International Journal of Economics, Business and Innovation Research
https://e-journal.citakonsultindo.or.id/index.php/IJEBIR
E-ISSN : 2964-0865
IJEBIR

Analysis Of Strategy For Planning Sugarcane Farming Area Expansion In Indonesia To Support National Food Needs

Muhammad Nurdya Faiz[1], Al Hasin[2]

[1,2]Department of Management, Department of Management, Faculty of Business and Economics University of Islam Indonesia, Indonesia.

Abstract

Indonesia's reliance on sugar imports necessitates strategic agricultural expansion to achieve national food and energy security. This study aims to formulate land planning strategies for sugarcane area expansion and identify the factors influencing land adequacy for the sustainability of the sugar industry. The internship and research were conducted at PT Sinergi Gula Nusantara (PT SGN), the sugar subholding of PTPN Group, which plays a strategic role in supporting Indonesia's sugar self-sufficiency program. A qualitative approach was employed through in-depth interviews and field observations and data were analyzed using an interactive qualitative model to evaluate corporate strategies and field constraints. The results indicate that effective expansion relies on rigorous spatial identification, agroclimatic assessment, and the integration of digital technologies (GIS, drones, and smart farming) to enhance planning accuracy and operational efficiency. Furthermore, land adequacy is critically constrained by four interconnected factors: legal ownership status, infrastructure deficits, climate volatility, and labor regeneration challenges. The study also highlights that integrating sugar and bioethanol production is a vital strategy to maximize commodity value and support national energy security. Ultimately, successful land expansion requires integrated, multi-stakeholder planning. Strategic collaboration among the government, corporations, and farmers is essential to achieve sugar self-sufficiency and foster sustainable agricultural development in Indonesia

.

Keywords: sugarcane land expansion; sugar self-sufficiency; food and energy security; agricultural operations management; sustainable agriculture.

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

International Journal of Economics, Business and Innovation Research
https://e-journal.citakonsultindo.or.id/index.php/IJEBIR
E-ISSN : 2964-0865
IJEBIR

INTRODUCTION

Sugarcane is a strategic plantation commodity crucial for Indonesia's food and energy security, serving as the primary raw material for sugar and renewable bioethanol (Sitanggang, 2023). Despite its potential, national sugar production remains insufficient to meet domestic demand. With national production estimated at only 2.46 million tons against a consumption requirement of approximately 3.4 million tons annually, Indonesia heavily relies on sugar imports (Outlook tebu, 2023). This deficit is driven by limited productive agricultural land, land conversion, suboptimal soil quality, inadequate modern technology application, poor supporting infrastructure, and uneven land distribution, which collectively hinder optimal domestic market fulfillment (Ahmad Zainuddin, 2018). To address this, the Indonesian government issued Presidential Regulation No. 40 of 2023 on the Acceleration of Sugar Self-Sufficiency and Bioethanol Provision, which strategically mandates a national expansion of sugarcane land to 700,000 hectares to boost production, reduce import dependence, and develop eco-friendly bioethanol (Sitanggang, 2023). However, this expansion necessitates comprehensive and sustainable planning that accounts for potential land availability, infrastructure development, resource management, multi-stakeholder collaboration, and socio-environmental impacts to prevent negative ecological and social consequences (Silalahi, 2024).

As a sugar sub-holding of the PTPN Group, PT Sinergi Gula Nusantara (PT SGN) plays a pivotal role in this national self-sufficiency program and is required to enhance productivity and operational efficiency through precise sugarcane sector development strategies (Sri Rizky Amala, 2025). Consequently, an in-depth analysis of land expansion planning is essential. Sugarcane land expansion is intrinsically linked to operations management and supply chain management; as the primary raw material source, optimal land management directly improves operational efficiency and secures national sugar supply stability (Kamila Anindita, 2020). Therefore, implementing operations management and Total Quality Management (TQM) concepts is vital to ensure effective, efficient processes oriented toward continuous quality improvement. Furthermore, Indonesia possesses vast untapped land potential, particularly in Sumatra, Kalimantan, and Papua, which presents a significant opportunity for increasing national sugar production if managed with appropriate strategies (Hakim, 2010).

Based on this context, this study aims to analyze sugarcane land expansion planning strategies to support national food and energy security. Furthermore, it seeks to identify the factors influencing land adequacy for the sustainability of Indonesia's

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

sugarcane agricultural sector. Ultimately, this research provides strategic recommendations for the government and PT SGN to develop a more effective, efficient, and sustainable sugarcane sector, thereby supporting the achievement of national sugar self-sufficiency and renewable energy development (Silalahi, 2024).

OBJECTIVE

This study is designed to provide practical benefits for PT Sinergi Gula Nusantara by enhancing operational effectiveness and facilitating better decision-making. Specifically, the research objectives are twofold: first, to formulate effective land planning and utilization strategies to meet national food and energy demands through sugarcane land expansion; and second, to identify and analyze the factors influencing land adequacy to support the sustainability of the sugarcane agricultural sector in Indonesia.

LITERATURE REVIEW

Agricultural Land Expansion

Agricultural land expansion is an extensification strategy to increase production capacity by adding cultivated areas when intensification limits are reached (Soekartawi, 2003). In the sugarcane sector, this secures raw materials for the national sugar and bioethanol industries, driving new developments outside Java to support self-sufficiency. However, expansion requires meticulous site selection based on land suitability, climate, soil fertility, water availability, and environmental sustainability, especially since it often involves low-productivity marginal lands needing specialized management. Success also depends on supporting infrastructure, cultivation technology, mechanization, and plantation-industry integration, which collectively enhance processing efficiency and new area productivity (Silalahi, 2024).

National Sugar Self-Sufficiency Policy

Presidential Regulation No. 40 of 2023 serves as a strategic foundation to accelerate national sugar self-sufficiency and bioethanol development, responding to high import dependency and the need for eco-friendly alternative energy. Mandating the sugar sector to fulfill both food and energy security, the regulation targets a productivity increase to 93 tons/ha and a 700,000-hectare land expansion sourced from plantations, abandoned lands, and specific forest areas. This frames land expansion as a cross-sectoral strategy encompassing economic, food, energy, and environmental aspects. Furthermore, it emphasizes industrial efficiency via mill modernization, yield

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

improvement, and farmer welfare, targeting consumption self-sufficiency by 2028 and industrial/bioethanol self-sufficiency by 2030. Achieving these goals requires multi-stakeholder synergy, ultimately positioning the policy to simultaneously support national food security and renewable energy development (Perpres No. 40, Tahun 2023).

Operations Strategy in Operations Management

Sumayan (2003) defines operations strategy as the directional driver for decision-making integrated with business strategy to generate consistent decisions and competitive advantage. Similarly, Heizer, Render, and Munson (2020) state it builds competitive advantage by delivering products efficiently, with high quality, timely delivery, and flexibility. In agriculture, this translates to improving land productivity, input efficiency, mechanization, and capacity expansion. Thus, agricultural land expansion acts as a capacity strategy decision, as production capacity relies heavily on the managed land area alongside technology and labor. Broadly, operations management efficiently transforms inputs into outputs through planning, organizing, and controlling to boost productivity, reduce costs, and ensure flexibility (Novitasari, 2022). It creates value-added, competitive products by comprehensively managing production and distribution to deliver optimal customer value (Schroeder, 2011).

Supply Chain Management

Supply Chain Management (SCM) coordinates procurement, production, inventory, and delivery from suppliers to customers, encompassing administration, logistics, and information processing (Irawan, 2024). In the sugarcane industry, SCM is critical due to the time-sensitive nature of the product and raw material quality. The chain spans land provision, cultivation, harvesting, milling, and distribution, requiring seamless integration for an effective and sustainable system (Syamil, 2023). Agricultural land is the foundational starting point; its availability and quality directly dictate supply chain continuity. Adequate land ensures raw material supply for mills, whereas instability disrupts production and market prices (Jumiono, 2024). Ultimately, SCM reduces costs, accelerates distribution, minimizes harvest losses, and enhances competitiveness through effective multi-stakeholder coordination and integrated logistics and information systems(JuliaF,2024).

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

International Journal of Economics, Business and Innovation Research
https://e-journal.citakonsultindo.or.id/index.php/IJEBIR
E-ISSN : 2964-0865
IJEBIR

Land Availability for Expansion

Land availability is crucial for expanding sugarcane areas to achieve national self-sufficiency and bioethanol goals. The Agency for Agricultural Land Resources Research and Development (BBSDLP) identifies 30.67 million hectares of underutilized agricultural land in Indonesia, including 15.31 million hectares of dry land suitable for perennial plantations like sugarcane. Mostly located in Kalimantan, Papua, and Sumatra, these areas offer vast reserves compared to Java, which faces heavy land conversion. Consequently, new development is directed outside Java. However, utilization faces challenges regarding land legality and status, as much of it lies in production or convertible forests requiring regulatory adjustments. Furthermore, biophysical constraints like peat and acidic marginal lands demand specialized management technologies to ensure productivity. Thus, land suitability evaluations, conservation, and technological innovation are essential for optimal development (Anny Mulyani, 2011). Strategically, expanding on these potential lands can increase domestic production, reduce imports, and support national food and energy security, provided environmental sustainability is strictly maintained to prevent ecosystem damage and land-use conflicts.

METHODOLOGY

This study employs a qualitative approach to analyze sugarcane land expansion strategies supporting national food and energy security, as mandated by Presidential Regulation No. 40 of 2023 (Creswell, 2014). Conducted during an internship at PT Sinergi Gula Nusantara (PT SGN), primary data were gathered via field observations and in-depth interviews with key informants (e.g., APTRI Head, farmers, mill officials) to explore expansion strategies, land adequacy, and technological integration (Nasution, 2023). These insights were triangulated with secondary data from institutional reports, land assessments (BBSDLP, 2021), and literature to establish a robust contextual foundation (Sulung, 2024). Data were processed using an interactive qualitative analysis model (Sugiyono, 2020; Miles & Huberman, 2014; Miles, 2014), progressing through data collection, reduction, display, and conclusion drawing with verification (Qomarudin, 2024). Ultimately, this process evaluates corporate policies against real-world challenges (e.g., land limitations, legal constraints, infrastructure deficits) to formulate effective, sustainable solutions for national sugar self-sufficiency.

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

International Journal of Economics, Business and Innovation Research
https://e-journal.citakonsultindo.or.id/index.php/IJEBIR
E-ISSN : 2964-0865
IJEBIR

RESULTS AND DISCUSSION

The empirical findings derived from in-depth interviews with three key informants: Sunardi Edy Sukamto (Chairman of APTRI Regional Board), Suparmin (Sugarcane Farmer), and Agus Santoso (Sugar Mill Official). Direct, in-depth questioning allowed the researcher to obtain rich, contextualized insights based on the informants' practical experiences and perspectives (Arianto, 2024). The findings are structured to directly address the two primary research objectives of this study.

Land Planning and Utilization Strategies for National Food and Energy Demands

To meet national food (sugar self-sufficiency) and emerging energy demands, PT Sinergi Gula Nusantara (SGN) employs a multi-dimensional strategy for sugarcane area expansion, integrating rigorous planning with modern technology.

Strategic Land Planning and Utilization

Effective expansion requires a phased approach to ensure both productivity and sustainability. First, spatial identification and mapping utilize Geographic Information Systems (GIS) to verify land legality (e.g., distinguishing HGU, community land, or forest areas) and assess topographic suitability for mechanization. Second, agroclimate suitability evaluation analyzes microclimatic conditions (rainfall, dry months, sunlight) and edaphic characteristics (soil texture, pH, nutrients) to guarantee high tonnage and yield. Third, economic and market feasibility ensures financial viability by projecting initial investment costs against harvest yields, while strictly enforcing a <24-hour harvest-to-mill logistics window to preserve sucrose amendment. Finally, this planning is anchored by institutional support and environmental sustainability, incorporating mutually beneficial smallholder partnership models, Good Agricultural Practices (GAP) training, and zero-burning land clearing to prevent ecological degradation and land-use conflicts.

Technology-Driven Utilization for Operational Efficiency

To actualize these plans, SGN leverages technology to transition from manual reliance to data-driven decision-making. GIS and digital mapping provide macro-level land suitability filtering and legal overlay verification to prevent agrarian disputes. Unmanned Aerial Vehicles (UAVs/drones) generate high-resolution 3D topographic models for precise irrigation and block design prior to land clearing. During cultivation, smart farming applications enable real-time monitoring of vegetative health (via NDVI indices) and precision agriculture for targeted fertilization and irrigation. Furthermore,

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

integrated digital platforms facilitate early pest detection, daily growth monitoring, and predictive yield forecasting, seamlessly synchronizing field harvest readiness with the Sugar Mill's (PG) grinding capacity.

Integration with Bioethanol for Energy Demand Fulfillment

Beyond food security, land utilization strategies are increasingly aligned with national energy demands. SGN is actively exploring the integration of sugar and bioethanol production. This circular economy approach diversifies corporate revenue, maximizes the value-added of sugarcane by-products, and reduces production waste. By utilizing the entire sugarcane plant, this integration enhances overall industrial efficiency, positioning sugarcane expansion as a dual pillar for both national food and energy security.

Factors Influencing Land Adequacy for Sector Sustainability

The sustainability of the Indonesian sugarcane agricultural sector is heavily contingent upon land adequacy, which this study identifies as being governed by four critical, interrelated factors.

Legal Certainty and Land Ownership Status

Legal clarity is the foundational prerequisite for land adequacy. Interview findings reveal that technically suitable lands are frequently hindered by administrative bottlenecks, overlapping permits, and agrarian conflicts. Because the sugar industry requires long-term, continuous raw material supply, ambiguous land status poses severe operational and investment risks. Thus, integrated and transparent land administration is non-negotiable for sustainable agricultural investment.

Supporting Infrastructure Adequacy

Physical infrastructure directly dictates the economic viability of sugarcane land. Proximity to sugar mills, road accessibility, and irrigation networks are paramount. Given sugarcane's rapid post-harvest sucrose degradation, inadequate logistics infrastructure inflates transportation costs and degrades raw material quality. Robust infrastructure not only optimizes the supply chain but also incentivizes farmer participation by guaranteeing reliable market access.

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

Agroclimate Vulnerability and Climate Change

Natural conditions remain a primary determinant of land adequacy. SGN rigorously evaluates baseline agroclimate data (rainfall, temperature, topography) before expansion. However, increasing climate volatility manifested in erratic rainfall, prolonged dry seasons, and extreme weather elevates crop failure risks. Consequently, long-term land adequacy requires proactive climate adaptation strategies embedded within the expansion planning phase.

Socio-Demographic Shifts and Labor Availability

Sustainability is ultimately a human endeavor. Findings indicate that land adequacy is meaningless without adequate social support and labor. A critical threat to the sector is the aging demographic of current sugarcane farmers and the declining interest of younger generations, who perceive agriculture as economically unviable. Addressing this requires systemic interventions to improve the socioeconomic appeal of farming, ensuring a competent, productive, and regenerated workforce to sustain future production.

CONCLUSION

Based on the findings regarding sugarcane land expansion at PT Sinergi Gula Nusantara (PT SGN), the success of this initiative relies not solely on land availability, but on the company's capacity for effective and sustainable resource management. PT SGN's strategy effectively integrates land potential identification, technology-based mapping, suitability analysis, and stakeholder coordination. The utilization of digital technologies, specifically Geographic Information Systems (GIS), drones, and smart farming systems significantly enhances planning accuracy, operational efficiency, and monitoring effectiveness. Furthermore, this study confirms that land adequacy for sector sustainability is governed by four interconnected factors: (1) land legality and ownership status, which dictate long-term investment certainty; (2) infrastructure availability (roads, irrigation, transport), which directly impacts productivity and distribution efficiency; (3) agroclimatic conditions, where climate change poses a tangible risk to crop yields; and (4) social factors, notably labor availability and farmer regeneration, which present critical long-term sustainability challenges. Ultimately, this strategic sugarcane development supports dual national goals: food security through increased sugar production and energy security via bioethanol integration.

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

To optimize these outcomes, strategic recommendations are directed toward both the company and the government. For PT SGN, it is crucial to continuously strengthen data-driven land expansion planning using GIS and integrated monitoring. The company should also expand partnerships with farmers and local governments to accelerate new land development and boost existing productivity through technical guidance and modern agricultural technology transfer. Concurrently, integrating the sugar and bioethanol industries must be prioritized to increase commodity value-added and support national energy security. For the government, accelerating the resolution of land legality issues and harmonizing spatial policies are imperative to expedite national sugar self-sufficiency programs. Furthermore, the government must enhance agricultural infrastructure to support supply chain efficiency and fortify farmer regeneration programs. Providing incentives, entrepreneurship training, and improved financing access is essential to make the sugarcane sector more attractive and viable for the younger generation.

REFERENCES

Ahmad Zainuddin, R. W. (2018). analisis potensi produksi tebu dengan pendekatan fungsi produksi frontir di PT Perkebunan Nusantara X. *Jurnal Pangan*, 33-42.

Anny Mulyani, S. R. (2011). Potensi Dan Ketersediaan Sumber Daya Lahan Untuk Mendukung Ketahanan Pangan. *Jurnal Litbang Pertanian*, 73-79.

Braun, V. &. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 77-101.

Hakim, M. (2010). Potensi Sumber Daya Lahan untuk Tanaman Tebu di Indonesia. *Jurnal Agrikultura*, 5-12.

International Journal of Qualitative Methods, 16 (1).

Irawan, I. (2024). *Manajemen Rantai Pasok.* Jambi: PT. Sonpedia Publishing Indonesia. John

W. Creswell, J. D. (2014). *Research Design .* Singapore: SAGE Publication.

Julia F, S. E. (2024). Kinerja Industri dan Dinamika Kebijakan Komoditas Gula Kristal Putih Nasional. . *Indonesian Sugar Research Journal*, 68-79.

Jumiono, A. (2024). *Manajemen Rantai Pasok .* Jambi: Sonpedia Publishing Indonesia.

Jurnal Perencanaan Pembangunan Pertanian, 75-86.

Kamila Anindita, I. G. (2020). Kinerja Rantai PAsok Di Pabrik Gula Madukismo Dengan Metode Supply Chain Operation Reference Analytical Hierarchy Process. *Jurnal Sosial Ekonomi dan Kebijakan Pertanian*, 125-134.

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

Miles, M. B. (2014). *Qualitative Data Analysis : A Metods Sources Book .* Singapore: SAGE Publication.

Nasution, A. F. (2023). *Metode Penelitian Kualitatif.* Bandung: Harfa Creative.

Novitasari, D. (2022). *Manajemen Operasi Konsep dan Esensi.* Yogyakarta: STIE Widya Wiwaha.

Nowell, L. S. (2017). Thematic analysis : Striving to meet the trustworthiness criteria. Silalahi, A. V. (2024). Kebijakan Pengembangan Tebu Menuju Swasembada Gula Konsumsi.

SIlalahi, A. V. (2024). Kebijakan Pengembangan Tebu Menuju Swasembada Gula Konsumsi.

Sitanggang, L. (2023). Kebijakan Gula dan Bioethanol : Perpres 40/ 2023 Langkah Nyata Ketahanan Pangan dan Energi. *Policy Brief*, 1407-1411.

Sri Rizky Amala, M. S. (2025). Kedudukan Hukum Sub Holding Dalam Restrukturisasi BUMN: Studi Kasus PT Sinergi Gula Nusantara. *Jurnal Ilmiah "Advokasi"*, 1132-1148.

Sugiharto. (2000). *Total Quality Management.* Jakarta: PT Gramedia Pustaka Utama. Sugiyono. (2020). Metode Penelitian Kualitatif, Kuantitatif, dan R&D. *Alfabeta*, 105.

Syamil, A. (2023). *Buku Ajar Manajemen Rantai Pasok .* Indoneisa: Sonpedia Publishing Indonesia.

undari sulung, m. m. (2024). memahami sumber data penelitian : primer, sekunder, dan tersier. *Indonesian Institute for corporate learning and studies*, 110 - 116.

Qomarudin, H. S. (2024). Kajian Teoritis tantang Teknik Analisis Data dalam Penelitian Kualitatif: Perspektif Spradley, Miles dan Huberman. *Journal of Management, Accounting and Administration*, 77-84.

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.