

Used Cooking Oil Supply Chain Risk Management (Used Cooking Oil) Based on ISO 31000:2018

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Abstract

Indonesia's reliance on fossil fuels and the growing volume of household used cooking oil (UCO) present opportunities for a sustainable biodiesel business while simultaneously introducing complex risks across the supply chain. This article outlines and analyzes the risk management plan of PT Biofuel Unggul Lestari (PT BUL)—a company engaged in the collection, pre-treatment, and export of UCO—based on the ISO 31000:2018 Risk Management Guidelines framework. This descriptive-qualitative study employs a case study approach, using External Factor Evaluation (EFE) and Internal Factor Evaluation (IFE) analyzes as the basis for risk identification, alongside the Risk Priority Number (RPN = Probability × Impact, on a scale of 1–5) method to assess and prioritize risks. The identification process revealed 35 risks categorized as either internal or external: 18 were classified as High, 17 as Medium, and none as Critical. The five risks with the highest RPN scores (16) were fluctuations in the Crude Palm Oil (CPO) reference price, reliance on a single supplier, exchange rate risk, sudden changes in government regulations, and competition from CPO-based rivals and regional players. Mitigation strategies implemented include a combination of risk reduction and transfer measures, such as supplier diversification based on the 20:80 principle, long-term supply contracts, hedging via forward contracts, and accelerating International Sustainability and Carbon Certification (ISCC) acquisition. These findings confirm that the application of systematic, international-standard risk management can serve as a foundation for the sustainability of waste-based biodiesel businesses in Indonesia.

Keywords: Risk Management, ISO 31000:2018, Used Cooking Oil (UCO), Supply Chain, Risk Priority Number, Biodiesel, Sustainability

Abstrak

Ketergantungan Indonesia terhadap bahan bakar fosil dan meningkatnya volume limbah minyak jelantah (used cooking oil/UCO) rumah tangga membuka peluang bisnis biodiesel berkelanjutan sekaligus menghadirkan risiko yang kompleks di sepanjang rantai pasoknya. Artikel ini menyusun dan menganalisis perencanaan pengelolaan risiko PT Biofuel Unggul Lestari (PT BUL), sebuah pelaku usaha pengumpulan, pengolahan pendahuluan (pre-treatment), dan ekspor UCO, dengan mengacu pada kerangka kerja ISO 31000:2018 tentang

Risk Management Guidelines. Penelitian bersifat deskriptif-kualitatif dengan pendekatan studi kasus, memanfaatkan hasil Analisis Faktor Eksternal (EFE) dan Analisis Faktor Internal (IFE) sebagai basis identifikasi risiko, serta metode Risk Priority Number ($RPN = \text{Probabilitas} \times \text{Dampak}$, skala 1–5) untuk menilai dan memprioritaskan risiko. Hasil identifikasi menemukan 35 risiko yang terbagi ke dalam risiko internal dan eksternal, dengan komposisi 18 risiko berkategori High, 17 risiko berkategori Medium, dan tidak ditemukan risiko berkategori Critical. Lima risiko dengan skor RPN tertinggi (16) adalah fluktuasi harga acuan Crude Palm Oil (CPO), ketergantungan pada pemasok tunggal, risiko nilai tukar, perubahan regulasi pemerintah yang mendadak, serta persaingan dari kompetitor berbasis CPO dan pemain regional. Strategi penanganan yang diterapkan berupa kombinasi reduce dan transfer, seperti diversifikasi pemasok dengan prinsip 20:80, kontrak pasokan jangka panjang, lindung nilai (hedging) melalui forward contract, serta percepatan sertifikasi International Sustainability and Carbon Certification (ISCC). Temuan ini menegaskan bahwa penerapan manajemen risiko yang sistematis dan berbasis standar internasional dapat menjadi fondasi keberlanjutan bisnis biodiesel berbasis limbah di Indonesia.

Kata Kunci: Manajemen Risiko, ISO 31000:2018, Minyak Jelantah (UCO), Rantai Pasok, Risk Priority Number, Biodiesel, Keberlanjutan

BACKGROUND

The energy transition to renewable sources has become a national strategic agenda, one of which is through the ever-increasing biodiesel blending mandate as part of the energy policy of the Ministry of Energy and Mineral Resources (ESDM) of the Republic of Indonesia. On the other hand, used cooking oil, which has been widely discarded or reused inappropriately, has the potential to become a high-value biodiesel feedstock if managed through a structured supply chain. This situation has encouraged the emergence of a business model for the collection, pre-processing, and export of UCO, targeting both domestic and international biodiesel markets, including the European market, which requires compliance with the Renewable Energy Directive (RED II) and ISCC certification.

PT Biofuel Unggul Lestari (PT BUL) is a business player building a UCO supply chain from fragmented upstream suppliers to export buyers. Effective supply chain management integration, particularly in the face of competitive market dynamics, has proven to be a key element in maintaining the company's competitive advantage and business performance (Angelia, Puspitasari, Syah, & Alhabsyi, 2021). This business model, while promising in terms of revenue growth, is not free from various risks that can hinder the achievement of the company's goals. These risks include fluctuations in the benchmark Crude Palm Oil (CPO) price that affect UCO prices, dependence on government biodiesel policy mandates, export market concentration in certain destination countries, potential ISCC certification failure, supply instability due to dependence on informal collectors, and liquidity risks arising from mismatches in the payment cycle to suppliers and the receipt cycle from international buyers.

The problem raised in this article is how PT BUL can systematically identify, analyze, evaluate, and handle these risks so that the sustainability of the UCO supply chain is

maintained, while meeting the sustainability standards required by the export market. To answer this problem, this article aims to: (1) identify external and internal risks faced by PT BUL based on the results of the EFE and IFE Analysis; (2) measure the priority level of each risk using the Risk Priority Number method which is the result of multiplying probability and impact; and (3) formulate a risk management strategy that is in line with the principles and framework of ISO 31000:2018 so that it can reduce residual risk to a level acceptable to the company.

This study is based on established strategic management and risk management theories, including Porter's (2008) five competitive forces framework to understand competitive pressures in the CPO-based industry, Barney's (2011) and Grant's (2010, 2016) theory of sustainable competitive advantage to explain the importance of a company's unique resources and capabilities, and the international standard ISO 31000:2018 as the primary reference framework for the risk management process. By combining strategic theory and globally recognized risk management standards, this article is expected to provide an empirical contribution to the development of a risk management model in the relatively new and growing waste-based biodiesel industry in Indonesia.

METHOD

This research uses a descriptive-qualitative approach with a case study design on PT Biofuel Unggul Lestari as the unit of analysis. The case study approach was chosen because it can provide an in-depth description of the risk management process within a specific business entity within the context of the used cooking oil supply chain industry, which has unique characteristics in terms of regulation, market, and operations.

The analysis framework refers to the ISO 31000:2018 standard on Risk Management Guidelines, which includes eight risk management principles and a risk management process consisting of communication and consultation, determining scope, context and criteria, risk assessment (identification, analysis, and evaluation), risk treatment, recording and reporting, and monitoring and review.

Risk data was obtained from two primary sources previously compiled in PT BUL's business planning document: the External Factor Evaluation (EFE) containing thirteen external threat factors, and the Internal Factor Evaluation (IFE) containing nineteen internal weakness factors. These two analyses served as the basis for compiling a risk register containing 35 risks, comprising internal risks (marketing, operational, human capital, finance, competitive-strategic, environmental-ESG, and additional operational costs) and external risks (marketing, operational, finance, regulatory-compliance, competitive-strategic, and environmental-ESG).

Each risk is assessed using the Risk Priority Number (RPN) method, which is the multiplication of the Likelihood/Probability Level score (LK, scale 1–5, from Rare to Almost Certain) and the Impact Level score (LD, scale 1–5, from Insignificant to Catastrophic). The results of this multiplication are grouped into four risk categories: Low, Medium, High, and Critical. The risk with the highest RPN is then further analyzed to determine the appropriate handling strategy, in the form of avoidance, reduction, transfer, or acceptance, with the aim of reducing the residual risk post-treatment to a level acceptable to the company. Cost risk analysis is also conducted by linking each risk component to the projected operational and

investment budgets for the five-year projection, to ensure integration between financial planning and risk management.

RESULTS AND DISCUSSION

A summary of PT BUL's risk assessment shows no risks categorized as Critical, 18 risks categorized as High, and 17 risks categorized as Medium. The five risks with the highest RPN scores (16) which are the top priority for handling are presented in the following table.

Code	Risk	LK	LD	RPN	Category
R02	Fluctuations in global CPO benchmark prices	4	4	16	High
R14	Dependence on a single/limited supplier	4	4	16	High
R25	Exchange rate risk (foreign exchange risk)	4	4	16	High
R28	Sudden changes in government regulations	4	4	16	High
R29	Competition with CPO-based players & regional competitors	4	4	16	High

These five priority risks are addressed with a combination of reduce and transfer strategies: currency hedging through forward contracts for exchange rate risk, supplier diversification and minimum volume contracts to reduce dependence on a single supplier, active regulatory monitoring with contingency scenarios to anticipate changes in government policy, and product differentiation based on ISCC certification to face competitive pressures from CPO-based players and regional competitors. Other High category risks, such as delays in ISCC certification (R09) and export market concentration risk (R03), are addressed through accelerated certification processes and buyer loyalty programs, while Medium category risks are generally managed through strengthening standard operating procedures (SOPs), human resource training, and automation of payment systems and traceability.

CONCLUSION

The implementation of the ISO 31000:2018 framework at PT Biofuel Unggul Lestari has resulted in a systematic, measurable, and integrated risk management model with the company's strategic and financial planning. Of the 35 risks identified in the UCO supply chain, no risks were categorized as Critical, while 18 risks were categorized as High requiring priority attention and mitigation, particularly the risks of fluctuations in the CPO benchmark price, dependence on a single supplier, exchange rates, changes in government regulations, and regional competitive pressures.

The formulated mitigation strategies, ranging from supplier diversification with the 20:80 principle, long-term supply contracts, an end-to-end digital traceability system, currency hedging, and accelerated ISCC certification, demonstrate that effective risk management serves not only as a loss mitigation tool but also as a foundation for building supplier and international buyer trust and supporting the achievement of revenue growth targets (CAGR

25% per year). Going forward, the successful implementation of this risk management depends on consistent monthly monitoring, semi-annual risk reviews, and strengthening a risk-aware culture at all levels of the organization, as mandated by the principles of ISO 31000:2018. These green supply chain strengthening and risk management practices will ultimately contribute significantly to increasing the company's long-term value and sustainability (Subhan, Siregar, Hamdi, & Syah, 2021). Further research is recommended to empirically test the effectiveness of this mitigation strategy after the operational period, including evaluating the accuracy of residual RPN projections compared to actual risk incidents in the field.

BIBLIOGRAPHY

- Angelia, LA, Puspitasari, IH, Syah, TYR, & Alhabsyi, T. (2021). The Effect Of Supply Chain Management, Green Innovation, And Competitive Advantage On Business Performance In The Digital Era. *International Journal Of Research In Business And Social Science* (2147-4478), 10(7), 41-49.
- Ardiansyah. (2022). Analysis Of Processing Efficiency And Characteristics Of Raw Materials For Used Cooking Oil And Crude Palm Oil.
- Author Team. (2026). PT Biofuel Unggul Lestari Business Planning Document, Chapter IX: Risk Management Planning. Esa Unggul University.
- Awasthi, A., Et Al. (2022). Sustainability Evaluation Of Biodiesel Production Chains From Used Cooking Oil. *Journal Of Cleaner Production*.
- Barney, J. B. (2011). *Gaining And Sustaining Competitive Advantage* (4th Ed.). Pearson.
- Besanko, D., Dranove, D., Shanley, M., & Schaefer, S. (2017). *Economics Of Strategy* (7th Ed.). John Wiley & Sons.
- Burnes, B. (2017). *Managing Change* (7th Ed.). Pearson.
- David, FR, & David, FR (2023). *Strategic Management: A Competitive Advantage Approach, Concepts And Cases* (17th Ed.). Pearson.
- Demirbas, A. (2009). Political, Economic And Environmental Impacts Of Biofuels: A Review. *Applied Energy*, 86, S108-S117.
- Directorate General Of New, Renewable Energy, And Energy Conservation (EBTKE). (2025). 2025 Performance Report: Contribution Of B35 Biodiesel To Indonesia. Ministry Of Energy And Mineral Resources Of The Republic Of Indonesia.
- Farizal, Et Al. (2024). Inefficiencies In Traditional Collection Methods Of Used Cooking Oil. *Journal Of Cleaner Production*. <https://doi.org/10.1016/j.jclepro.2024.142646>
- Grant, R. M. (2010). *Contemporary Strategy Analysis* (7th Ed.). John Wiley & Sons.
- Grant, R. M. (2016). *Contemporary Strategy Analysis: Text And Cases* (9th Ed.). John Wiley & Sons.
- Greene. (2021). Renewable Energy Directive (RED II) And Green Performance Of UCO In The European Union.
- He, Et Al. (2021). Price Sensitivity And Structural Dynamics In Oligopsonistic Biofuel Markets. *Energy Policy*.
- Hill, C. W. L., & Jones, G. R. (2012). *Strategic Management Theory: An Integrated Approach* (10th Ed.). Cengage Learning.

- Hossain, Et Al. (2023). Electric Vehicles Vs Biofuels: A Long-Term Substitution Analysis. Renewable And Sustainable Energy Reviews.
- International Organization For Standardization. (2018). ISO 31000:2018 — Risk Management Guidelines. ISO.
- Jones, G. R., & Hill, C. W. L. (2013). Strategic Management: An Integrated Approach. South-Western Cengage Learning.
- Kalamas, Et Al. (2020). Technological Flexibility Of Modern Biodiesel Refineries Toward Diverse Feedstocks. Bioresource Technology.
- Kojima, M. (2016). Government Mandates And Buyer Bargaining Power In Biofuel Industries. World Bank Group.
- Magar, V., Et Al. (2024). Competitive Dynamics In Growing Bioenergy Markets. International Journal Of Energy Economics.
- Mahesar, Et Al. (2014). Oxidation And Polymerization During Long-Term Storage Of Waste Cooking Oil. Journal Of Oleoscience.
- Maneerung, Et Al. (2016). Quality Enhancement And FFA Reduction Of Used Cooking Oil For Biodiesel Production. Energy Conversion And Management.
- Mannu, Et Al. (2019). Kinetics Of FFA Increase In Stored Waste Cooking Oils. Grasas Y Aceites.
- Ministry Of Energy And Mineral Resources (ESDM) Of The Republic Of Indonesia. (2023). National Biodiesel Mandatory Implementation Plan And Upstream Supply Readiness. Ministry Of Energy And Mineral Resources Of The Republic Of Indonesia.
- Panadés, Et Al. (2023). Traceability Systems In Global Bioenergy Supply Chains. Renewable Energy, 204, 115-127.
- Parker, G.G., Van Alstyne, M.W., & Choudary, S.P. (2016). Platform Revolution: How Networked Markets Are Transforming The Economy. WW Norton & Company.
- Porter, M.E. (2008). The Five Competitive Forces That Shape Strategy. Harvard Business Review, 86(1), 78-93.
- Rothaermel, F.T. (2020). Strategic Management (4th Ed.). Mcgraw-Hill Education.
- Rothaermel, F.T. (2021). Strategic Management (5th Ed.). Mcgraw-Hill Education.
- Rulli, Et Al. (2022). Overcapacity Dynamics In Regional Aggregations Of Used Cooking Oil. Resources, Conservation And Recycling.
- Schilling, M. A. (2020). Strategic Management Of Technological Innovation (6th Ed.). Mcgraw-Hill Education.
- Shapiro, C., & Varian, H.R. (1999). Information Rules: A Strategic Guide To The Network Economy. Harvard Business School Press.
- Silaban, & Sitorus. (2025). Pathways To Decarbonization In Indonesia: Mediating Effects Of Renewable Energy And Energy Efficiency On The Economic Growth-Emission Nexus. Kne Social Sciences. <https://doi.org/10.18502/Kss.V10i23.19764>
- Singh, & Kumar. (2024). Iot Sensors And Real-Time Quality Monitoring In Green Logistics. Journal Of Cleaner Production.
- Sorda, G., Et Al. (2010). Biofuel Policies And Certified Supply Chains Globally. Energy Policy, 38(11), 6977-6988.

Subhan, M., Siregar, H., Hamdi, E., & Syah, TYR (2021). The Integration Of Green Supply Chain Management And The Firm Value: A Conceptual Review. International Journal Of Research Publications And Reviews, 2(12), 1269-1273.