

# Contributions and Characteristics of Maritime Higher Education Institutions (PTKL) in the Sea Transportation Sector Supporting the Advancement of the National and International Shipping Industry

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## Abstract

Indonesia, being the largest archipelagic nation with over 17,000 islands and 70 percent of its territory consisting of maritime zones, holds a strategic advantage in the global maritime industry. This article examines the contributions and institutional profiles of Maritime Higher Education Institutions (PTKLs) under the Ministry of Transportation, which are central to producing internationally and professionally qualified maritime human resources. The study highlights the unique educational model of PTKLs that integrates vocational training, STCW-based certification, boarding school discipline, and an industry-oriented curriculum, using a qualitative descriptive and document analysis-based approach. Findings show that PTKLs not only meet national labor demands but also position Indonesia as the third-largest global supplier of seafarers. The system includes over 234 maritime institutions, with core PTKLs like STIP Jakarta and PIP Semarang producing approximately 1,800 certified graduates annually. These institutions maintain strategic partnerships with more than 400 entities, including shipping companies, international academies, and port authorities. Despite their effectiveness, PTKLs face regulatory issues such as misalignment of accreditation frameworks and lack of formal recognition within Indonesia's national education law. The article concludes with recommendations for establishing a specialized maritime accreditation body, aligning vocational standards, and institutionalizing financial mechanisms to enhance long-term competitiveness. Strengthening PTKLs is essential for advancing Indonesia's role as a Global Maritime Fulcrum.

**Keywords:** PTKL, Maritime Education, Indonesia, STCW

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## Introduction

Being the largest archipelagic nation in the world and having more than 17,000 islands out of which about 70 percent of the country is made up of waters, Indonesia has excellent maritime prospects (Moejiono, 2023). The shipping industry is very essential in linking these islands and the trade, transportation and communication within the archipelago and even in the world at large. The sea transportation industry being the backbone of the shipment system, both globally and locally needs the highly qualified, skilled, and certified human resources to sustain the qualities of operations, safety, and efficiency.

Maritime Higher Education Institutions (Higher Education Ministries and Institutions - PTKL) under the Ministry of Transportation, especially at Center of the Development of Human Resources of Sea Transportation (PPSDMPL) are strategic organizations in producing such human capital to the national and international sea transportation industries. Indonesian

maritime education system and specifically the PTKL known as STIP Jakarta, PIP Semarang and PIP Makassar is arranged to offer vocational training which combines theoretical education and practical training on shore and on the sea.

This system is also according to international standards such as the Standards of Training, Certification, and Watchkeeping (STCW), the presence of which guarantees the possibility of graduates only being academically qualified but professionally certified in order to be able to work in international waters. Such certifications are Certificate of Competency (CoC) and Certificate of Proficiency (CoP), which are the major requirements of maritime officers and technical personnel (Acar et al., 2024).

Sea transportation industry depends greatly on professional seafarers who can run a different kind of vessel, cargo ships, tankers, and cruise liners. The International Maritime Organization (IMO) estimates that about 80-90 percent of all trade (in volume) moves across the waves, so the scale of the responsibility borne can be estimated by maritime professionals. Shortfall in the number of ship officers is anticipated to be 63,000 by 2026 demonstrating the increasing recruitment of maritime graduates (IMO, 2024). One of the countries that can curb this shortage is readily available as the third supplier of seafarers globally, Indonesia, which is preceded by the Philippines and China.

PTKLs possess a unique learning culture and system and this often entails a boarding-school system, character building programs and highly demanding discipline regimes unlike that of the academic focus of the typical university. The graduates of these institutions have not only a well-developed technical competence, but also the right leadership, ethical behavior and the ability to work in multicultural and stressful conditions (Muid et al., 2024). Also, PTKLs have close connections with maritime industry and overseas institutions, which results in the relevance of its curriculum and the establishment of job pipeline based on the internship program and direct recruitment arrangements.

The major contribution of PTKLs to Indonesia can be attributed to the fact that it contributes directly on the country foreign exchange earnings by the means of seafaring profession. More than Rp 425 trillion worth of remittances came in between 2021 and 2023 by the Indonesian seafarers, and over 60 percent of it was done by PTKL graduates. It is expected that by 2024, this contribution will grow to Rp 159.8 trillion thus further highlighting the economic worth of the maritime education and training. The remittances contribute to the development of the nation, and it confirms the key role of PTKLs in the maritime diplomacy of Indonesia in the global context.

The role of PTKLs was even more apparent during the COVID-19 crisis, when more than 400,000 seafarers got stranded in the seas as a consequence of the international travel prohibition. Nevertheless, seafarers managed to guarantee the non-stop circulation of products, thereby maintaining the global supply chain. On the same note, incidences such as the stranding of the Ever-Given ship in the Suez Canal in 2021 exhibited the economic risk of shipping debris, as devastation losses of global trade came at a rate of \$9.6 billion a day. Such incidences reiterate the importance of highly trained professionals under the maritime industry, something that PTKLs will be able to provide.

To address changing requirements of the industry, PTKLs are constantly updating their training modules comprising of non-STCW courses in relation to the consultation with industry stakeholder and international partners. Such studies include sophisticated firefighting, medical skills, ship security, and bridge and engine room management among other skill up. PTKLs

also focus on acquiring soft skills, including good competence of maritime English, intercultural communication, crisis management, or great skill in leadership, so that graduates can operate successfully within multinational crews and a complicated situation of actions.

There is still the institutional challenge, though, in recognition and regulation of maritime vocational education. The difference in accreditation standards between the Ministry of education and the Ministry of Transportation, and the lack of special legislative foundations of marine education in the National Education System Bill (RUU Sisdiknas) disrupt the highest work and international recognition of PTKLs. Hence, it is necessary to establish a special Maritime Vocational Accreditation Body and to legalize the PTKL boarding system and sea practices to raise the credibility and effectiveness of the maritime training in Indonesia (Ndori et al., 2023).

As Indonesia aspires to become a Global Maritime Fulcrum (World Maritime Axis), the strategic role of PTKLs in producing world-class seafarers becomes increasingly vital. Their contributions extend beyond domestic development to global trade stability, environmental protection, maritime safety, and international diplomacy. With sustained policy support, regulatory reform, and international collaboration, PTKLs can serve as the foundational pillar for Indonesia's maritime leadership in the 21st century.

## Methods

This paper is qualitative descriptive in nature which is a deep and systematic analysis of functions, contributions and institutional features of the Maritime Higher Learning Institutions (Higher Education Ministries and Institutions - PTKL) in Indonesia. Since the qualitative descriptive method is only an expeditious and appropriate way to explore and exhibit complex phenomena of the institutional setting without distilling it to numerical generalization, it is a natural way of methodological exploration and illustration. It enables the author to afford a rich story of PTKLs and their role in national and international development of maritime, and focus on the contextual and structural factors peculiar to the Indonesian maritime education. The information, based on which this study is created, is purely secondary and includes both national and global official records, documents on policy, inner reports of any institutions, statistical archives, and technical regulations regarding the maritime sector in the sphere of education and training. Other important data are internal reports of the Center for the Development of Human Resources for Sea Transportation, the policy data provided by the Directorate General of Sea Transportation of the Ministry of Transportation, international forecasting of the International Maritime Organization, global shipping industry analysis made by such organizations and the BIMCO-ICS Seafarer Workforce Report. The documents have full information on the operational range of PTKLs, institutional structures, human resource outputs, international recognition and network of partnerships.

Interesting themes and patterns are extracted through the method of document analysis employed in these sources. This entails a systematic search of textual documents to find institutional requirements, curriculum standards, training rules (such as those that are stipulated by the STCW Convention), graduate profiles, and portfolio of aligning with strategies between maritime education and the national objectives. Focus is on signs of things like; certification criteria (CoC, CoP), training modules, aboard practice programs, post-graduation employment, and remittance inputs. Comparative tidings between PTKLs and general universities are also looked upon in the analysis to formulate the unique features of the PTKL educational model.

Another asset of the article is the fact that it cites supplementary statistical data to boost descriptiveness. As an illustration, the data concerning the amount of PTKL schools, the number of graduates annually, international remittances and the estimated workforce shortages worldwide are based on publications of the databases and monitoring records. No primary fieldwork and surveys were performed, but the inclusion of longitudinal data (e.g. 2021-2024 graduate trends and levels of remittance contributions) add analytical strength and political importance to the article. The methodology makes the article to evaluate strategic positioning of PTKLs in the education system of Indonesia, as well as, in the illustrious maritime employee market. The proposed approach focuses on thematic consistency and policy relevance which is more concern in view of the wider Indonesian ambition to become a global maritime fulcrum. Upon examination of documented partnerships, regulatory frameworks, curriculum structure, and performance indicators, the article is in a position of giving an all-inclusive insight of how PTKLs have become the active driver of human capital creation in the field of sea transportation. The study also incorporates a policy analysis component, reviewing the implications of existing regulatory gaps and proposed reforms, particularly regarding accreditation standards, recognition of the boarding school system, and vocational training policy alignment. These insights are grounded in official legislative documents, such as Presidential Regulation No. 173 of 2024 and various ministerial regulations related to maritime education.

## **Result and Discussion**

Due to Indonesia ambitions of becoming a Global Maritime Fulcrum, the role of PTKLs is becoming extremely crucial in providing the country with a qualified, certified, and internationally competitive maritime workforce. They are not just educational institutions but also a formal training ground that has an orientation in accordance to international conventions and standards like the STCW Convention. The importance of PTKLs is based on the fact that they were able to cater to not only the domestic logistical issues but also global labor shortage within the shipping sector. PTKLs differ with the traditional higher education systems by inculcating the elements of boarding-based vocational training, sea practices, and international certification programs. The main results of the research performed are introduced below on the basis of the extensive review of institutional data, regulatory frameworks, certification system, and strategic alliances. These findings are presented in a thematic manner in order to depict the extent, nature and substance of PTKLs on the maritime industry of Indonesia and their role in international maritime labor markets.

### **The Uniqueness of the Maritime Education System in PTKL**

To be more exact, there are several specific aspects that the maritime education system provided by PTKLs (Higher Education Ministries and Institutions) under the Ministry of Transportation may be referred to as unique features not presented in the basic model of higher education in Indonesia. Largely, PTKLs run a competency and vocational-based education course structure where the combination of theory and practical maritime training conditions exists. The system is typified by the existence of a boarding school organization whereby the students (cadets) are put in boarding houses in the campus controlled by a highly systems and Command structure. This semi-militaristic atmosphere is aimed at training discipline, leadership, resilience, and a professional work ethic to become prepared by the cadets to face real life operations on the sea. However, unlike ordinary universities, PTKLs must be programmed so that they do not just offer education on an academic level, but to recreate the chain-of-command culture that exists in ships.

Moreover, PTKLs incorporate the international maritime rules into their own curricula, particularly the STCW (Standards of Training, Certification and Watchkeeping) regulations formulated by International Maritime Organization (IMO). That way, every graduate has to acquire internationally acceptable certifications like the Certificate of Competency (CoC) and the Certificate of Proficiency (CoP) beside their formal diplomas (IMO, 2023). Such certifications are essential in working domestically and on foreign-flagged ships, and they make sure that the graduates will be at the international standard of: safety, navigation, engineering, and emergency response.

A characteristic feature of a PTKL educational route is that it comprises a combination of classes and a sea practice period called the Onboard Training and normally amounts to 12 months. At this stage cadets are put on vessels under supervision to put into practice in real situations at sea what they learnt in the classrooms. This experience is augmented by land based practical training, especially in the logistic of ports and operational management of the ports which makes the PTKL graduate very versatile and industry ready. The two-track approach between theory and ground work separates the education of PTKL education system and a common higher educational system which commonly focuses on theoretical education rather than field experience.

Moreover, PTKLs provide a great variety of trainings in accordance with the IMO Model Course, such as Basic Safety Training (BST), Advanced Fire Fighting (AFF), Medical First Aid (MEFA), and Crowd Management Training, and they are critical in the case of emergency and crisis on board. It also has specialized programs that cover training on tankers, liquefied gas carriers, radio operations (GMDSS), and security awareness; so that cadets may gain niche skills that are applicable to certain business and vessel as well as international operations. It is through the Directorate General of Sea Transportation that the delivery of these programs by accredited and approved training centers provide support on ensuring that global standards on maritime issues and regulatory expectations are followed upon.

Besides, soft skills development within the framework of pedagogy of PTKLs is important in the context of multicultural and multinational character of the maritime work. They learn maritime English, cross-cultural communication, emergency leadership and team coordination and by studying these, cadets can work with crews of international nationalities and react appropriately in stressful situations. The holistic nature of maritime education in PTKL that is the conundrum of technical skills, character building, physical and international certification makes the PTKL system highly personalized to yield internationally competitive professional seafarers with operational skills.

### **Scope and Institutional Profile of PTKLs**

The institutional availability of PTKLs (Higher Education Ministries and Institutions) in the maritime education and training sector of Indonesia is large and in a strategic nationwide localisation in order to have an equitable access to maritime education in the country. By the year 2025, the system of the maritime education and training organized by Center of the Development of the Human Resources in Sea Transportation (PPSDMPL) will consist of 234 educational organizations serving different levels of competency in maritime activities and career paths. These consist of 11 official PTKLs which are under the Ministry of Transportation: STIP Jakarta, PIP Semarang, PIP Makassar, and Politeknik Cruise (Polteknepel) campuses in Barombong, Surabaya, Malahayati (Aceh), Sorong, Sulawesi Utara, Sumatera Barat, Banten and Tangerang. These institutes have a special mandate of producing certified

marine officers as well as professionals in line with the national shipping needs and international requirements.

Other than the basic PTKL network, there are 21 maritime-based Public and Private Universities (PTN/PTS) independent of the Ministry of Transportation (including UNIMAR AMNI Semarang, Polytechnic The State of Bengkalis, and POLIMARIM Makassar). These institutions play a major role in the education of people in the maritime field but both the governing systems and accreditation procedures differ. In addition, it has 33 other maritime higher educational institutions including specialized academies (Nusantara Maritime Academy Cilacap and STIMAR Jakarta) providing specialized training in navigation, marine engineering and logistics.

At the secondary level, the ecosystem is supported by 70 maritime vocational schools (SMK Cruise) spread across the country, with well-known examples like SMK Cruise Katangka in Makassar and SMK Cruise Tegal, which serve as feeder schools for tertiary maritime education. In addition, the system includes 99 maritime training centers, both government-run and private, such as Pertamina Maritime Training Center (MTC) Jakarta, Imari MTC, and Bina Sena MTC, which provide short-course and specialized certification programs, including refresher training for active seafarers.

The comprehensive reach of these institutions ensures that maritime education is not concentrated only in Java or Sumatra, but extends to Eastern Indonesia, supporting Indonesia's commitment to regional equality and the development of maritime human capital across provinces. This structure reflects a multi-tiered and decentralized maritime education system that addresses both the upstream and downstream aspects of seafarer development from basic vocational education to advanced professional training and certification.

Each tier within the PTKL ecosystem plays a vital role. The higher education institutions focus on producing maritime officers and professionals capable of fulfilling operational, managerial, and leadership roles, while SMK Cruise and training centers serve as the foundation for entry-level technical competencies and lifelong learning. The system is also responsive to industrial demands, adapting curricula and certification offerings to align with the evolving needs of the global maritime industry, including logistics, port management, and vessel operations.

Moreover, the presence of such a wide institutional network enables the Indonesian government to supply a significant portion of the global seafaring workforce. The total number of graduates from core PTKLs is estimated at around 1,800 individuals per year, with a consistent annual growth trend of 5%, indicating a proactive effort to meet both domestic and international labor shortages in the maritime sector. This human capital output is a direct result of the structured and regulated expansion of PTKL institutions under the coordination of the Directorate General of Sea Transportation.

### **Professionally Certified Human Resources**

The PTKLs (Higher Education Ministries and Institutions) graduates are a breed or type of maritime professionals who are both academically trained as they are professionally certified based on international standards. This, among others, is one of the many factors that make the graduates of PTKL unique: their dual qualification (vocational-academic degrees: D-III or D-IV/S1 towards specialized maritime education subjects: Nautical Studies, Marine Engineering, Maritime Logistics) and at the same time having an international level of qualifications needed to be hired into a merchant and non-merchant number of vessels. These are Certificate of Competency (CoC) and Certificate of Proficiency (CoP) provided according to the Standards

of training, certification and watchkeeping of the seafarer (STCW) in promotion with the International Maritime Organizations. The certification procedure is very strict and guarantees the fact that all graduates are prepared with both theoretical and practical skills that may be applied to their work on the shipboards, safety procedures, emergencies response, and policies aimed at preserving marine environment.

The graduate profile as set out by the Nautical Studies (Deck Department) stream entails the ability to navigate the ship successfully, plan routes or voyages, handle contemporary navigational tools, overseeing of cargo handling activities, emergency handling as well as watchkeeping whilst conforming to STCW guidelines. They also train to use Life-Saving Appliances (LSA) and Fire-Fighting Appliances (FFA) and safety procedures in case of voyages and visits in ports. In the meantime, the graduates of Marine Engineering (Engine Department) curricula have the skills to run their main engines and auxiliary systems, jump power shipboard electrical power, do emergency shutdown, make preventive and corrective maintenance. It is highly important to discuss competence based on these skills and to verify the security and functionality of the vessels that conduct operations in international waters.

In the case of the students undertaking the Maritime Logistics and Shipping Management program, PTKLs equip graduates with skills to super-vice the activities in ports and shipping, the handling of the supply chain, organizing scheduling and documentation, and evidence-based analysis of cost-effectiveness in maritime transportation. In the ships and on the land, in the logistic centers and the ports authorities, these graduates play an important role. They undergo training to ensure that they operate within international laws such as the maritime laws, customs laws, freight documents check, and shipping conventions, which allowed them to operate in multinational settings.

Another distinguishing feature of the PTKL graduates is the mandatory practical training period, which is 12 months onboard training period to deck cadets and engine cadets and immersion period to land based industry to logistic cadets. This practice in the sea is not symbolic but is regulated and is assessed, as a module of the diploma program. The cadets will complete real work under the on-board supervision of licensed officers during their on-board stay, and in multinational crews, with the practical experience required to pass flag state endorsements along with the ship registry. The practical part also makes sure that the graduates should be operational by the time they hit the labor market so that shipping concerns save on the cost of hiring, and the labor absorption rate of the country increases.

In addition to technical skills, PTKL graduates are intensively trained in soft skills deemed essential in the global maritime workforce. These include maritime English communication, interpersonal coordination in multicultural crews, crisis and crowd management, and ethical leadership. Graduates must also pass certifications in critical areas such as Basic Safety Training (BST), Advanced Fire Fighting (AFF), Survival Craft and Rescue Boats (SCRB), and Radar Navigation and Simulator Training, all of which are aligned with IMO Model Courses. Furthermore, the boarding school model instills character traits such as time discipline, chain-of-command obedience, and decision-making under pressure, which mirror real maritime working environments.

Importantly, PTKL certificates and academic degrees are recognized internationally through endorsement mechanisms, wherein flag states accept Indonesian seafarer credentials based on bilateral agreements and STCW compliance audits. This provides PTKL graduates with global employment opportunities, allowing them to serve aboard international fleets from countries such as Panama, Liberia, the Bahamas, Japan, South Korea, and Germany. Their certifications

are considered valid for service on tankers, container vessels, bulk carriers, offshore vessels, and passenger ships, reflecting the high standards maintained by Indonesia's maritime education system.

### **Global Industry Needs and Human Resource Challenges**

The global maritime industry is undergoing a dynamic transformation driven by increasing trade volumes, technological advancements, and evolving regulatory standards. At the center of this transformation lies a growing demand for highly skilled, certified, and globally mobile maritime professionals. According to the International Maritime Organization (IMO), approximately 80 to 90 percent of global trade by volume is carried by sea, making the maritime sector the backbone of the international supply chain. The scale of global shipping activity, which involves the operation of more than 105,500 active merchant vessels, underscores the critical need for a robust and sustainable maritime workforce. However, this demand is not being matched by an adequate supply of competent seafarers. The BIMCO-ICS Seafarer Workforce Report (2021) estimates that by 2026, the world will face a shortage of 63,000 ship officers, posing a significant threat to the stability of global shipping operations.

Indonesia, as the third-largest supplier of seafarers in the world, following the Philippines and China, plays a strategic role in mitigating this global workforce gap. In 2023 alone, Indonesia recorded an estimated 250,000 active seafarers working across global fleets, contributing not only to international maritime operations but also to the national economy through remittances and foreign exchange. Yet, Indonesia's ability to maintain and expand this contribution depends heavily on the capacity of PTKLs to continually produce seafarers who are not only numerically sufficient but also meet stringent international qualifications. The ever-changing landscape of maritime labor regulations, increasing automation aboard vessels, and the need for multi-disciplinary competencies pose significant challenges for human resource development.

To address these challenges, PTKLs have expanded their training portfolios, offering not only standard STCW-based certifications such as the Certificate of Competency (CoC) and Certificate of Proficiency (CoP), but also additional specialized training programs that respond to the needs of both sea-side and shore-side operations. On the sea-side, this includes training in advanced ship handling, crisis management, radar and electronic chart display systems, and shipboard resource management. On the shore-side, cadets and graduates are equipped with competencies in port logistics, maritime law, supply chain optimization, and digital maritime operations, preparing them for roles in shipping companies, port authorities, and regulatory agencies. Such programs are increasingly aligned with the expectations of the Fourth Industrial Revolution, where data literacy, digital navigation tools, and cyber-awareness are becoming standard competencies for maritime personnel.

In addition to regulatory and skill-based demands, the resilience of the maritime workforce has emerged as a key concern in the post-pandemic era. The COVID-19 crisis (2020–2021) exposed the vulnerability of maritime labor, with over 400,000 seafarers stranded on ships due to global travel restrictions. Despite these hardships, seafarers continued to operate vessels, ensuring the flow of critical goods and commodities around the world. This crisis not only highlighted the indispensable role of seafarers in sustaining the global economy but also emphasized the urgent need for robust support systems, including mental health preparedness, contractual protection, and fair recruitment processes. Institutions like PTKLs are thus challenged to prepare their students not only for technical tasks but also for mental endurance, multicultural engagement, and adaptive leadership during crises.

Furthermore, major maritime incidents have revealed how a shortage of skilled professionals can result in catastrophic disruptions. The grounding of the *Ever Given* in the Suez Canal in 2021, which blocked one of the world's busiest maritime trade routes, led to an estimated \$9.6 billion in losses per day, demonstrating how human error and inadequate crisis preparedness can ripple through the global economy (Lloyd's List Intelligence, 2021). These events reinforce the importance of producing competent, well-trained, and quick-thinking professionals who are capable of responding to both routine and extraordinary maritime challenges.

To enhance national readiness and global competitiveness, PTKLs have begun developing non-STCW training modules tailored to domestic industry feedback and international benchmarks. These include programs in Port State Control, marine environment protection, maritime cybersecurity, and digital vessel monitoring systems, many of which are delivered through collaboration with LSPs (Professional Certification Institution) and international partners. This shift towards customized, industry-responsive training ensures that PTKLs are not just following static regulations but are innovating ahead of global trends.

### **Strategic Partnerships and Industrial Alignment**

To ensure the relevance and responsiveness of its educational programs, PTKLs (Higher Education Ministries and Institutions) have actively cultivated extensive strategic partnerships across multiple sectors ranging from international maritime institutions to domestic shipping companies, port operators, and local governments. These collaborations are not incidental but are structurally embedded within the educational and training model of PTKLs, aligning curricula with the competencies required by the maritime labor market. According to data from PPSDMPL (2025), PTKLs maintain formal cooperation with 152 shipping companies, 98 universities, 63 government institutions, and 112 professional associations and certification bodies, resulting in an integrated and expansive ecosystem of industrial support. Key industry partners include PT Pelni, ASDP Indonesia Ferry, Meratus Line, SPIL, and international firms such as Hanjin Shipping, NYK Line, and Mitsui OSK Lines, which collectively absorb thousands of PTKL graduates annually and host cadets for onboard training placements.

The alignment between education and industrial demand is also enhanced through PTKL cooperation with foreign maritime academies and institutions, including the Academy of Maritime Malaysia, Jade University of Applied Sciences in Germany, and Columbia Shipmanagement Korea. These partnerships allow for international benchmarking, student exchange, joint certification development, and harmonization of training standards, particularly in relation to the STCW Convention and other IMO-related frameworks. Through these international linkages, PTKLs have positioned themselves to meet the requirements of global shipping operators who seek seafarers trained under universally accepted regulations, thereby enhancing the international mobility of Indonesian maritime graduates.

Beyond onboard training, these partnerships support the placement of graduates in shore-based careers, such as logistics coordination, port terminal management, maritime insurance, customs brokerage, and shipping agency operations. Several PTKLs have co-designed modules with private operators and port authorities to address the increasing need for shore-side maritime professionals who are fluent in digital maritime systems, green port practices, and supply chain analytics. This trend aligns with global shifts in the maritime sector, where traditional seafaring roles are being complemented by new functions driven by automation, sustainability regulations, and intermodal logistics integration.

To formalize and institutionalize these relationships, PTKLs have developed memorandums of understanding (Moues) and long-term cooperative agreements that outline clear commitments on curriculum development, student internships, joint certification programs, and faculty training. For example, cooperation with CIMA (Center for International Maritime Affairs), INSA (Indonesian National Shipowners' Association), and IALA (International Association of Marine Aids to Navigation and Lighthouse Authorities) ensures that PTKL graduates are trained with the most current regulatory and technological knowledge. Such collaborations also allow industry stakeholders to provide direct feedback on the effectiveness of training programs, which is essential in maintaining the dynamic relevance of PTKL offerings.

At the domestic policy level, coordination with regional governments such as BPSDM Pemda Aceh, the City Government of Semarang, and the East Kalimantan Provincial Government—has supported the regionalization of maritime education access. These collaborations often take the form of cost-sharing mechanisms for cadet training, sponsorship of non-STCW certifications, and localized curriculum development for small port management and coastal transport systems. This has allowed PTKLs to expand their social impact by producing maritime professionals in remote and coastal areas, in line with Indonesia's national commitment to maritime equity and inclusion.

Additionally, the strategic partnership framework has allowed PTKLs to function as nodes of industry-academia-government collaboration, where institutional outputs are not only workforce-centric but also serve broader economic and developmental objectives. These include support for Indonesia's role in international maritime diplomacy, enhancement of global port connectivity, and the contribution to blue economy strategies outlined in national development plans. The dynamic between PTKLs and their stakeholders represents a successful model of “link and match” between education and industry an approach often cited but rarely implemented at such scale and continuity in other sectors.

## **Discussion**

The strategic nature of the contribution of PTKL (Higher Education Ministries and Institutions) towards the growth of maritime industry in Indonesia is seen in not only the output of education but also the form in which it is organized as correlating to the international standards and the national priorities in career of mariner. The implications of this study were that PTKLs would be the foundation of maritime human capital development and set better foundations to bring forth seafarers and maritime professionals who are globally competitive, with appropriate skills that are technical in their nature as well as subject to change according to the mother industry. This correlates with the maritime vision of the country covered in the vision of the Global Maritime Fulcrum, according to which the country desires to be the point of World Maritime Affairs (Saeed et al., 2021).

Among the most notable features of PTKLs is the capacity to provide vocational training which can easily be converted to the employment and operational competence. In contrast to the more traditional academic institutions, which regularly find it difficult to design curricula to match the requirements of the labor market, the PTKLs are in a competency-based condition of education with origin in STCW structures and IMO-certified course of study routes. The model increases the level of employability notably and offers an added benefit of the growth in the credibility of Indonesia as a labor-providing country in the maritime industry (Bargsted et al., 2021). The dual-certification strategy, which implies merging academic degrees with professional licenses (CoC and CoP), puts the PTKL graduates in a relative league in the domestic and global labor market.

Nonetheless, at this extent of technical/operational seamlessness, do not come free of institutional and regulatory issues. Differences between Ministry of Transportation and Ministry of Education, Culture, Research and Technology in the accreditation standards, as it is indicated in the article, is one such fragmentation that risks undermining the harmoniousness and validity of PTKL credentials. This is the reason why a specialized maritime vocational accreditation agency, acronymic as Lembaga Vocational Accreditation Maritim (LAVM) has become the pressing need in order to align quality assurance procedures and safeguard the special character of PTKL education. The lack of formality in having the boarding school system, sea practices and semi-militaristic nature of character formation of PTKL in national education law (RUU National Education System) also withdraws the strength of institutions and limits the public investment towards maritime training infrastructure.

The other important implication has to do with Indonesia as a strategic position in regard to situation of global workforce shortages (Efendi et al., 2022; Ssenyonga, 2021). As the IMO anticipates an excess of more than 63,000 ship officers worldwide by 2026, Indonesia has a chance and a role to play as a global source of labor. However, this also makes too much pressure on PTKLs to produce more graduates, enhance the effectiveness of the training system, and guarantee international acceptance of seafarer's certification. In their absence, insufficient regulatory support and investment would also have the potential to undermine the quality of training at the expense of fulfilling these expectations resulting in long-term consequences in the form of a reputation in the labor market and diplomatic leverage (Singun, 2025).

Of solidarity action, PTKLs have effectively formed strategic alliance with local and overseas maritime institutions, to ease internship placements, curriculum collaborations, and double certification initiatives. This cooperation with such entities like Columbia Shipmanagement Korea, Academy of Maritime Malaysia, and other shipping companies (Pelni, ASDP, Meratus) are good examples of the collaboration between industry-education-government (Kepli & Vethiah, 2023; Chuah, et al., 2021; Zulkifli & Musa, 2022). They are good examples of how PTKLs might be able to create relevance in training and at the same time expand the job opportunities. Furthermore, collaborating with port authorities and logistics providers, PTKLs are moving out of sea-related tier roles into ship-side areas including port management, maritime policy, and environmental regulation, which are major aspects of the blue economy in the developed setting.

Another issue that it raises is that PTKLs have gone the extra mile to develop non-STCW training programs in conjunction with Professional Certification Institution (LSP), professional associations, and authorities in each province. They comprise such courses as cybersecurity, anti-piracy, green shipping, and superior handling of cargo which are becoming more and more important in an industry where technology has advanced (Elsayed, 2023). With such programs, it is not only that PTKLs are viewed as providers of education, but also viewed as centers of innovation and transformation of skills in the maritime industry.

Economically, the role of PTKL graduates towards national development is huge. Maritime labor has macroeconomic significance to the availability of foreign exchange from the remittance by the increased foreign exchange remittances expected in the period 2019-2024 estimated to be Rp 159.8 trillion in 2024 as well as during post-pandemic recovery. Alumni of PTKL alone constitute more than 60 percent of this value, which is evidence of the efficiency of these institutions in converting the state investment into economic payoff. Such numbers do not only show the payoff of maritime education but also cause the strategic necessity of the

long-term funding principles, i.e., endowment funds or cost-sharing programs, to secure sustainable comparative operations (Kleiman et al., 2025; Grgičević, et al., 2025).

## Conclusion

PTKLs (Higher Education Ministries and Institutions) are being used as the foundation of resource development of the Indonesian marine human capital as the model that offers a unique education model combining workforce, global accreditation, character shaping, and aligning the modeling industry. They do not only contribute by producing seafarers, rather they produce mariners who can work across the world and in the maritime sector on land and the sea. By adhering to worldwide standards such as STCW, achieving close cooperation with both local and international stakeholders, and meeting the needs of the industry PTKLs enhance the role of Indonesia as a major provider of maritime labor in the world. Nevertheless, to continue and enhance this role it is imperative that the regulatory acknowledgment, reform of accreditation and long-term funding is needed so that it can continue to produce high quality, certified and internationally competitive graduates into the future who will spearhead the future of both the national and international shipping industry.

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