



Proposed Business Strategy for Implementation of Green Port at Merak Ferry Port to Achieve Sustainability

Muhammad Ikhsan Anwar¹, Widhyawan Prawiraatmadja²

^{1,2}School of Business and Management, Bandung Institute of Technology (ITB), Indonesia

ABSTRACT: Climate change is a challenge for the global world, requiring immediate action to reduce its impact on the environment. Indonesia is a party to the Paris Agreement, where Indonesia is committed to reducing greenhouse gas emissions by 31.89% by 2030. As a state-owned company, PT. ASDP Indonesia Ferry (Persero), which operates in the port and ferry sector, is one of the transportation industry entities in Indonesia that plays a role in supporting this commitment. Merak Ferry Port, the largest port managed by PT. ASDP Indonesia Ferry (Persero) requires the implementation of environmentally friendly port practices to be in line with sustainability goals. This research aims to develop a business strategy for implementing a green port at the Merak Ferry Port to achieve sustainability. Identify best practices from globally successful green port initiatives, evaluate the status of Merak Ferry Port in terms of sustainability initiatives, and propose actionable strategies to transition towards sustainable port operations. The research methodology includes qualitative analysis by collecting primary data through stakeholder interviews and collecting secondary data from case studies and related documents. Analytical tools such as Benchmarking, PESTEL, VRIO, and Value Chain analysis are used to assess internal and external factors influencing port sustainability. These findings indicate that there is a great opportunity for the Merak Ferry Port to improve environmental performance through the application of renewable energy, energy-saving technology and a comprehensive waste management system. The proposed strategy emphasizes the integration of environmental, economic and social dimensions of sustainability by utilizing the Triple Bottom Line approach. The green port implementation strategy implementation plan outlines specific actions, timelines, and resource allocation to ensure successful implementation of environmentally friendly port practices. This study contributes to knowledge about sustainable port management and provides business solutions for PT. ASDP Indonesia Ferry (Persero) to increase operational efficiency and concern for the environment. The results of this research underscore the importance of aligning business strategy with a commitment to national and international sustainability to achieve long-term viability and competitiveness in the port and ferry industry.

KEYWORDS: Business Strategy, Green Port, Merak Ferry Port, Sustainability, Triple Bottom Line.

INTRODUCTION

The world is grappling with an unprecedented climate crisis, characterized by rising global temperatures, melting ice caps, and extreme weather events. In response, international agreements such as the Paris Agreement and the United Nations Framework Convention on Climate Change (UNFCCC) have been established. These agreements set targets for countries to reduce greenhouse gas emissions and mitigate climate change impacts. Article 2 of the Paris Agreement aims to limit global temperature increase to well below 2°C, with efforts to reduce it further to 1.5°C above pre-industrial levels.

Indonesia, as a signatory to these agreements, has committed to reducing greenhouse gas emissions by 31.89% by 2030, as stated in its Enhanced Nationally Determined Contributions (ENDC) presented at the UNFCCC in September 2022. This commitment is reinforced by Presidential Regulation No. 98 of 2021, which addresses the implementation of carbon economic value to achieve national contribution targets and regulate greenhouse gas emissions in the context of national development. This regulation underscores Indonesia's dedication to combating climate change. To control greenhouse gas emissions, Indonesia has integrated climate policies into its national development plans, aiming for low greenhouse gas emissions development and climate resilience by 2050. PT ASDP Indonesia Ferry (Persero), a state-owned enterprise operating in the port and ferry industry, plays a crucial role in contributing to environmental sustainability. Given the environmental impact of its operations, PT ASDP Indonesia Ferry (Persero) is committed to aligning its activities with the country's sustainability goals.

The 2014–2024 National Action Plan for Climate Change Adaptation (RAN-API) mandates contributions from various ministries and institutions, including the Ministry of Transportation, to enhance resilience and reduce vulnerability to climate change. As part



of the Ministry of State-Owned Enterprises, PT ASDP Indonesia Ferry (Persero) operates within the regulatory framework of the Ministry of Transportation, which has outlined its role in handling global climate change impacts on the maritime sector in the 2020–2045 Climate Resilience Development Policy Document.

Merak Ferry Port, the largest port managed by PT ASDP Indonesia Ferry (Persero), is a critical node connecting Java and Sumatra. Serving hundreds of ferry trips daily, the port has a significant environmental footprint. Recognizing the need to reduce this impact, the port is adopting the Green Port concept, which emphasizes sustainable practices and management to minimize environmental impact. The Green Port concept includes reducing emissions and energy use, implementing green technologies, and improving waste and water management. While the benefits of transitioning to a Green Port are clear, the process involves challenges such as the need for significant capital investment, technological upgrades, and changes in operational practices. Additionally, regulatory frameworks must support and incentivize green practices.

PT ASDP Indonesia Ferry (Persero) has outlined its vision, mission, and company strategy, emphasizing sustainable environmental standards. The company's strategy, represented as a "strategy house," includes three strategic pillars: Business Expansion, Operational Excellence, and Foundation. These pillars support the company's growth and sustainability goals, aligning with the Sustainable Development Goals (SDGs) prioritized by the company.

This study aims to develop a business strategy for implementing a Green Port at Merak Ferry Port to achieve sustainability. The research explores the application of green port strategies in other countries, evaluates the current status of Merak Ferry Port in implementing green port practices, and develops a strategy for the implementation of green port practices at Merak Ferry Port. The objectives are to identify best practices in green port initiatives from other countries, assess Merak Ferry Port's current status in implementing green port practices, and formulate a strategy for implementing green port practices at Merak Ferry Port.

LITERATURE REVIEW

A. *The Concept of Sustainability*

Sustainability is an essential and contemporary concept that deals with the fundamental challenge of harmonizing human needs with environmental preservation. The notion of sustainability has undergone significant development in recent decades, propelled by mounting apprehensions regarding the repercussions of human activities on the planet's resources and the imperative to ensure a viable future for future generations.

The concept of sustainability emerged during the 1960s and 1970s in response to mounting ecological concerns, resulting in a heightened focus on safeguarding the environment (Najjar, 2022). The notion of sustainable development arose as a consequence of this and was formally delineated by the Brundtland Commission in 1987 as "development that meets the needs of the present generation, without compromising the ability of future generations to meet their own needs" (Siew, 2015). This definition highlights the importance of achieving a balanced equilibrium between economic, social, and environmental factors in order to ensure long-term viability and equitable distribution of resources.

B. *Sustainability Development*

Sustainability in business has become a critical issue, influencing production, consumption, and decision-making processes. Organizations increasingly recognize the need to fulfill their economic, environmental, and social responsibilities. Sustainable development is more than regulatory compliance or occasional green initiatives; it involves integrating sustainability throughout an organization's operations and decision-making processes. Sustainability aims to meet present needs without compromising future generations' ability to meet their own needs (Alshehhi et al., 2018).

A comprehensive business strategy that addresses sustainability challenges aligns social, environmental, and economic factors. Collaboration between business, government, and civil society is essential for sustainable development, as sustainability relies on collective efforts and a commitment to the environment and societal well-being (Soomro, 2023). Integrating sustainable practices into core operations and decision-making processes is crucial. This involves aligning sustainability goals with business strategy and embedding sustainable practices across the value chain, from procurement to customer engagement (Developing a Brilliant Business Strategy for Sustainable Development, 2020).



C. Integrating Sustainability into Business Strategy

The Triple Bottom Line (TBL), developed by John Elkington in the mid-1990s, expands the traditional focus on financial performance to include ecological and social imperatives. This model emphasizes that a company's success should be measured not only by its financial outcomes but also by its impact on the planet and people. By aligning profit, people, and the planet, organizations can achieve long-term, comprehensive sustainability (Gopalakrishnan et al., 2012). The economic component of the TBL represents a company's capacity for prosperity, profitability, and financial solvency. It involves not only short-term profitability but also long-term competitiveness through sustainable practices. This approach encourages organizations to consider environmental and social factors alongside economic objectives to create long-term value. The environmental dimension addresses issues such as climate change, global warming, pollution, and resource depletion. Businesses are encouraged to reduce their carbon footprint, minimize waste, and conserve resources. Incorporating environmental sustainability can save money, enhance corporate image, and foster innovation in green products and services (McDonough, 2002; Gopalakrishnan et al., 2012). The social aspect pertains to the impact of a business on its employees, the local community, and society at large. It includes labor practices, worker health and safety, community engagement, and social equity. The interconnectedness of the economic, environmental, and social dimensions equips businesses to deliver long-term value, manage risks, and adapt to changing market requirements (A Comprehensive Guide on Corporate Social Responsibility (CSR), 2020). By aligning these three areas, companies can develop sustainable initiatives that drive innovation, provide operational benefits, and establish themselves as responsible businesses.

D. Green Port

The Green Port concept encompasses the integration of environmental stewardship and sustainable practices into port operations, with a focus on mitigating significant environmental impacts including energy consumption, waste generation, and pollution (Hollen et al., 2014). Green Ports have been developed in response to these challenges with the goal of minimizing their ecological impact through the implementation of sustainable practices and innovative strategies. The key focus of Green Port development is to ensure that transportation functions are in line with urban sustainability principles (Hall, 2007). This entails developing and implementing advanced transportation infrastructure and technologies to reduce the negative environmental impacts caused by port operations. Important strategies to address environmental concerns in ports include reducing greenhouse gas emissions, optimizing ship routes, and integrating renewable energy sources and energy-saving technologies into port infrastructure.

The concept of Greening and Performance Relativity is essential for achieving a balance between environmental and financial considerations in green port operations (Lun et al., 2015). Investing in environmentally friendly practices can improve the performance of companies, especially in the shipping industry, by optimizing strategies for managing fleets, routes, schedules, and fuel consumption. This equilibrium promotes both ecological and financial sustainability in port operations. The attainment of a Green Port necessitates the collaboration of key decision-makers, port authorities, the shipping industry, and other relevant parties in order to devise and execute cutting-edge, environmentally friendly measures. The transition from a trade-focused to a sustainable governance framework entail utilizing emerging technologies, streamlining logistical operations, and harmonizing incentives and regulations. Ports can achieve substantial reductions in greenhouse gas emissions and air pollution, as well as improve operational efficiency and economic sustainability, by incorporating renewable energy, energy-efficient technologies, and comprehensive fleet management strategies (Tong & Mao, 2014).

E. Port Sustainability Performance

The sustainability of ports has emerged as a crucial issue in contemporary port activities, affecting the environment, social well-being, and economic competitiveness (Hollen et al., 2014). Ozispa and Arabelen (2018) have developed comprehensive tools for evaluating the environmental performance of small ports. These tools allow for the identification of inefficiencies, implementation of best practices, and comparison of eco-friendliness with industry standards. These tools assess the sources of emissions, inefficiencies, and overall environmental performance, assisting ports in showcasing their sustainability qualifications and competing successfully (Yarmy & Sereno, 2011).

A comprehensive framework for port sustainability comprises 16 actions and measures that encompass economic, social, and environmental aspects. These efforts are in line with the United Nations Sustainable Development Goals (Abood, 2007; Ozispa & Arabelen, 2018). An exhaustive examination of existing literature on the measurement of port sustainability performance emphasizes the significance of precise indicators for assessing sustainability. This examination specifically emphasizes the



measurement of sustainability in relation to pollution, human resource management, and port management and investment. In addition, a theoretical intelligent framework for managing the sustainability performance of Nordic container ports utilizes artificial intelligence to monitor performance in the economic, environmental, and social domains (Yarmy & Sereno, 2011). There has been an increase in research on the sustainability and performance of ports. This research focuses on studying ways to develop industrial ecosystems and make ports more environmentally friendly. It also explores the use of different management tools for this purpose (Hollen et al., 2014). Conducting pilot projects to test the efficacy and implementation effort of sustainability guidelines. The significance of conducting a systematic analysis of performance indicators in major ports in India is highlighted by the performance analysis. This analysis enables ports to evaluate their effectiveness, identify any deficiencies, and strategize for enhancements (Yarmy & Sereno, 2011).

RESEARCH METHOD

According to Khanday & Khanam (2019), research design is a methodical structure that allows researchers to develop a well-structured and logical approach to effectively address the research problem. The main objective of the framework is to efficiently integrate various research components into a comprehensive plan that encompasses the stages of data collection, measurement, and analysis in the research process (Indu & Vidhukumar, 2019).

The authors employ a qualitative methodology to investigate and examine business issues using the tools and frameworks as shown in Figure 1. The data collection process will entail obtaining primary data through interviews and secondary data through case studies and relevant documents. The external analysis will be performed using benchmarking and PESTEL analysis, whereas the internal analysis will be carried out using VRIO and value chain analysis. A cost-benefit analysis will assess the potential costs and benefits of adopting green port strategies. SWOT analysis is a method that gathers insights from both internal and external analyses. The process of developing a strategy for implementing the green port strategy at the Merak Ferry Port involves a methodical approach to establishing objectives, assessing the environment, defining measurable goals, coordinating divisional plans, selecting effective strategies, and creating comprehensive action plans. By adhering to these steps, companies can synchronize their strategy with their desired long-term goals and achieve successful execution and ongoing enhancement.

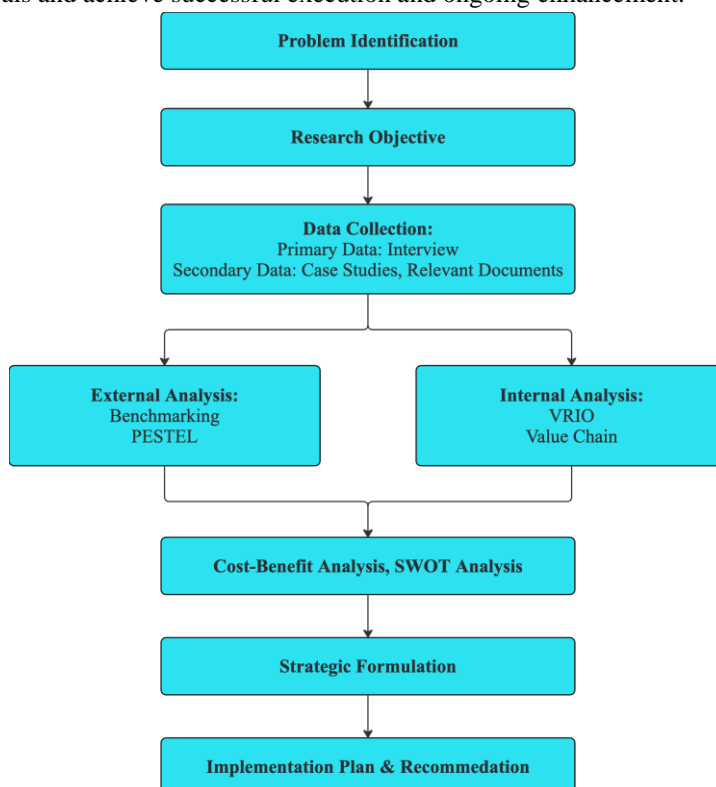


Figure 1. Research Design Framework (Source: Author, 2024)



ANALYSIS

A. External Analysis

BENCHMARKING: The process entails the identification of industry-leading practices and sustainability standards, which subsequently expose deficiencies and potential areas for enhancement at Merak Ferry Port. In order to achieve success and avoid common mistakes, Merak Ferry Port should analyze successful initiatives in green port practices and develop effective strategies accordingly. The benchmarking analysis will compare the best practices of the world's leading Ro-Ro ferry ports with Merak Ferry Ports. This analysis will assist the author in identifying discrepancies between the implementation of sustainability and operational strategies in Merak Ferry Ports and will offer valuable insights into the most effective methods for achieving sustainability objectives. Two international Ro-Ro ferry ports were chosen for the study: Gothenburg Ferry Port in Sweden and Zhoushan Ferry Port in China. Both ports are known for their sustainability initiatives and practices in their daily operations.

Table I. Gap Analysis on The Social Aspects of Merak Ferry Port (Source: Author, 2024)

Focus Area	Desired Future State	Identified Gap	Action Plan
Stakeholder Involvement	Wider and inclusive collaboration with stakeholders including communities around the port.	Lack of extensive collaboration with stakeholders in sustainability programs.	Develop a more intensive and inclusive stakeholder engagement strategy.
HR Development and Training	Comprehensive ongoing training program for sustainability.	Training programs that do not yet include more advanced sustainability technologies and practices.	Develop and implement advanced training programs on sustainability technologies and practices.
CSR Initiatives	A comprehensive CSR program with a big impact.	CSR programs are still limited in scope and scale.	Expand CSR programs to include more environmental and community development initiatives.

Table II. Gap Analysis on The Economic Aspects of Merak Ferry Port (Source: Author, 2024)

Focus Area	Desired Future State	Identified Gap	Action Plan
Economic Impact	Wider and inclusive collaboration with stakeholders including communities around the port.	Limited focus on broader economic contribution and stability.	Develop strategies to increase the port's economic contribution, support local jobs, and stimulate regional development.
Energy Efficiency and Waste Management	Effective and efficient energy and waste management systems.	Waste management system still in the planning stage and energy efficiency initiatives not yet optimal.	Develop and implement advanced training programs on sustainability technologies and practices.
Innovative Financing Models	Financing models that support investment in environmentally friendly technology.	Financial constraints in investing in environmentally friendly technology.	Explore innovative cooperation models such as public-private partnerships and profit-sharing schemes.
Infrastructure Development	Port infrastructure that supports economic sustainability.	Limitations in investing in environmentally friendly infrastructure due to financial challenges.	Identify and secure additional funding sources for the development of environmentally friendly infrastructure.



Table III. Gap Analysis on The Environmental Aspects of Merak Ferry Port (Source: Author, 2024)

Focus Area	Desired Future State	Identified Gap	Action Plan
Integration of Green Technology	Comprehensive implementation of environmentally friendly technology.	Limited integration of environmentally friendly technology at Merak Ferry Port.	Implement renewable energy sources and other environmentally friendly technologies.
Commitment to Environmental Regulations	Compliance with global and national environmental regulations.	Need to enhance integration of safety and health standards with environmental sustainability.	Achieve certifications such as ISO 14001 and improve compliance with global environmental and safety standards.
Renewable Energy	Increase the use of renewable energy sources such as solar and wind power.	Dependence on conventional energy sources is still high.	Increase the capacity and number of solar panel installations and the use of electric vehicles at ports.
Hazardous Waste Management	Effective hazardous waste management system.	Hazardous waste (B3) management still in the planning stage.	Accelerate the development and implementation of a comprehensive hazardous waste management system.

PESTLE: The PESTLE Analysis is a methodology employed to evaluate and supervise the external factors that influence an organization, such as political, economic, sociocultural, technological, ecological, and legal factors. In a particular country or region, these factors are the most significant in terms of their impact on a business (Rothaermel, 2021). This analysis covers several aspects including Political, Economic, Social, Technological, Environmental and Legal which are important for developing and implementing a successful environmentally friendly port strategy. Understanding the impact of these factors helps authors identify opportunities and challenges and ensure that proposed strategies are not only effective but also sustainable in the long term. By aligning with government policies, exploiting economic opportunities, community involvement, adopting advanced technology, mitigating environmental impacts, and complying with legal regulations, PT ASDP Indonesia Ferry (Persero) can create a strong foundation for implementing a green port strategy to achieve sustainability.

Table IV. The PESTLE Analysis of PT ASDP (Source: Author, 2024)

Factor	Description	Opportunity/Threat
Political	<ul style="list-style-type: none"> Indonesia's commitment to reducing greenhouse gas emissions by 31.89% by 2030 presents an opportunity for PT ASDP to align with national goals and gain government support for green initiatives. Compliance with global agreements like the Paris Agreement and IMO regulations can enhance PT ASDP's reputation and open up international funding and support for green projects. 	Opportunity
Economic	The significant capital investment required for infrastructure and technology upgrades presents a financial challenge that needs strategic planning and innovative financing models.	Threat
Social	<ul style="list-style-type: none"> Increasing environmental awareness drives the adoption of green practices, providing social support for PT ASDP's initiatives. Active involvement of local communities, employees, and stakeholders ensures broad support and aligns the green port strategy with local needs. Investing in continuous training programs helps build a skilled workforce capable of implementing and maintaining sustainable practices. 	Opportunity



Technological	<ul style="list-style-type: none"> Adoption of advanced technologies such as electric and hybrid ferries, renewable energy systems, and automation offers opportunities to reduce emissions and improve efficiency. Continuous research and development and collaboration with experts can lead to the implementation of innovative and sustainable practices. 	Opportunity
Legal	Complying with national and international environmental, safety and health regulations will increase the reputation and operational legitimacy of PT ASDP.	Opportunity
Environmental	<ul style="list-style-type: none"> Regular energy audits and optimization offer opportunities to improve efficiency and reduce operational costs. Implementing electric vehicles and onshore power supplies can significantly reduce the port's carbon footprint, contributing to environmental sustainability. 	Opportunity

B. Internal Analysis

VRIO Analysis: The VRIO framework is a strategic analysis tool that evaluates the internal resources and capabilities of PT ASDP to determine if they can offer a lasting competitive advantage. VRIO is a shortened form of the acronym that stands for Valuable, Rare, Inimitable, and Organized. The VRIO framework enables the author to assess and analyze the resources and capabilities of PT ASDP in their implementation of the Green Port strategy with the goal of achieving sustainability. A company's internal resources are analyzed using the VRIO framework to ascertain whether it can establish a sustainable competitive advantage (Rothaermel, 2021).

Table V. Internal Analysis of PT ASDP Using VRIO Framework (Source: Author, 2024)

Resource/Capability	Value	Rarity	Imitability	Organization	Result
Environmental Sustainability Commitment	Yes	No	No	Yes	Temporary Competitive Advantage
Strategic Location	Yes	Yes	No	Yes	Temporary Competitive Advantage
Green Port Initiatives	Yes	Yes	Yes	Yes	Sustainable Competitive Advantage
State-Owned Enterprise Advantage	Yes	Yes	Yes	Yes	Sustainable Competitive Advantage
Integrated Port and Ferry Services	Yes	Yes	Yes	Yes	Sustainable Competitive Advantage
Established Infrastructure	Yes	No	Yes	Yes	Sustainable Competitive Advantage
Operational Expertise	Yes	Yes	Yes	Yes	Sustainable Competitive Advantage
Green Technology Adoption	Yes	Yes	Yes	Yes	Temporary Competitive Advantage
Organizational Structure	Yes	No	No	Yes	Temporary Competitive Advantage
Strategic Alignment	Yes	No	No	Yes	Temporary Competitive Advantage
Support from Government and Stakeholders	Yes	Yes	Yes	Yes	Sustainable Competitive Advantage

Value Chain Analysis: Assessing a company's value chain in relation to a particular industry is essential for identifying its competitive advantage. Value chain analysis is a method used to dissect activities into smaller segments in order to identify important differences that can lead to a competitive advantage (Porter, 1985). The value chain is categorized into two distinct sets of activities: Primary Activities and Supporting Activities. PT ASDP concentrates on transportation companies that manage ferry ports and ferries that market and provide products and services to consumers and ferry operators.



Table VI. Internal Analysis of PT ASDP Using Value Chain Framework (Source: Author, 2024)

Primary Activities		Strength/Weakness
Inbound Logistics	Manage procurement of fuel, spare parts and other critical supplies needed for port and ferry operations. Effective supply chain management ensures that these resources are available in a timely manner.	Strength
	The company's ability to procure necessary supplies efficiently helps maintain a steady flow of operations without significant disruption.	
Operations	Handles operational activities of ferry services, including arranging crossing schedules, port facilities, and maintenance activities. These operations also involve managing disruptions and ensuring efficient service delivery despite challenges such as dock closures and repairs.	Strength
	The ability to manage schedules efficiently ensures ferry services run smoothly, minimizing delays and maximizing resource utilization.	
Outbound Logistics	Scheduling ferry departures, loading vehicles and passengers, and ensuring on-time departures. This requires efficient scheduling, coordination with other ports, and timely communication with ferry operators	Strength
	The ability to efficiently schedule ferry departures and effectively manage the loading process ensures reliable and timely service.	
Marketing and Sales	Marketing and sales activities focus on promoting crossing services provided by PT ASDP, managing customer relationships, and handling online ticket sales.	Weakness
	The ferry services market is highly competitive, with many alternative transport options available to customers, impacting market share and Reliance on digital systems for marketing and sales activities means that any technical issues can disrupt this process.	
Service	Customer service, handling complaints, and providing assistance to passengers.	Strength
	The company's commitment to providing excellent customer support ensures high levels of customer satisfaction and loyalty.	
Supporting Activities		Strength/Weakness
Firm Infrastructure	The company's infrastructure includes management of terminal buildings, docking facilities and IT systems that support operations. Administrative services also play an important role in ensuring smooth operations and compliance with regulatory requirements.	Strength
Human Resource Management	Human resource management focuses on recruiting skilled employees, providing ongoing training, and ensuring employee well-being. Training programs are essential to maintaining high standards of safety and service.	Strength
Technology	Implementation of advanced technology solutions, including online ticketing, and cashless payment systems, to simplify operations and improve service delivery.	Strength
Procurement	Involves procuring materials and equipment necessary for port operations, including maintenance supplies, ferry spare parts, and office equipment. Effective supplier relationship management ensures timely and cost-effective procurement.	Strength



C. Cost-Benefit Analysis

According to Walcott et al. (2018), benefit-cost analysis is an economic evaluation method that focuses on providing stakeholders with information to guide decisions on how resources should be allocated. This approach involves evaluating the potential advantages of offering a product or service in relation to the associated expenses (White & Crawford, 1998). This analysis aims to support PT ASDP in making investment decisions related to environmentally sustainable technologies and practices. It will achieve this by comparing the anticipated advantages of implementing environmentally friendly strategies with the estimated costs, thus ensuring the economic viability of the chosen strategy.

This research examines a specific aspect of sustainability initiatives, which involves the utilization of renewable energy in the establishment of green ports at the Merak Ferry Port. To enhance energy efficiency and promote environmental sustainability, PT ASDP can implement an initiative to install a Solar Power Plant system at Merak Port. The objective of this initiative is to diminish reliance on traditional energy sources, decrease carbon emissions, and lower operational expenses related to electricity consumption.

1) Cost Analysis

The author uses an On Grid Solar Power Plant with a capacity of 300 kWp with a potential for solar irradiation reaching 3.65 kWh/kWp per day. The operational lifespan of solar panels is 25 to 35 years, however, in the author's analysis, the lifespan of solar panels is 25 years with a degradation of PLTS power of 0.5% per year.

The author calculates the average percentage increase in electricity rates over a period of 20 years from 2003 to 2023, the electricity rate for group I3 has increased almost fourfold. So, if calculated the average increase in electricity rates from 2003 to 2023 will increase by around 7.1% per year. The current electricity rate is Rp1,035.78 per kWh. The financial analysis uses the Basic Macroeconomic Assumptions for 2024 agreed upon by the Indonesian Government, including the following: Controlled inflation of 2.8%, 10-year SBN interest rate of 6.7%, as a discount rate.

Table VII. Investment Cost and Other Expenses for Solar Power Plant (Source: Author, 2024)

Description	Cost Per Year	Cost For 25 Years
Initial Investment	Rp3,780,000,000	-
Operational and maintenance cost per year	Rp75,600,000	Rp2,685,073,442
Inverter Replacement in the 15 th year	-	Rp567,000,000
Annual insurance fee	Rp11,340,000	Rp283,500,000

In order to determine the viability of investing in the installation of Solar Power Plant at Merak Ferry Port, we will assess its feasibility using various financial metrics including Net Present Value (NPV), Internal Rate of Return (IRR), Return on Investment (ROI), Discounted Payback Period (DPP), Benefit Cost Ratio (BCR), and Total Savings.

Table VIII. Feasibility Analysis for Solar Power Plant (Source: Author, 2024)

Description	Result	Feasible/Not Feasible
NPV (Net Present Value)	Rp4,215,887,720	Feasible
Internal Rate of Return (IRR)	14%	Feasible
Return of Investment (ROI)	79%	Feasible
Discounted Payback Period (DPP)	9 Years	Feasible
Benefit Cost Ratio (BCR)	1.79	Feasible
Total Savings	Rp24,516,427,330	Feasible

2) Benefit Analysis

- The use of renewable energy with the Solar Power Plant at the Merak Ferry Port will directly reduce carbon emissions and contribute to a cleaner environment and comply with environmental regulations. The reduction in carbon emissions that can be avoided for 25 years by using PLTS reaches 7,487,948 kgCo2 from the total energy produced of 9,359,934 kWh.



- PT ASDP has the option to sell the energy produced by its solar power plants back to the main power plant or to other consumers, creating a potential for additional income. This potential is influenced by energy policy and sales levels. Companies with renewable energy sources can obtain Renewable Energy Certificates (RECs) from PT PLN (Persero). Each 1,000 kWh of clean energy produced equals 1 REC, valued at Rp35,000. These certificates can be traded on the renewable energy market, enabling companies to verify their renewable energy use, promote sustainable energy production, and achieve their sustainability objectives.
- Adopting green technology demonstrates the company's commitment to environmental sustainability, strengthening its brand as an environmentally conscious entity. Although the improvement in brand image and reputation is difficult to quantify directly, case studies have shown increased public perception and stakeholder trust. For instance, Rogers et al. (2008) found that company involvement in renewable energy projects can boost satisfaction and support from local communities.
- The installation of a solar power plant enhances PT ASDP's energy independence by reducing reliance on third-party energy suppliers. This sustainability initiative secures the energy supply, mitigates risks associated with energy price fluctuations and potential supply disruptions, and ensures greater operational stability.

D. Strategy Formulation

SWOT Analysis: The SWOT analysis was implemented by the author to acquire insights from both internal and external analyses. When evaluating an organization's future prospects, a SWOT analysis evaluates both internal and external factors. The following are the SWOTs of PT ASDP:

Table IX. The SWOT Analysis Table to Summarize Both the Internal and External Analysis. (Source: Author, 2024)

	Strengths	Weaknesses
Internal	<ol style="list-style-type: none"> 1. These are strategic locations that connect Java and Sumatra Island. 2. Existing infrastructure can reduce the initial investment required to upgrade environmentally friendly technologies compared to building new infrastructure from scratch. 3. The company's vision and mission statements, which are in line with national and international environmental goals, demonstrate its commitment to sustainability. 4. The government provides support for policies and commitments that promote sustainability. 5. Extensive experience in ferry and port operations in Indonesia. 	<ol style="list-style-type: none"> 1. The existing technology and infrastructure are optimized for energy efficiency or environmental sustainability. 2. The high cost of environmentally friendly technology and infrastructure improvements can be a barrier. 3. Navigating and complying with complex national and international environmental regulations can be a challenge. 4. Lack of skilled work force for environmentally friendly technologies.
	Opportunities	Threats
External	<ol style="list-style-type: none"> 1. Government efforts for sustainability can provide financial support and incentives for environmentally friendly initiatives. 2. Partnerships with ports and international organizations can produce advanced technology and expertise. 3. Stakeholders are becoming more aware of and demanding sustainable practices. 4. The availability of grants and funding from international environmental organizations can play an important role in supporting sustainable projects. 	<ol style="list-style-type: none"> 1. Economic downturn conditions can affect the availability of funds for investment in environmentally friendly technology. 2. Competition with other ports implementing environmentally friendly initiatives may pose a competitive threat. 3. Increasingly stringent environmental regulations can create additional compliance burdens. 4. Resistance from stakeholders such as employees, local communities, and the business world can hinder progress.



TOWS Matrix: The TOWS Matrix, which was developed by Heinz Wehrich in 1982, is a strategic planning tool that improves conventional SWOT analysis by systematically aligning internal strengths and weaknesses with external opportunities and threats to generate strategic options. To develop strategic alternatives, the TOWS strategy matrix integrates SWOT analysis by matching the Merak ferry port's strengths and weaknesses with external opportunities and threats. Table X shows the TOWS matrix and the strategy formulation for the Merak Ferry Port in the resulting green port implementation strategy.

Table X. The TOWS Matrix is based on all the analysis done beforehand. (Source: Author, 2024)

	Strengths (S)	Weaknesses (W)
	SO Strategies	WO Strategies
Opportunities (O)	SO1: Leverage government support and incentives to upgrade existing infrastructure. (S1, S2, O1)	WO1: Seek government and international grants to overcome financial constraints for green technologies. (W1, O1, O4)
	SO2: Partner with international organizations to adopt best practices and advanced technologies. (S1, S2, O2)	WO2: Address outdated technology by investing in modern, sustainable solutions with support from external collaborations. (W2, O2, O4)
	SO3: Promote the company's vision and mission to secure additional funding and stakeholder support. (S3, O3, O4)	WO3: Launch training programs to build a skilled workforce capable of implementing and maintaining green technologies. (W3, O2, O3)
	ST Strategies	WT Strategies
Threats (T)	ST1: Implement advanced green technologies to stay ahead of regulatory changes. (S2, T1)	WT1: Prioritize cost-effective green technologies to mitigate financial risks. (W1, W2, T2, T3)
	ST2: Develop strategic partnerships to share costs and risks associated with green initiatives. (S1, S2, T2, T3)	WT2: Strengthen stakeholder engagement to build support and reduce resistance. (W3, T4)
	ST3: Conduct awareness and training programs to mitigate stakeholder resistance and foster a culture of sustainability. (S3, T4)	WT3: Focus on incremental improvements to gradually meet regulatory requirements and spread out costs. (W1, W4, T1, T2)
	-	WT4: Enhance brand recognition through collaboration with stakeholders to mitigate resistance. (W3, T4)

BUSINESS SOLUTION

Based on the TOWS matrix analysis, the author identifies the following areas as priority areas for strategic improvement to overcome existing problems at the Merak Ferry Port to implement the green port strategy. PT ASDP can develop this solution to overcome key obstacles and align operations at the Merak ferry port with global and national sustainability goals. By implementing these solutions, the Merak ferry port can successfully transition to an environmentally friendly port, thereby ensuring long-term sustainability.

1. **Conduct Awareness and Training Programs:** The first step in this strategic initiative entails collaborating with experts to create comprehensive training materials that focus on developing accurate content related to renewable energy, waste management, and environmentally friendly technology. Materials should be created in diverse formats, including manuals, videos, and online resources, to accommodate different learning preferences and ensure that the content is informative and easily comprehensible. Subsequently, it is advisable to arrange workshops and webinars, with the participation of eminent professionals from the industry, who will conduct sessions on sustainable practices. These events ought to incorporate interactive components such as real-time question and answer sessions and group discussions to augment participant engagement and facilitate more profound learning. In order to promote greater engagement and feedback from stakeholders, PT ASDP has the ability to organize frequent



forums and meetings. These platforms will facilitate stakeholders in expressing their viewpoints and recommendations regarding green initiatives, delivering updates on sustainability projects, and methodically analysing feedback to enhance sustainability strategies.

2. Develop Strategic Partnership:

- Collaborate with Private Partners: Engage with experienced renewable energy companies, such as solar panel and wind turbine providers. Consider investment programs like Breakthrough Energy Ventures focused on decarbonization technology. Develop proposals outlining the benefits of these partnerships, including large-scale technology implementation potential.
- Collaborate with Non-Governmental Organizations (NGOs): Identify sustainability-focused NGOs, such as Greenpeace Indonesia, to discuss potential collaborations like environmental education programs for port staff or conservation initiatives around the port area. Establish a Memorandum of Understanding (MoU) to detail the roles of each party in joint sustainability projects.
- Partner with Research Institutes: Form partnerships with innovative research institutions like the Agency for the Assessment and Application of Technology Research Organization (BPPT) for research and technological developments in renewable energy and waste management. Initiate joint research projects focused on specific solutions for port operations, such as intelligent energy management systems or emission reduction technologies. Implement research findings at the port, such as integrated renewable energy systems or more efficient operational practices.

3. Prioritize Cost Effective Green Technologies: The initial strategic measure entails identifying ecologically sustainable technologies that provide the highest return on investment. PT ASDP can initiate the process by conducting an energy audit at Merak Ferry Port to assess the present energy consumption. Conduct an analysis of the audit to identify and assess various eco-friendly technologies in relation to their cost, efficiency, and return on investment. Conducting a cost-benefit analysis will guarantee that the chosen technology yields financial advantages while also meeting sustainability objectives. The second strategic action centers around the ongoing surveillance of the performance and impact of these technologies to guarantee their efficiency and effectiveness. PT ASDP has the capability to implement tools that offer up-to-date information on energy conservation, operational effectiveness, and environmental consequences. The continuous monitoring process guarantees that the implemented technologies make a significant contribution to the port's sustainability objectives.

4. Implement Advance Green Technologies: The initial strategic measure entails the adoption of cutting-edge environmentally sustainable technologies, such as solar panels, that provide substantial energy efficiency and carbon emission reduction advantages for Merak Ferry Port. PT ASDP has the potential to collaborate with solar panel providers in order to efficiently design and install this renewable energy system. In addition, PT ASDP can implement the use of electric vehicles for operational activities in order to enhance their support for sustainability initiatives. The second strategic action centers on guaranteeing adherence to existing and forthcoming environmental regulations. This entails performing a comprehensive examination of pertinent environmental regulations to pinpoint areas necessitating adherence and prospects for enhancement. PT ASDP aims to achieve environmental excellence at Merak Ferry Port by comprehending the regulatory landscape and striving to both meet and establish standards.

5. Enhance Waste Management Practices: The environmental impact of waste disposal can be minimized by significantly reducing the amount of waste sent to landfills through the implementation of an effective recycling program at Merak Ferry Port. In order to cultivate a culture of sustainability and promote proactive waste reduction behaviour, PT ASDP can educate employees and stakeholders about waste reduction practices, including the reduction of single-use plastics. Furthermore, PT ASDP has the option to collaborate with specialized waste management companies to manage waste disposal and recycling processes with the assistance of advanced technology and expertise. These partnerships have the potential to offer advanced solutions and ongoing improvements, thereby enhancing the effectiveness of waste management and ensuring that it is consistent with global sustainability objectives.

PROPOSED IMPLEMENTATION PLAN

The research includes an implementation plan that outlines a well-organized timetable for introducing important business solutions at the Merak Ferry Port, specifically for the purpose of implementing environmentally friendly practices. This timeline serves as a



guide for PT ASDP to ensure that all activities are executed in a systematic and coordinated manner. The provided information in Figure 2. presents a comprehensive overview of the strategy, including the specific actions to be executed and the timeframe for each activity. It covers the period from Quarters 1 - 2025 to Quarters 4 - 2025, and also includes ongoing efforts.

No.	Strategies	Year 2025				PIC
		Q1	Q2	Q3	Q4	
1	Conduct Awareness and Training Programs					
	Collaborate with Experts					HR, Business Innovation
	Design Training Material					HR, Business Innovation
	Workshop and Webinars					HR, Business Innovation
	Host Forum and Meetings					HR, Business Innovation
2	Develop Strategic Partnership					
	Identify Potential Partners					Business Development
	Formalize Partnership					Business Development, HR, Legal
	Implement Partnership Project					Business Development, HR, Engineering
	Monitor and Expand Partnership					Business Development

Figure 2. Implementation Timeline (1/2) (Source: Author, 2024)

No.	Strategies	Year 2025				PIC
		Q1	Q2	Q3	Q4	
3	Prioritize Cost-Effective Green Technologies					
	Conduct Feasibility Study					Business Development
	Implement Selected Technologies					Business Development, Engineering
	Monitor Performance and Impact					Engineering, Operations
4	Implement Advance Green Technologies					
	Identify Suitable Locations					Operations, Engineering
	Partnership with Supplier for Installation					Engineering, Legal, Commercial
	Install and Deploy Technologies					Engineering
	Monitoring and Optimize Performance					Engineering, Business Innovation
5	Enhance Waste Management					
	Conduct Waste Audits					Environmental Dept.
	Recycling Programs and Educational Campaigns					Environmental Dept., HR Dept.
	Educate Stakeholders on Waste Reduction Initiatives					Environmental Dept., HR Dept.
	Partner with Waste Management Companies					Environmental Dept., Operations Dept.

Figure 3. Implementation Timeline (2/2) (Source: Author, 2024)

CONCLUSION

This research proposes a comprehensive business strategy for implementing green port initiatives at Merak Ferry Port to achieve sustainability. By benchmarking against successful green ports like Gothenburg Ferry Port in Sweden and Zhoushan Ferry Port in China, the study identifies key sustainability practices such as the integration of advanced environmentally friendly technologies, comprehensive waste management systems, and active stakeholder involvement. Despite facing challenges such as outdated infrastructure and high energy consumption, PT ASDP's commitment to sustainability is evident through initiatives like routine energy audits and plans for hazardous waste management. These findings underscore the importance of adopting best practices and addressing operational inefficiencies to enhance Merak Ferry Port's environmental performance.



The proposed strategy includes developing awareness and training programs, building strategic partnerships, implementing sustainable waste management practices, and increasing stakeholder involvement. These initiatives aim to create a culture of sustainability, leverage external expertise, and ensure regulatory compliance while achieving significant environmental and economic benefits. Implementing these strategies not only enhances the port's operational efficiency but also strengthens its competitive position in the ferry industry. This research highlights the feasibility and necessity of transitioning to green port operations, positioning Merak Ferry Port as a leader in sustainable maritime practices.

REFERENCES

1. A Complete Guide on Corporate Social Responsibility (CSR). (2020, June 9). <https://assignmenthelp4me.com/blog/detailed-study-corporate-social-responsibility.html>
2. Abood, K A. (2007, March 22). Sustainable and Green Ports: Application of Sustainability Principles to Port Development and Operation. [https://doi.org/10.1061/40834\(238\)60](https://doi.org/10.1061/40834(238)60)
3. Alshehhi, A., Nobanee, H., & Khare, N. (2018, February 13). The Impact of Sustainability Practices on Corporate Financial Performance: Literature Trends and Future Research Potential. Multidisciplinary Digital Publishing Institute, 10(2), 494-494. <https://doi.org/10.3390/su10020494>
4. Developing a Brilliant Business Strategy for Sustainable Development. (2020, May 8). <https://sustainablebusinessforum.com/1103/developing-brilliant-business-strategy-for-sustainable-development/>
5. Gopalakrishnan, K S., Yusuf, Y., Musa, A., Abubakar, T., & Ambursa, H M. (2012, November 1). Sustainable supply chain management: A case study of British Aerospace (BAe) Systems. Elsevier BV, 140(1), 193-203. <https://doi.org/10.1016/j.ijpe.2012.01.003>
6. Hall, P. (2007, August 1). Seaports, Urban Sustainability, and Paradigm Shift. Taylor & Francis, 14(2), 87-101. <https://doi.org/10.1080/10630730701531757>
7. Hollen, R M., Bosch, F V D., & Volberda, H. (2014, October 23). Strategic levers of port authorities for industrial ecosystem development. Palgrave Macmillan, 17(1), 79-96. <https://doi.org/10.1057/mel.2014.28>
8. Indu, P. V., & Vidhukumar, K. (2020). Research designs-an overview. *Kerala Journal of Psychiatry*, 32(1). <https://doi.org/10.30834/kjp.32.1.2019.179>
9. Khanday, S. A., & Khanam, D. (2019). The Research Design. *Journal of Critical Review*, 6(3), 367-376. <file:///C:/Users/Personal/Downloads/theresearchdesign.pdf>
10. Lun, Y H V., Lai, K., Wong, C W., & Cheng, T. (2015, February 1). Greening and performance relativity: An application in the shipping industry. Elsevier BV, 54, 295-301. <https://doi.org/10.1016/j.cor.2013.06.005>
11. McDonough, W. (2002, August 1). Design for the Triple Top Line: New Tools for Sustainable Commerce. Elsevier BV, 9(3), 251-258. [https://doi.org/10.1016/s1066-7938\(02\)00069-6](https://doi.org/10.1016/s1066-7938(02)00069-6)
12. Najjar, R. (2022, June 27). Four-dimensional spatial sustainability (4DSS): a revolutionary approach toward utopian sustainability. *Springer Nature*, 3(1). <https://doi.org/10.1007/s43621-022-00090-x>
13. Özispa, N., & Arabelen, G. (2018, January 1). Sustainability issues in ports: content analysis and review of the literature (1987- 2017). *EDP Sciences*, 58, 01022-01022. <https://doi.org/10.1051/shsconf/20185801022>
14. Porter, M.A. *Competitive Advantage: Creating and Sustaining Superior Performance*; Free Press: New York, NY, USA, 1985.
15. Rothaermel, F.T. (2021). *Strategic Management*. McGraw-Hill Education
16. Siew, R. (2015, December 1). A review of corporate sustainability reporting tools (SRTs). Elsevier BV, 164, 180-195. <https://doi.org/10.1016/j.jenvman.2015.09.010>
17. Soomro, M A. (2023, June 21). Exploring Business Sustainability: Testing the Role of Service and Marketing Innovation., 13(6). <https://doi.org/10.6007/ijarbss/v13-i6/17763>
18. Tong, Y., & Mao, J. (2014). Towards Green Shipping with Integrated Fleet Deployment and Bunker Management. *arXiv (Cornell University)*.
19. Walcott, R., Corso, P S., Rodenbusch, S E., & Dolan, E L. (2018, March 1). Benefit–Cost Analysis of Undergraduate Education Programs. <https://doi.org/10.1187/cbe.17-06-0114>



20. Wehrich, H. (1982). The TOWS matrix—A tool for situational analysis. *Long Range Planning*, 15(2), 54–66. [https://doi.org/10.1016/0024-6301\(82\)90120-0](https://doi.org/10.1016/0024-6301(82)90120-0)
21. White, G W., & Crawford, G A. (1998, November 1). Cost-Benefit Analysis of Electronic Information: A Case Study. *Association of College and Research Libraries*, 59(6),
22. Yarmy, R., & Sereno, D. (2011, August 30). Port of Long Beach Sustainable Design and Construction Guidelines. [https://doi.org/10.1061/41190\(422\)82](https://doi.org/10.1061/41190(422)82)

Cite this Article: Muhammad Ikhsan Anwar, Widhyawan Prawiraatmadja (2024). Proposed Business Strategy for Implementation of Green Port at Merak Ferry Port to Achieve Sustainability. International Journal of Current Science Research and Review, 7(7), 5482-5496