Green Jobs and Skills Analysis in the Indonesia Maritime Industry: Unlocking Sustainable Workforce Opportunities

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Abstract: This study investigates the future job requirements and skill needs in the Indonesian maritime industry. This research adopts a qualitative case study approach with exploratory elements. The data was gathered from a variety of sources, including direct observation, literature reviews, official websites, journal articles, video conferences, and official reports from national and international organizations. Furthermore, the data was enriched through interviews with five experienced informants who are practitioners and academics in the maritime field. The data was organized and analyzed using NVivo 12 software, which helped create themes and subthemes. The study identified eleven distinct sectors in maritime services that offer green job opportunities. Green skills must be aligned and required for these jobs, which include awareness of green issues, metacognitive skills, and specific skills for new occupations. According to the study, the Indonesian government, maritime industry, and maritime-based campuses ought to invest in education and training programs that emphasize environmental-friendly skills. They should also develop regulations and incentives that promote environmentally friendly practices in the maritime sector and collaborate with other stakeholders to increase awareness of the importance of sustainability.

1 INTRODUCTION

The maritime industry is a crucial part of the global economy as it supports international trade, transportation of goods, and connectivity between nations. Historically, maritime activities have been the foundation for cross-border trade development and are essential for a country's economic growth. The industry's activities include shipping, ports, logistics, and the use of marine resources, which all contribute to economic growth and global sustainability.

The main roles of the maritime industry in the global economy include (1) *International Trade.* Cargo ships form the backbone of international trade, transporting various commodities and goods between countries. Sea transportation provides an efficient and cost-effective logistics route to move the flow of goods from producers to consumers all over the world. (2) *GDP Contribution.* The maritime industry plays an important role in a country's economic growth. Activities such as ship building, shipping, ship repair, and logistics services make a significant contribution to a country's Gross Domestic Product (GDP) (3) *Create Jobs*. The maritime industry creates millions of jobs around the world. Starting from sailors, shipping engineers, port workers, to personnel in the support services sector, many people work in this industry. (4) *Regional and Global Connectivity*. Ships operating in the seas carry people and goods from one country to another, forming a network of connectivity that supports international relations and global trading needs. (5*) Exploration and Exploitation of Marine Resources*. The maritime industry is also involved in exploring and exploiting marine resources, such as oil and gas, fish, minerals, and

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renewable energy such as wind energy and ocean waves. (6) *Marine Tourism*. Marine tourism is becoming an important part of the maritime industry. Cruise ships and marine tourism destinations attract billions of dollars from tourists who want to enjoy holidays at sea.

Although the maritime industry provides a variety of great economic benefits, it cannot be denied that maritime activities also have negative impacts on the environment, such as marine pollution and damage to coastal ecosystems. This is a concern shared by various academics, environmentalists, practitioners, and businessmen in the maritime field. The preservation of the marine environment and industrial growth must be in harmony.

Indonesia is a country that actively participates in a variety of marine activities. Activities at sea around Indonesia are visualized in Figure 1. Geographically, Indonesia is located close to several major shipping lanes in the world, where every year there is a large volume of traffic crossing its waters. This condition has two important aspects, namely the high maritime emissions in Indonesian waters and the potential to optimize this traffic as a valuable economic opportunity (Global Maritime Forum & University College London, 2022). The temporary reduction of emissions and help in achieving Indonesia's national development goals can be achieved by addressing these issues. In particular, this step will contribute to sustainable job creation in the long term, decarbonize other industrial sectors, improve public health, strengthen import and export activities, and support efforts to preserve Indonesia's biodiversity.

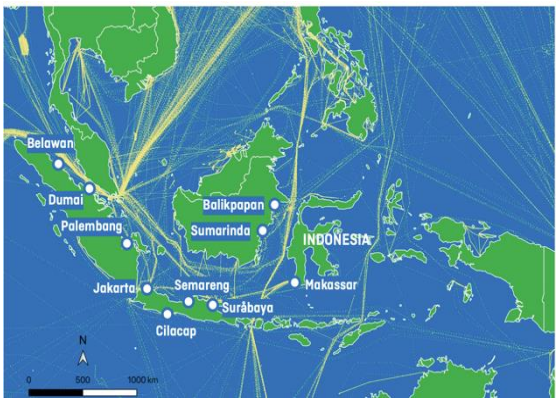

Figure 1: Maritime Activities Around Indonesian Coastal Waters. Source: (Skill Future Singapore, 2023).

This study is centered on the provision of jobs, skills, and other matters related to the future of the maritime industry. Based on the explanation in the previous paragraph regarding the importance of creating harmony in the environment and maritime activities, it is important to identify opportunities in today's environmentally friendly jobs and skills. Green job opportunities can not only reduce emissions but also contribute to a greener and more environmentally friendly economy. Industrial revolution 4.0 (IR 4.0) will require work processes and functions to change. Job tasks will in turn be impacted. The workforce must be trained in a combination of IR 4.0, digital, and green skills to support job roles that are emerging and in demand (Skill Future Singapore, 2023). Equipping the workforce with relevant green skills is equally important, as it ensures a smooth transition to sustainable industries and practices.

In addition, the maritime industry should consider investing in training and developing green jobs that can lead to new job creation and economic growth, while contributing to Indonesia's commitment to fighting climate change and protecting its unique biodiversity. Recognizing and seizing these opportunities can be crucial in leading the nation towards a more sustainable and prosperous future. Therefore, this research aids the maritime industry in identifying the demand for green jobs and essential skills that are valuable both now and in the future. Thus, the research questions of this study are 1. What are the future job requirements in the maritime industry in Indonesia? 2. What are the skills required for the maritime industry in Indonesia in the future?

1.1 Literature Review

To dig into the world of green jobs in the maritime industry, one must first understand the core concepts of green job and green skills. Understanding the gap between green job opportunities and the skills required to meet them is also critical.

1.1.1 Green Job

There is no consensus definition of what a green job it is. Bureau of Labor Statistics (BLS) defines green jobs as "jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources (U.S Bureau of Labor Statistics, n.d.)." The Environmental Protection Agency (EPA) defines green jobs as "jobs that help reduce pollution and protect the environment." (United Nation Environment Programme, 2008). Bezdek (2022) defines a green job as a full-time job, directly or indirectly related to green economy activities.

This research will refer to the definition made by the International Labour Organization (ILO) because the ILO is an international organization that is take more concern on the field of green jobs and has made various reports on green jobs from various countries. ILO defines a green job is any job that contributes to environmental protection and enhancement, the reduction of pollution and resource consumption, the adaptation to climate change, and the development, diffusion and application of environmentally sound technologies. Green jobs should also create decent and productive work, provide decent wages and social protection, contribute to poverty reduction, empower women and youth, and respect workers' rights (*International Labour Organization*, n.d.).

1.1.2 Green Skill

The International Labour Organization (2011) defines green skills as the knowledge, abilities, and values required to contribute to a sustainable and resource-efficient society. The skills here include both technical skills (such as engineering, construction, and IT) and soft skills (such as problem-solving, communication, and teamwork)

The main difference between green skills and green jobs is that green skills are the knowledge and abilities people need to do green jobs. For example, someone working in the renewable energy field needs to have green skills in engineering, construction, and IT. However, not everyone who has green skills works in green jobs. For example, someone who has green skills in problem-solving and communication can work in a variety of jobs, including both green and non-green jobs.

1.1.3 Green Job and Green Skill Gap

The shift to sustainability in the economy will have a big impact on employment. Likewise, the industrial revolution 4.0 created various gaps and job requirements in multi-industry, this also happened to the needs of the green industry. Here are four ways work is impacting the need for green jobs (Organisasi Perburuhan Internasional, 2013):

1. *New jobs will be created*. For example, there will be a need for workers to manufacture and install pollution control devices.
2. *Some jobs will be replaced*. For example, truck production will likely be replaced by tram production, and landfilling and incineration of waste will be replaced by recycling.
3. *Some jobs may be eliminated*.For example, jobs that involve the use of materials that are no longer allowed, such as plastic packaging, may be eliminated.
4. *Existing jobs will be transformed*. The skills and daily work methods of many professions, such as plumbers, electricians, metalworkers, and construction workers, will need to be updated to reflect the shift towards sustainability.

Holger Dieter (2023) stated that the US faces a shortage of green skills, where the demand for green jobs exceeds the supply of workers with the necessary skills. This gap is due to increased investment in green energy and climate technologies. Companies are embracing creativity in recruiting workers with green work experience, upskilling current workers, and hiring people from shrinking economies to bridge the gap.

The green skills gap is not just limited to the US. This inequality will expand to become a worldwide issue that is felt in numerous nations. The green skills gap is not just about technical skills. Also included are soft skills like problem solving, communication, and teamwork.

The employment gap and green skills are also a big challenge for Indonesia. The ILO estimates that there will be 1.2 million green jobs created in Indonesia by 2030, but there will be a shortage of 1.1 million workers with the skills needed to fill these jobs. This is due to a number of factors, including Indonesia's rapid green economy growth, under-investment in green skills training, and a mismatch between the skills taught and the skills required in a green economy (Zaituni et al., 2010).

2 METHODOLOGY

This study adopts a qualitative case study approach with an exploratory element. Data is collected from diverse sources, including direct observations, literature reviews, official websites, journal articles, conferences video, and official reports from national and international organizations. Furthermore, data is enriched through interviews with five experienced informants who are both practitioners and academics in the maritime field. The process of organizing and analyzing the data is facilitated by the use of NVivo 12 software. NVivo help to create themes and sub-themes from the data was collected.

3 RESULT AND DISCUSSION

Although sustainability and green practices are increasingly important in the maritime industry, information about green jobs in this sector may not be as widely disseminated in the public sphere as compared to other, more well-known sectors. The majority of journal articles deal with green jobs in a multi-industry context. Unfortunately, the exploration of green jobs in the maritime sector to date may have had lower visibility compared to some other sectors. This study's limitations are due to the difficulty in finding references and previous research that specifically address green jobs in the maritime sector.

Nonetheless, the information in this study is a result of synthesis from official websites and official reports of international organizations, as well as local and international conferences related to the topic of green jobs in the maritime sector. The data analysis results are also complemented by the results of observations and interviews. The informant is a captain, manager, and supervisor in the maritime industry, as well as a lecturer with extensive maritime knowledge.

The maritime industry covers a diverse range of economic, industrial, and service activities that involve the use and utilization of sea, river, and lake waters. In the Big Indonesian Dictionary (KBBI), the term "maritime" is defined as "pertaining to the sea, especially matters relating to shipping and trade at sea." The maritime sector includes a variety of aspects, such as marine transportation, management of marine resources, ship construction, maritime security, protection of the maritime environment, and many more. In general, the maritime sector encompasses all human activities in the waters, including trade, tourism, and the exploration of marine resources.

The categories of businesses in the maritime sector need to be understood before green jobs can be classified. This study classifies the maritime businesses in Indonesia according to the laws and regulations in the country. Article 27, paragraph 3 of Law No. 32 of 2014 of the Republic of Indonesia classifies the *maritime industry* in Indonesia into the following categories:

1. Shipyard
2. Procurement and manufacturing of spare parts
3. Ship equipment
4. Ship maintenance

Article 27, paragraph 4 of the same law explains that *maritime services* can be in the form of:

1. Education and training
2. Lifting of valuable objects from the cargo of a sinking ship
3. Dredging and cleaning of shipping lanes
4. Search and rescue
5. Environmental remediation
6. Construction services
7. River, lake, crossing, and inter-island transportation

3.1 Green Job Opportunity in Maritime Sector

Figure 2: Maritime Green Job Word Cloud Query Coding at NVIVO12.

To identify green job types relevant to maritime needs, we collected information from a variety of sources, including conference recordings, interviews, observations, and literature. Some of these jobs are already open in the industry, but others are still very limited or have not yet been created in Indonesia.

Coding classify was carried out based on job themes based on the classification of the Indonesian Maritime Industry. The classification of green jobs in the maritime sector is:

Table 1: Shipyard/Ship Equipment/Ship Maintenance.

Green Job	Description
Environmental Compliance Specialist	To ensures that an organization adheres to all environmental laws and regulations while implementing sustainable practices to minimize its ecological footprint and environmental impact.
Marine Renewable Energy Technician	Responsible for installing, maintaining, and troubleshooting renewable energy systems such as offshore wind turbines and tidal energy generators in marine environments, helping to harness clean energy from the sea.
Emission Control Technician	Tasked with installing, operating, and maintaining emission reduction systems, like exhaust gas cleaning systems and selective catalytic reduction systems, on ships and industrial facilities to ensure compliance with environmental regulations and reduce air pollution.
Green Ship Design Engineer	Specializes in designing environmentally sustainable ships, utilizing innovative technologies and materials to enhance fuel efficiency, reduce emissions, and minimize the ecological impact of maritime transportation.
Recycling and Waste Management Specialist	Responsible for developing and implementing efficient waste disposal and recycling strategies, ensuring proper handling of hazardous materials, and promoting environmentally responsible waste management practices to minimize the ecological footprint of shipyard operations.
Environmental Health and Safety Manager	Oversees safety protocols while ensuring that all operations align with environmentally responsible practices, safeguarding the well-being of employees and minimizing the ecological impact of shipyard activities.
Renewable Energy Integration Engineer	Focuses on seamlessly incorporating renewable energy sources such as solar panels, wind turbines, and energy storage systems into shipyard infrastructure to enhance sustainability and reduce reliance on fossil fuels.
Sustainable Materials Procurement Coordinator	Responsible for identifying, sourcing, and procuring environmentally friendly and ethically produced materials, ensuring that the organization's manufacturing processes align with sustainability goals and practices.

Table 2: Procurement and manufacturing of spare parts.

Green Job	Description
Sustainable Part and Material Engineer	Specializes in sourcing, evaluating, and implementing eco-friendly materials and components, reducing the environmental impact of production while maintaining quality and performance standards.
Sustainable Packaging Specialits	Responsible for selecting and implementing eco-conscious packaging solutions that minimize waste, reduce carbon footprints, and align with sustainability goals while ensuring the safe and efficient transport of spare parts.
Sustainable Project Manager	Leads and coordinates initiatives aimed at integrating sustainable practices into procurement and production processes, focusing on reducing environmental impact, enhancing efficiency, and promoting responsible sourcing throughout the project lifecycle.

Table 3: Education and Training.

Green Job	Description
Maritime Sustainabilty Instructor	Those who teach about sustainable practices, energy efficiency, and environmental protection to prospective seafarers, crew members, or other maritime personnel. They help raise awareness of sustainability issues in the maritime sector.
Maritime Safety Instructor	Instructor who specializes in maritime safety training, including training for dealing with emergencies and actions to take in dangerous situations.
Renewable Energy Trainer	Those who provide training on renewable energy technologies on board, such as the use of solar panels or sea wind turbines. They help in adopting sustainable technologies in the maritime industry
Maritime Green Researcher	Investigates and develops environmentally sustainable solutions, technologies, and practices within the maritime industry, contributing to the sector's efforts to reduce its environmental impact.

Table 4: Lifting of valuable objects from the cargo of a sinking ship.

Green Job	Description
Eco-Friendly Salvage Diver	Divers specially trained in eco-friendly salvage techniques who retrieve valuable cargo while minimizing disturbance to the underwater environment.
Historical and Cultural preservation Officer	Individuals who focus on preserving the historical and cultural significance of the cargo being salvaged, ensuring that valuable artifacts are handled with care and respect.

Table 5: Dredging and cleaning of shipping lanes.

Green Job	Description
Marine Ecologist	This expert monitors the impact of dredging activities and cleaning of shipping lanes on marine ecosystems. They also provide advice on how to reduce the negative impact.
Dreeding Project Sustainability Manager	Those who ensure that a dredging or shipping channel cleanup project complies with environmental regulations, engages in sustainable practices, and minimizes environmental impact.

Table 6: Search and rescue.

Green Job	Description
Marine Wildlife Rescue Specialist:	In situations where marine wildlife is involved in a search and rescue operation, this specialist would focus on rescuing and rehabilitating animals while considering their specific needs and the preservation of their natural habitats.

Table 7: Environmental remediation.

Green Job	Description
Recycling and Waste Manager	Responsible for overseeing the proper collection, treatment, and disposal of waste materials generated during remediation projects, implementing recycling initiatives, and ensuring compliance with environmental regulations to minimize the ecological impact of maritime cleanup efforts.
Waste Reycling Technician	Tasked with efficiently sorting, processing, and recycling waste materials generated during cleanup operations, contributing to sustainable waste management practices and reducing the environmental footprint of maritime environmental remediation efforts.

Table 8: Construction service.

Green Job	Description
Solar Panel Technician	Responsible for the installation, maintenance, and repair of solar panel systems on maritime structures and vessels, harnessing clean energy from the sun to enhance sustainability.
Wind Power Technicians	Specializes in the installation, maintenance, and repair of wind turbine systems on maritime structures and vessels, harnessing wind energy to promote sustainability and reduce reliance on traditional power sources.
Weatherproff Construction Experts	Professionals who specialize in the construction of infrastructure that can withstand severe weather and climate change, including seawall upgrades and coastal protection structures.

Table 9: River, lake, crossing, and inter-island transportation.

Green Job	Description
Sustainable Ship Captain	Who is trained in operating ships with energy efficiency, reducing emissions and minimizing environmental impact.
Sustainable Ship Engine Technician	Technician responsible for maintaining and repairing ship engines with a focus on fuel efficiency and environmentally friendly technology.
Electric Boat Skipper	Professionals who operate electric or hybrid boats to reduce exhaust emissions and air pollution.
Sustainable Transportation manager	Manager who plans and manages river, lake and inter-island crossing transportation systems with a focus on the use of renewable energy and sustainability.
Green Logistic Expert	Experts who design efficient and environmentally friendly transportation routes and networks to reduce travel distances and fuel consumption.

Table 10: Economy.

Green Job	Description
Energy Auditor	Individual who conducts comprehensive assessments of vessels and maritime facilities to identify energy inefficiencies, recommends energy-saving solutions, and promotes the adoption of eco-friendly technologies to enhance energy efficiency and reduce carbon emissions.
Sustainable Supply Chain Manager	Manages maritime supply chains with an emphasis on reducing environmental impact and promoting eco-friendly shipping practices, including sourcing sustainable materials and optimizing logistics.
Economic Sustainability Analyst	Focuses on the economic implications of maritime industry sustainability, including the impact of green policies, regulations, and technologies on the sector's overall financial health.
Carbon Credit Accountant	Specializes in managing carbon credit accounting for maritime companies, helping them quantify and monetize their emissions reduction efforts.
Green Shipping Investment Analyst	Analyzes investment opportunities in eco-friendly shipping technologies, alternative fuels, and sustainable maritime ventures for financial institutions or investment firms.

3.1.1 Green Skills Required

The demand for green jobs is increasing, and the skills required to fill these jobs are also changing. It is therefore important to understand the skills required for green jobs in order to prepare for the future of work. We synthesize three skills that must be possessed to support green jobs in the maritime sector; *Green awareness, metacognitive skills, specific green skills for new occupation*.

Green awareness skills refer to the ability to be conscious of and knowledgeable about environmental issues, as well as the ability to make informed and sustainable choices in everyday life. This could include skills such as recycling, conserving energy and resources, reducing waste, and supporting environmentally friendly practices and products. This skill are essential for supporting the transition to a sustainable economy. Individuals can use these skills to comprehend and tackle environmental problems, and to create and implement sustainable solutions. People with green awareness skills are in high demand in a variety of industries, including renewable energy, energy efficiency, waste management, and sustainable agriculture. The development of green awareness skills can be achieved through formal education, informal learning experiences, and on-the-job training. Formal education programs in environmental science, environmental engineering, and sustainability offer students the opportunity to learn about environmental issues, develop critical thinking skills, and gain experience in sustainable practices. Informal learning experiences, such as volunteer work with environmental organizations and participation in environmental workshops and conferences, can also help individuals to develop green awareness skills. On-the-job training is a valuable way for individuals to learn about specific green skills and practices that are relevant to their workplace. By developing green awareness skills, individuals can contribute to a more sustainable future for themselves and for society as a whole.

Figure 3: Green Skill in Maritime Industry.

Metacognitive skills refer to thinking about and managing one's cognitive processes and knowledge. They involve awareness and control over one's own thinking and learning processes. Metacognition encompasses a range of mental activities that help individuals plan, monitor, assess, and adjust their thinking and problem-solving strategies. These skills are essential for effective learning, problem-solving, and decision-making. Metacognitive skills are

essential for supporting green jobs in the maritime industry because they enable workers to learn and adapt to new technologies and challenges.

The maritime industry is quickly adapting to the challenges of climate change and environmental protection. This has created a number of new green jobs, such as renewable energy technicians, marine ecological scientists, and sustainable port managers. These jobs require workers to have a deep understanding of complex environmental issues and the ability to think critically about the environmental impact of their work. Metacognitive skills enable workers to develop the knowledge and skills they need to succeed in these new green jobs. For instance, a renewable energy technician is tasked with installing a new solar panel system on a boat. The technician uses their metacognitive skills to plan the installation carefully, considering factors such as the size and type of solar panels, the location of the panels on the boat, and the potential environmental impact of the installation

Specific green skills for new jobs in the maritime industry are the abilities and knowledge needed to perform roles that focus on environmentally friendly practices at sea. These skills are related to the hard skills needed in the maritime industry, such as engineering, navigation, and maritime law. Green skills necessitate a complete comprehension of environmental issues and the capacity to apply this knowledge to real-life situations. If someone is targeting a specific green job in the maritime industry, they should prepare themselves through formal, informal, and non-formal education. Formal education programs in marine engineering, environmental science, and maritime sustainability can provide the necessary foundation in green skills. Informal learning experiences, such as volunteer work with environmental organizations and participation in industry workshops and conferences, can also help individuals to develop green skills. On-the-job training is a valuable way for individuals to learn about specific green skills and practices that are relevant to their workplace.

4 CONCLUSIONS

This study has explored the growing field of green jobs and the skills required for them in the Indonesian maritime sector. We identified three key categories of green skills:

Green awareness skills, are essential for creating an environmentally conscious workforce that understands the complexities of environmental issues and the importance of sustainability in the maritime industry. These skills enable people to make informed and sustainable choices in their professional roles.

Metacognitive skills, are also critical for a green workforce. These skills involve higher-order thinking abilities that allow people to plan, monitor, and adapt their actions as needed, especially in the context of green practices. By developing these skills, maritime professionals can effectively align their activities with sustainability goals and address the challenges of evolving environmental regulations and best practices.

Specific green skills for new occupations in the maritime sector, are also important. These specialized competencies and knowledge domains are essential for the emerging job roles that prioritize eco-friendly and sustainable practices in the maritime industry. These roles involve a wide range of tasks and responsibilities, such as emissions reduction, ballast water management, energy efficiency, and waste reduction.

Our exploration included the possibilities of green jobs in the maritime sector of Indonesia. We categorized maritime services into eleven distinct sectors, such as shipyard operations, procurement, the manufacturing of spare parts, ship equipment, ship maintenance, and various maritime services such as education and training, search and rescue, and environmental remediation. These categorizations provide a foundation for understanding the diverse range of green job prospects in the industry.

In conclusion, this research provides a comprehensive overview of the potential for green jobs and the skills required to foster sustainability in the Indonesian maritime industry. By elucidating these opportunities and the associated skill sets, this study contributes valuable insights that can be instrumental in the development of an environmentally conscious and sustainable maritime workforce in Indonesia. This endeavor aligns with broader global initiatives aimed at protecting the environment and promoting green practices in the maritime sector, positioning Indonesia as a proactive participant in these vital efforts.

5 RECOMMENDATIONS

The research is useful for providing several useful recommendations for the government, maritime industry, universities and society. The recommendations are:

- The Indonesian government should invest in education and training programs that teach environmentally friendly skills.
- The Indonesian government should develop regulations and incentives that promote environmentally friendly practices in the maritime sector.
- The Indonesian maritime industry should work to develop and adopt new technologies that are more environmentally friendly.
- The Indonesian maritime industry should collaborate with other stakeholders to raise awareness of the importance of sustainability.
- Maritime-based campuses should become pioneers in producing human resources who are ready to fill green jobs with adequate green skills, through curriculum development and providing training that is open to students or the public.
- The public must increase their knowledge and literacy regarding green skills and jobs in the maritime sector. This knowledge will help the community to be able to compete and fill the need.

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