luthra, & Huisingsh, 2022). BCT, among these innovative technologies, emerges as a catalyst for revolutionizing manufacturing systems and nurturing economic and environmental sustainability (Rejeb, Suhaiza, Rejeb, Seuring, & Treiblmaier, 2022). By enabling transparent and immutable record-keeping, BCT empowers organizations to monitor material, component, and product movements across supply chains, heralding a new era of transparency, traceability, and innovation (Böckel, Nuzum, & Weissbrod, 2021). As a decentralized digital ledger, BCT ensures the creation of tamper-resistant records, underpinning trust and accountability in supply chain transactions (Treiblmaier, 2018).