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Development of Green Shipyard Marketing Strategy to Enhance PT PAL Indonesia's Competitiveness in the Green Industry Era

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Abstract: Global challenges are pressuring the maritime industry, including shipyards, to adopt sustainable practices, as it contributes nearly 3% of global greenhouse gas emissions. Indonesian shipyards, such as PT PAL, face difficulties implementing standardized environmental management systems. This study examines how PT PAL, a strategic national industrial company, can develop and implement an effective green shipyard strategy. The research uses a qualitative case study and phenomenological approach, conducted from March to July 2025, involving key informants from Strategic Planning, Production, Supply Chain, and Technology divisions. Data collection includes in-depth interviews, direct observations, and document analysis. Thematic and narrative analyses with NVivo software are used. Coding results show "Green Technology" as the most dominant theme in the Production Division (6%), focusing on eco-friendly practices and adherence to global standards like ISO 14001 and IMO MARPOL. The Strategic Planning Division emphasizes "Technology Adaptation," integrating green technologies into long-term plans. The Technology Division is committed to eco-friendly tech adoption to reduce carbon emissions. Key challenges include limited investment capital for infrastructure and technology, lack of local technology, and a shortage of skilled green-industry labor. However, opportunities exist through increasing global demand for sustainable products, government incentives, and advancements in digital technology. The study aims to provide recommendations for PT PAL's green transformation and enhanced competitiveness in the international shipbuilding market.

Keywords: *Green Shipyard, Marketing Strategy, Competitiveness, Green Industry, PT PAL Indonesia*.

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I. INTRODUCTION

In recent decades, global challenges such as climate change, environmental degradation, and the energy crisis have significantly impacted industries worldwide, including the maritime sector [1]. Shipyards, known for their energy-intensive and environmentally harmful processes, are under pressure to adopt sustainable practices. The maritime industry alone contributes nearly 3% of global greenhouse gas emissions, with the potential for significant growth if no mitigation actions are taken [2]. Shipyards, including those in Southeast Asia and Indonesia, face difficulties in implementing standardized environmental management systems and often rely on conventional methods [3]. The global push for sustainability, particularly through the United Nations' Sustainable Development Goals (SDGs), has driven countries like South Korea and Norway to develop green shipyard frameworks, incorporating renewable energy, waste recycling, and digital technologies [4]. In Indonesia, PT PAL, a major state-owned shipyard, encounters both the opportunity and the challenge of transitioning to a green shipyard model. While initiatives such as energy efficiency and digitalization have begun, progress remains limited [5]. Government policies, such as the National Energy Plan, further support the shift to green industries [6]. However, PT PAL still faces obstacles including high capital investment, lack of local technology, and a shortage of skilled green-industry labor [7]. With increasingly strict global regulations, PT PAL must adapt in order to stay competitive in the international shipbuilding market. This study aims to examine how PT PAL can develop and implement an effective green shipyard strategy by identifying challenges, opportunities, and recommendations to enhance its sustainability and competitiveness.

II. METHODS

This research uses a qualitative case study and phenomenological approach to examine the implementation of green shipyard strategies at PT PAL Indonesia, conducted from March to July 2025. Key informants from the Corporate Planning, Production, Supply Chain, and Technology divisions will be selected using purposive sampling. Data

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will be gathered through in-depth interviews, direct observations, and analysis of internal documents.

The data collection involves three stages: preparing interview guidelines, conducting interviews and observations, and collecting relevant documents. Thematic and narrative analyses will be used to identify key patterns and construct a comprehensive understanding. Triangulation ensures data validity. Findings will be presented through narratives, tables, and graphs. The study aims to assess the effectiveness of PT PAL's green initiatives and provide recommendations to strengthen its green transformation and competitiveness in the shipbuilding industry.

III. RESULTS

PT PAL Indonesia is a strategic national industrial company that plays a critical role in supporting the independence of Indonesia's defense and maritime sectors. Established in the Ujung, Surabaya, East Java, the company has a long-standing history in building both military and commercial ships for domestic and international markets. PT PAL is part of Indonesia's state-owned defense industry holding, as regulated by Government Regulation No. 5 of 2022, with PT LEN Industri (Persero) serving as the holding company and majority shareholder. In its operations, PT PAL focuses not only on military shipbuilding—such as warships and submarines—but also on commercial vessels, general engineering and offshore structures. Its reputation extends beyond national borders through collaborations with countries like the Philippines, the United Arab Emirates, and South Korea. These international partnerships have significantly contributed to PT PAL's growth and global recognition as a major player in the shipbuilding industry.

PT PAL Indonesia is supported by advanced production facilities that accommodate a wide range of strategic business lines in both defense and maritime sectors. These include the Shipbuilding Plant, with a capacity of 50,000 tons per year, used for building various vessels such as Landing Platform Docks (LPD), hospital ships (BRS), missile destroyers (PKR), and patrol boats (KCR). The Submarine Workshop focuses on constructing and overhauling submarines, including the Nagapasa-class built in collaboration with DSME from South Korea. The General Engineering Division handles the production of heavy industrial structures and the integration of defense and weapon systems. PT PAL also operates two Graving Docks (50,000 and 20,000 tons) for large-scale vessel construction and maintenance, and a Transfer Shiplift system with a 1,500-ton lifting capacity, which boosts shipyard productivity by efficiently moving ships between land and sea.

In this study, qualitative data analysis is conducted using NVivo software to identify key themes and relationships relevant to developing a Green Shipyard Marketing Strategy for PT PAL Indonesia [8]. Data sources include in-depth interviews, company policy documents, and observations on sustainability and green marketing practices. The analysis explores both thematic patterns and deeper narratives regarding internal practices in building the green shipyard image [9]. The findings will help map challenges, opportunities, and key elements for an integrated strategy that enhances PT PAL's competitiveness in the sustainable maritime industry. The NVivo-based approach provides valuable insights for the effective implementation of the green shipyard marketing strategy [10].

In this study, respondents are selected using purposeful sampling, focusing on those directly involved in PT PAL Indonesia's green shipyard strategy. The population includes four key divisions: 1) Corporate Strategic Planning – responsible for integrating sustainability into company policies; 2) Production – ensures the implementation of eco-friendly technologies in shipbuilding; 3) Supply Chain – manages green supply chains and vendor selection; 4) Technology – develops green technologies and digitalized production processes. Each division plays a vital role in executing the green shipyard strategy.

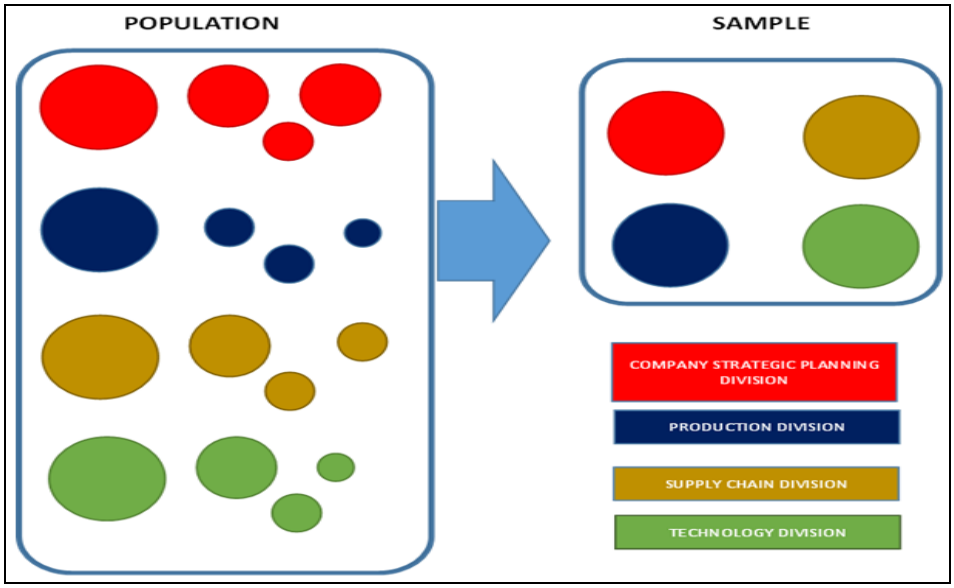

Fig 1 Population and Sample.

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In selecting informants, two sampling methods are used: Purposive Sampling, choosing informants based on specific criteria such as strategic roles, sustainability experience, and involvement in the green shipyard strategy, and Snowball Sampling, identifying additional informants through recommendations [11]. Data collection continues until saturation is reached, meaning no new information emerges [12]. The selected informants represent diverse perspectives from each division—Strategic Planning, Production, Supply Chain, and Technology—ensuring a comprehensive understanding of PT PAL's green shipyard strategy. This approach ensures the integration of various functional views, creating a solid foundation for formulating an effective and competitive green marketing strategy.

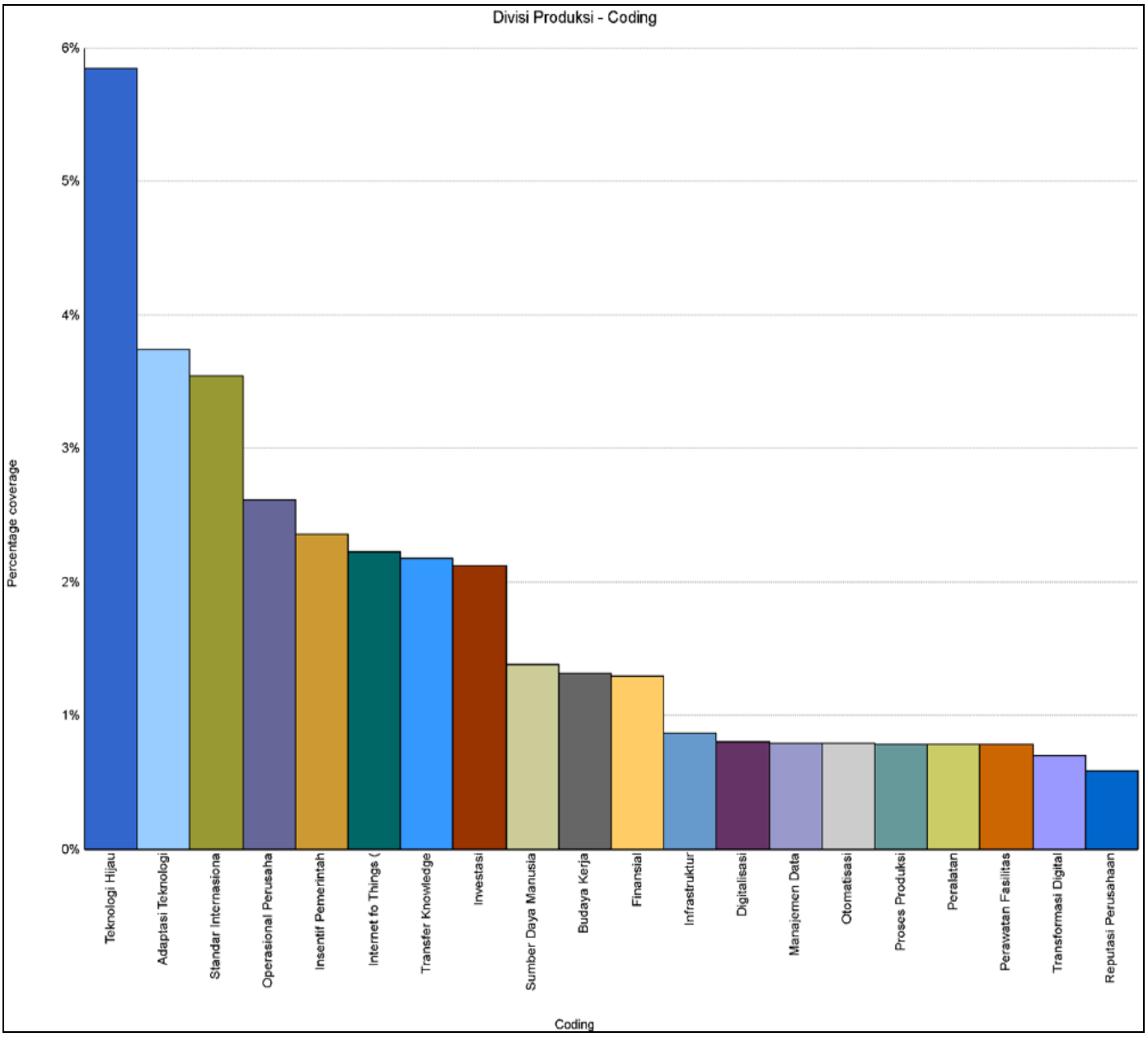

Fig 2 Production Division Coding Result

The coding results from the Production Division highlight "Green Technology" as the most frequently mentioned theme (6%), indicating a strong focus on eco-friendly practices like energy-efficient welding, low-VOC materials, and sustainable waste management. Related themes such as "Technology Adoption" and "International Standards" (around 3.5–3.8%) reflect efforts to align with global standards like ISO 14001 and IMO MARPOL. Mid-level themes—"Company Operations," "Government Incentives," and "IoT"—show the link between production, policy, and digital tools. However, challenges like limited investment, low green literacy, and a conventional work culture hinder full strategy implementation. Less frequent themes like "Infrastructure" and "Digitalization" point to the need for smarter, energy-efficient systems. Overall, the Production Division is pivotal in PT PAL's green shipyard transformation, with success relying on technological advancement, policy support, and strategic resource investment.

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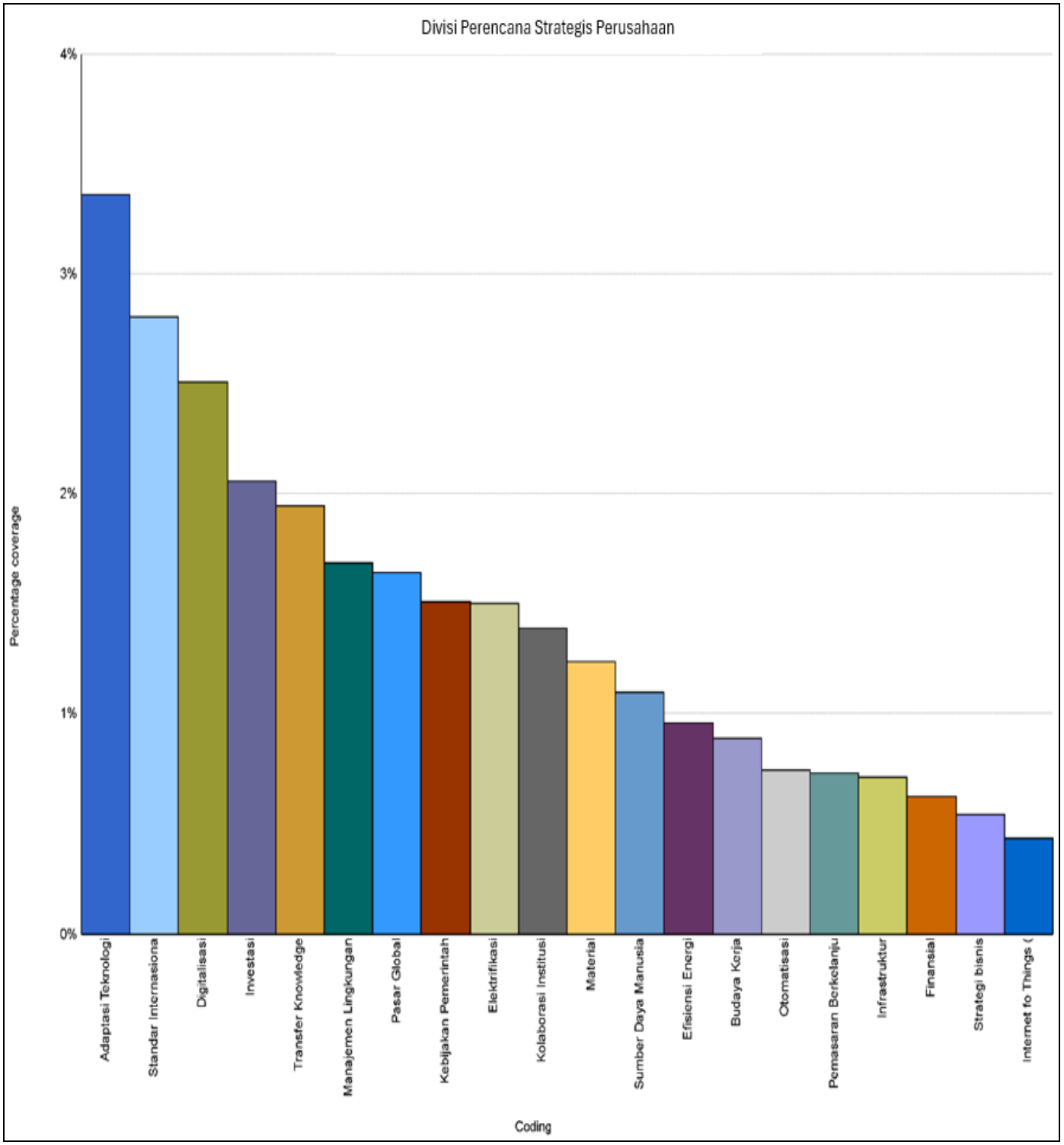

Fig 3 Corporate Strategic Planning Division Coding Result

Coding analysis from PT PAL Indonesia's Corporate Strategic Planning Division highlights "Technology Adaptation" as the most dominant theme, underscoring the company's reliance on integrating green technologies into long-term planning. Other key themes include "International Standards," "Digitalization," and "Investment," indicating a strategic focus on global compliance (e.g., IMO MARPOL, ISO 14001) and efficiency through digital systems. Themes like "Knowledge Transfer," "Environmental Management," and "Global Market" reflect awareness of international competitiveness. Emerging issues such as "Government Policy," "Effectiveness," and "Institutional Collaboration" show the importance of policy support and partnerships with academia. Meanwhile, themes like "Energy Efficiency," "Materials," and "HR" signal alignment with circular economy principles, though still in early stages. Overall, the division plays a crucial role in aligning PT PAL's long-term vision with global green shipyard standards through a synergy of technology, regulation, and institutional collaboration.

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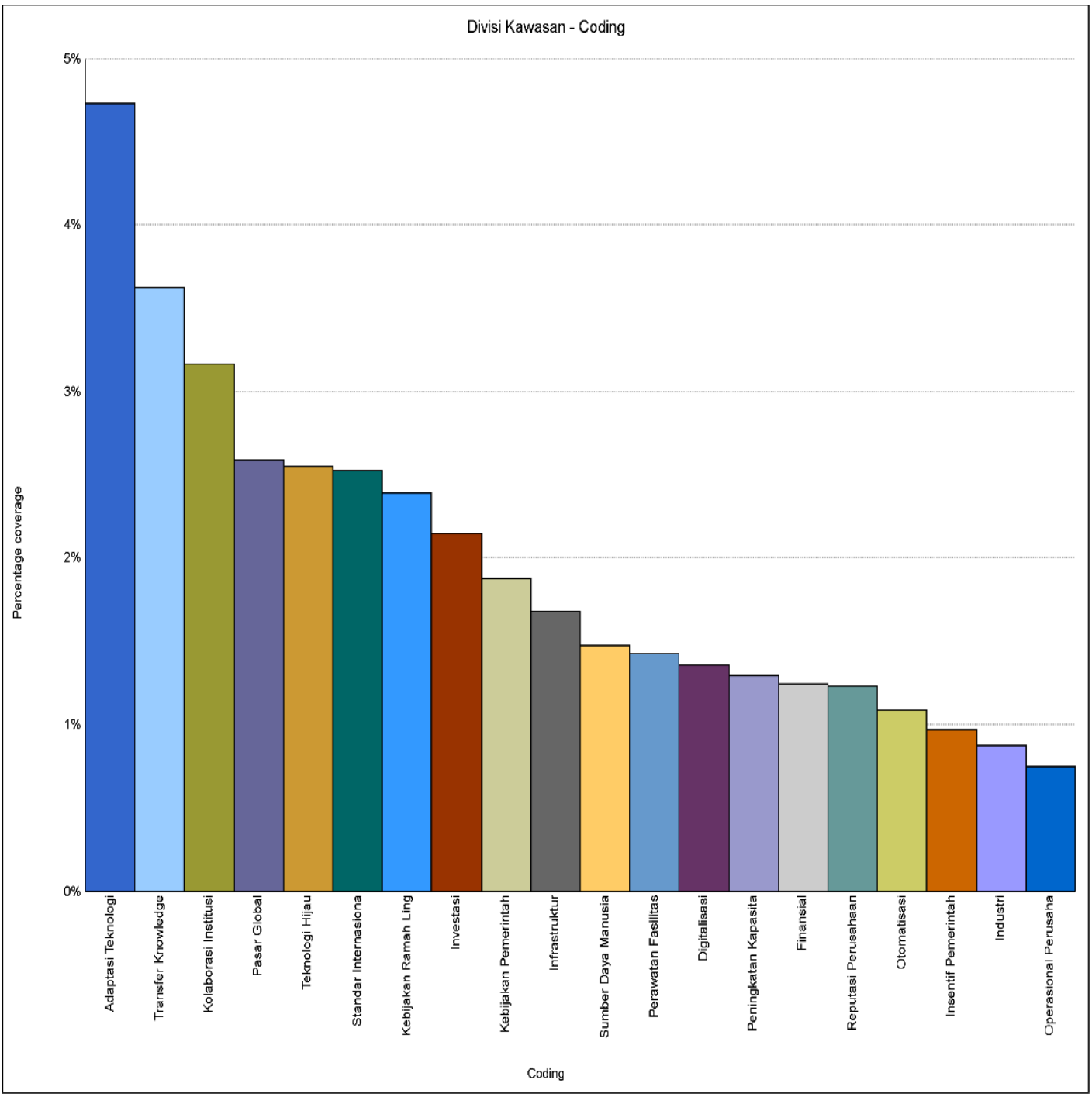

Fig 4 Area Division Coding Result

The coding analysis from the Area Division reveals that "Technology Adaptation" is the dominant theme, highlighting the urgency of modernizing shipyard infrastructure to integrate green technologies such as energy-efficient systems, smart grids, and digital waste management [13]. This finding supports the notion that infrastructure readiness is a key enabler for green industry development. Other significant themes, including "Knowledge Transfer," "Institutional Collaboration," and "Global Market," underscore the importance of cross-sector partnerships with universities, research institutions, and international actors for successful green shipyard transformation [14]. Aligning operations with global environmental standards such as ISO 14001 and the IMO GHG Strategy is also considered crucial [15]. Challenges identified, such as "Investment," "Government Policies," and "Infrastructure," point to the need for sufficient funding and strong government support, especially in Southeast Asia, where the high initial cost of green technologies remains a major barrier [16]. Additional themes such as "Digitalization," "Human Resources," and "Facility Maintenance" reflect a growing focus on integrating digital systems and ensuring the sustainability of physical assets. Although less frequently mentioned, themes like "Government Incentives," "Industry," and "Operational Company" remain critical factors in accelerating the transition toward green shipyard standards.

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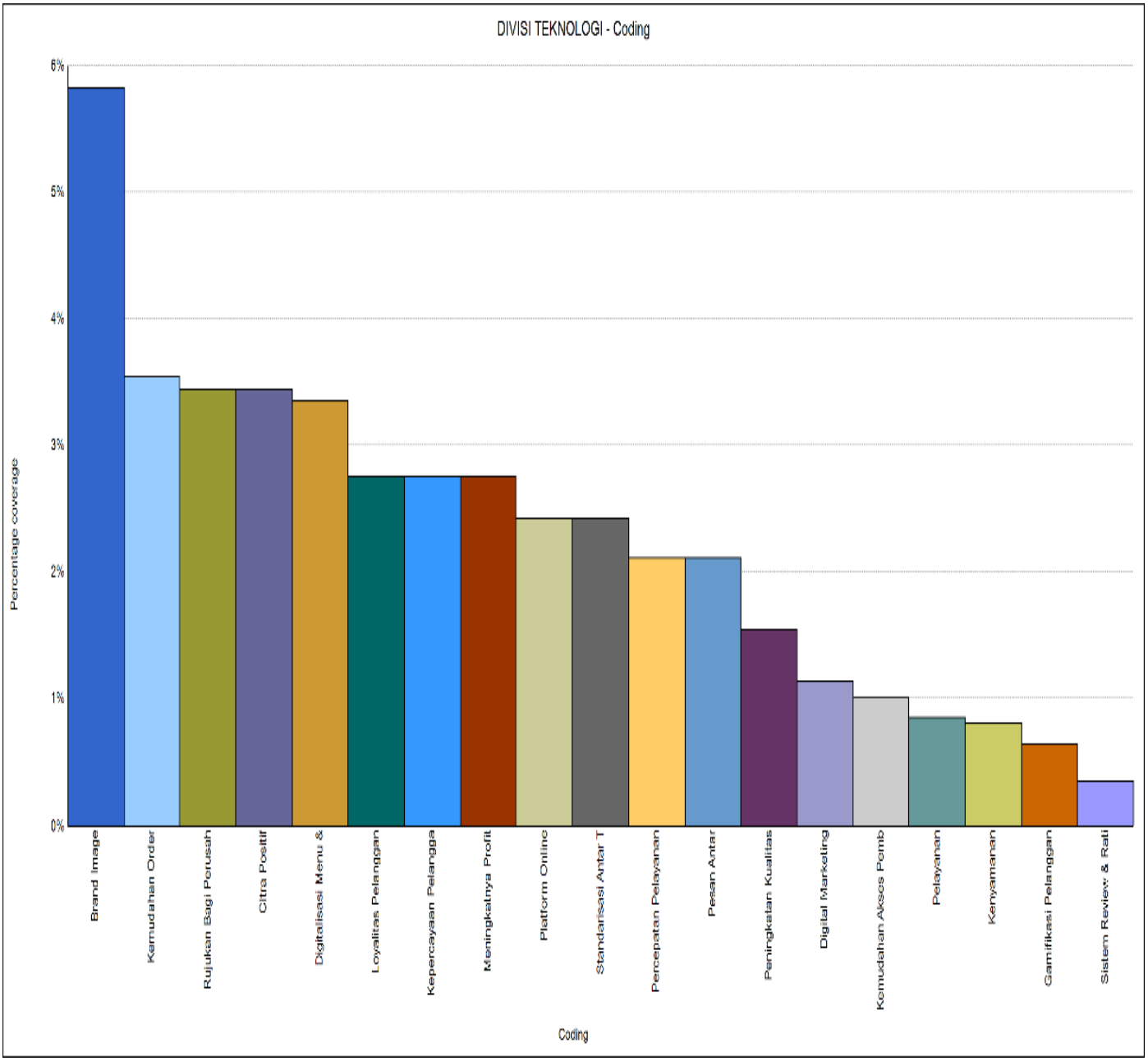

Fig 5 Technology Division Coding Result

The coding analysis from the Technology Division at PT PAL Indonesia reveals a strong focus on developing and implementing innovations supporting the transition to a green shipyard. The dominant theme is "Green Technology," reflecting the division's commitment to adopting eco-friendly technologies such as eco-design, energy efficiency, and digital systems that reduce carbon emissions [17]. This aligns with previous research emphasizing that green technology adoption significantly enhances competitiveness in the maritime sector. Themes like "Knowledge Transfer," "Environmental Policies," and "Digital Transformation" underscore the division's dual role as both implementer and facilitator, accelerating digital production and integrated systems [18]. Digitalization is vital for real-time environmental monitoring and improving production efficiency, consistent with findings by Yang et al. (2022) on Industry 4.0's role in sustainable manufacturing. Additional themes such as "Human Resources," "Financing," and "International Standards" highlight the division's emphasis on upgrading workforce capabilities in advanced technologies—such as energy sensors, digital twins, and predictive maintenance—while ensuring compliance with global standards like ISO 14001 and the IMO GHG Strategy [19]. themes including "Automation," "Facility Maintenance," and "Infrastructure" indicate ongoing efforts to embed sustainability into production systems and infrastructure management. Although less frequently mentioned, themes like "Business Strategy," "Energy Efficiency," and "IoT" illustrate the division's long-term orientation towards research collaboration, eco-materials, and smart technology integration. Altogether, these results reveal a comprehensive strategy within the Technology Division—combining innovation, skills, data, collaboration, and policy—to advance PT PAL's green shipyard vision.

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Fig 6 Word Cloud

The Word Cloud above visualizes key themes from interviews and documents related to the development of a green shipyard marketing strategy at PT PAL Indonesia. The prominence of words like *"technology"* highlights the central role of technological transformation in making the shipyard more environmentally friendly. The presence of terms such as *"green," "environment,"* and *"implementation"* underscores the focus on sustainability and the adoption of eco-friendly technologies. Words like *"strategy," "implementation,"* and *"application"* emphasize the importance of clear policy direction and operational steps in building a green shipyard, aligning with Porter and van der Linde's (1995) argument that well-integrated environmental strategies can drive innovation and create competitive advantage [20].

Additionally, terms such as *"Indonesia," "international,"* and *"global"* reflect PT PAL's dual commitment to complying with both national and global standards, including the IMO GHG Strategy and the Paris Agreement on maritime decarbonization. The appearance of terms like *"collaboration," "government," "subsidies,"* and *"investment"* shows that successful green transformation depends not only on internal innovation but also on external support, such as government policies and financial incentives.

In the marketing context, keywords like *"market," "reputation,"* and *"business strategy"* highlight the importance of sustainable marketing in building a competitive edge. This supports Peattie and Crane's (2005) assertion that authentic green marketing enhances market trust and customer loyalty. Overall, the word cloud illustrates how technology, policy, human resources, and marketing are interconnected in PT PAL's strategic transition toward becoming a competitive player in the global green shipbuilding industry [22].

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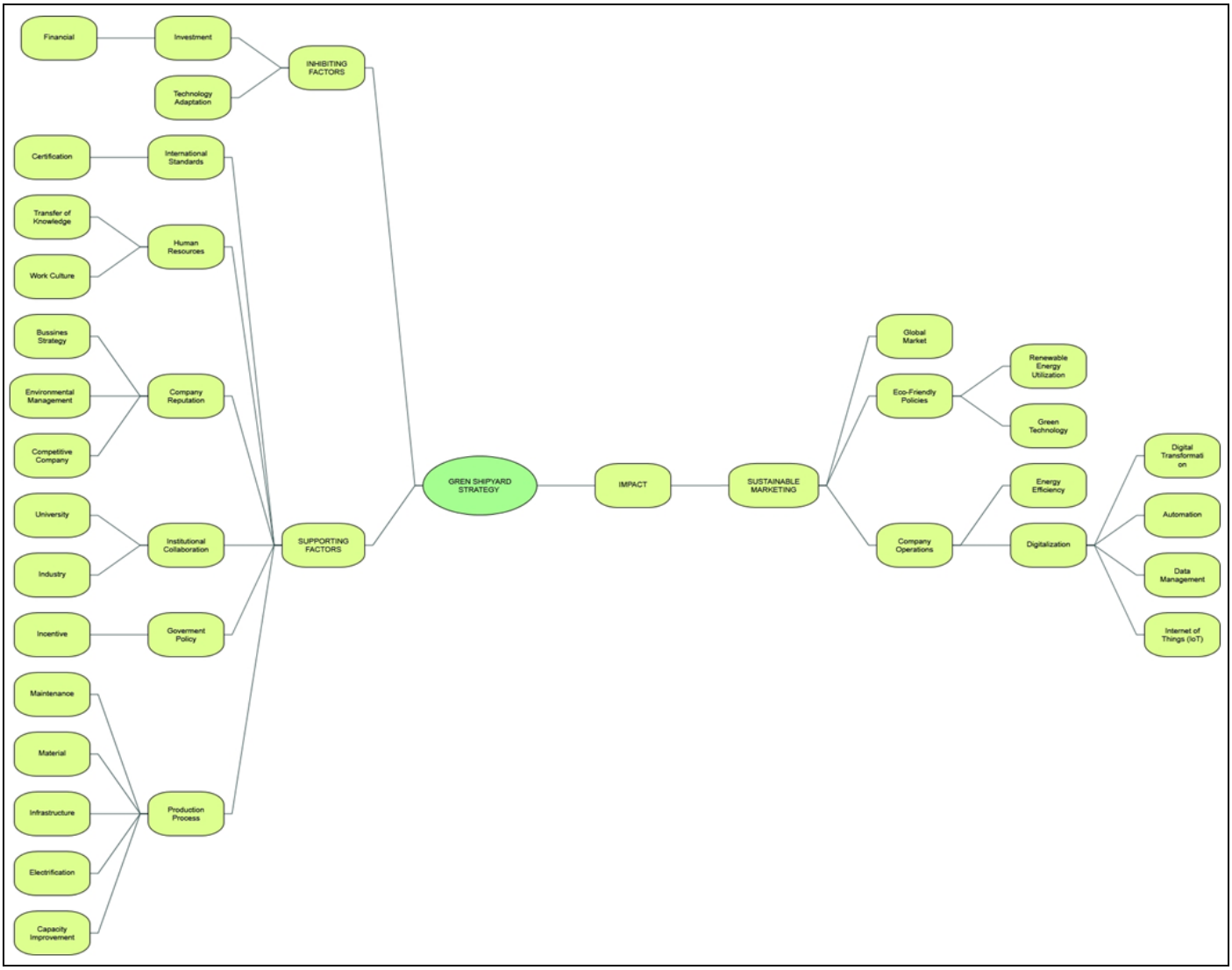

Fig 7 Mind Map

The mind map illustrates the key elements in developing a green shipyard strategy for enhancing PT PAL Indonesia's competitiveness. It categorizes these components into three main areas: supporting factors, barriers, and impacts, which are interconnected in fostering a sustainable maritime industry. At the core of the map is the green shipyard, whose success depends on balancing internal and external support with the challenges faced.

Key supporting factors include human resources, with emphasis on certification, knowledge transfer, and cultivating a sustainability culture, all of which are essential for building technical competencies and environmental awareness. The company's reputation, shaped by business strategy and environmental management, plays a critical role in attracting international market interest. Institutional collaboration with universities and industry partners is also vital to drive innovation and technology.

Government policies providing incentives and regulatory frameworks are necessary to accelerate green transformation, alongside sustainable production practices, such as eco-friendly materials, electrification, and high-efficiency equipment, which contribute to environmental impact reduction. The integration of digital technologies like IoT, data systems, and automation further supports operational efficiency, while compliance with international standards, such as ISO 14001, legitimizes PT PAL's position in global markets.

Conversely, financial limitations and investment barriers remain key obstacles, hindering the adoption of green technologies and sustainable infrastructure. Technological adaptation and long-term maintenance also demand managerial and technical readiness.

The final impact of these dynamics is the development of sustainable marketing, encompassing green product promotion, renewable energy use, and efficient resource management. This approach ensures that PT PAL's offerings are not only technologically advanced but also meet ethical and environmental expectations. In conclusion, the mind map highlights that PT PAL's transformation into a competitive green shipyard depends on maximizing enablers, addressing structural challenges, and aligning its strategy toward an integrated and sustainable marketing system.

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IV. DISCUSSION

PT PAL Indonesia faces several strategic and operational challenges in developing a green shipyard, primarily due to limited investment capital required for infrastructure and technology transformation. The shift to green production systems involves high costs for building environmentally friendly facilities, acquiring energy-efficient equipment, and implementing advanced digital technologies such as IoT and automation. Additionally, adapting to new technologies requires system readiness, technical expertise, and ongoing funding for maintenance and upgrades. Human resources also pose a challenge, as workers must undergo a cultural and mindset shift to support sustainability practices, with an added need for intensive training and knowledge transfer. Despite these challenges, PT PAL has opportunities to strengthen its competitiveness. Global awareness of climate change and increasing international environmental regulations present a chance to highlight its green products, such as energy-efficient ships with low emissions. Government incentives, such as green finance and industrial transformation programs, further support the implementation of a green shipyard. Strategic collaborations with universities and international partners can drive innovation and technology development, while digital technologies like IoT and data analytics offer efficiency, real-time environmental monitoring, and operational transparency. Additionally, meeting international standards, such as IMO regulations and ISO certifications, will enable PT PAL to access export markets and gain international trust. Thus, while challenges exist, PT PAL can leverage these opportunities to build a competitive, sustainable shipyard capable of thriving in the global green industry.

V. CONCLUSION

PT PAL Indonesia faces significant challenges in developing and implementing its green shipyard marketing strategy, including financial constraints, technology adaptation, and human resource readiness. Limited investment for green infrastructure, gaps in eco-friendly technology mastery, and the need for intensive workforce training hinder the transition to a green shipyard, compounded by minimal collaboration between industry, government, and research institutions. However, the green shipyard marketing strategy has proven to positively impact PT PAL's competitiveness by focusing on sustainability, enhancing energy efficiency, adopting green technologies, and complying with international standards. This has helped improve the company’s reputation, attract global market interest, and create a competitive edge, while also supporting operational efficiency and expanding business opportunities. Opportunities for PT PAL include the increasing global demand for sustainable ship products, government incentives, and advances in digital technology and production automation. Additionally, compliance with international environmental standards offers access to export markets and global tenders. To leverage these opportunities, PT PAL should focus on long-term green investment planning through innovative financing, strengthen human resources with continuous training, foster strategic partnerships with universities and research institutions, and optimize its marketing strategy to emphasize eco-friendly product excellence and transparency to reach a broader international market.

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