

RESEARCH ARTICLE

Research on vocational education development of nautical technology major in hainan free trade port from the perspective of internationalization based on big data descriptive analysis

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ABSTRACT

This paper presents a meticulous analysis of the UNCTAD's 2019 data pertaining to commercial ships, with a particular focus on Chinese-funded vessels. The objective is to assess their status and further predict the demand for shipping talents within the Hainan Free Trade Port. Notably, it is revealed that approximately 34.91% of the Chinese-funded ocean-going ships operate under flags of convenience, representing a substantial share of 55.9% in terms of tonnage. In order to address this situation and enhance the attractiveness of Hainan for vessel registration, a comprehensive "master plan" has been devised. Recent statistics indicate a favorable trend towards a reversal in this trend, with more Chinese-funded ships choosing to register in Hainan. Consequently, there is a pronounced demand for skilled shipping talents within the free trade port.

Furthermore, this article delves into the intricate nuances of nautical technology vocational education, both domestically and internationally. It underscores the crucial role of skilled professionals who possess a global perspective and offers suggestions for fostering international collaboration and enhancing educational resources. Additionally, it identifies and discusses the challenges encountered in the Hainan Free Trade Port, along with proposed measures for improvement. The article emphasizes the imperative for responsive reforms to ensure that educational competencies are aligned with global standards. The implementation of these measures is anticipated to bring about transformative changes in nautical technology education within the Hainan Free Trade Port, thereby contributing significantly to the overall progress of the maritime industry globally.

Keywords: descriptive analysis of big data; higher vocational education; internationalization; navigation technology; Hainan free trade port; English skills

1. Introduction

The management of ships and their safety and security is crucial and is primarily categorized into two key areas: Supporting ship operations and maintaining ship technology. These tasks encompass diverse activities, such as planning and maintaining routes, overseeing safe and efficient voyages, and executing detailed ship maintenance procedures. Notably, however, there is a paucity of educational programs

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specifically designed to impart knowledge and skills related to ship (navigation) structure management. Consequently, seafaring officers typically rely on on-board practical experience and trial-and-error methods to acquire the necessary techniques.

While the intellectual capabilities of seafaring officers have improved over time, the rapid advancements in ship equipment technology have rendered modern ship operations and management increasingly complex. The responsibilities entrusted to these officers are highly demanding, and any shortcomings in decision-making can potentially jeopardize the safety of the ship and its crew, leading to potentially catastrophic accidents and issues. It is anticipated that managing future ships will become even more intricate and challenging, particularly amidst a decreasing pool of seafaring officers.

Therefore, it is imperative to cultivate personnel, including third mates and ship engineers, who possess high-level intellectual capabilities. To address this gap, the establishment of an educational program dedicated to imparting knowledge and skills in ship (navigation) structure management, along with the nurturing of specialists in this domain, is urgently needed. This chapter endeavors to theorize the education of individuals involved in ship management and offers insights into future prospects. Consequently, the research and education of ship (navigation) structure management specialists hold paramount importance. (1)

1.1. Background

Regarding the cultivation of deep-sea talents, the current situation is characterized by a "hard-to-start and hard-to-grow" predicament. This arises from the elevated demands posed by the developing deep-sea industry in Hainan, leading to challenges in the existing level of talent training. (2)

Furthermore, the establishment of the Free Trade Port has urgently necessitated the cultivation of professionals skilled in internationalized navigation technology. Consequently, the focus of vocational education and talent development has shifted towards aligning with the construction of a cutting-edge, application technology-oriented vocational institution.

The ongoing development and opening-up of Hainan necessitate a diverse pool of highly skilled and internationally competent individuals across various sectors. This esteemed college, established in 1960, has served as a pivotal institution in nurturing transportation professionals, including numerous captains and navigators who have made significant contributions.

In light of the newfound objective of cultivating internationalized talents, a proposal has been formulated to elevate the entire curriculum to an undergraduate level. This presents a remarkable opportunity for local vocational education and, if successfully implemented, will effectively meet the demand for exceptional talents across diverse fields.

Given its rich informational content and potential for long-term follow-up research, this endeavor is particularly suited for an in-depth case study. The ultimate aim of this study is to steer the direction of education towards serving the community in a meaningful and impactful manner. The research is firmly grounded in a functionalist sociological perspective on education, emphasizing its crucial role in catalyzing social change and fostering holistic individual and societal development. (3)

1.2. Goals and aims

1.2.1. To analyze the current state of vocational education in navigation technology

To provide a more comprehensive analysis, this study will expand its cross-sectional observational approach to include a longitudinal component. This will allow for a deeper understanding of how vocational education and talent development trends evolve over time within the Hainan Free Trade Port. We will

implement advanced data analysis techniques, such as panel data analysis, to track changes and trends over an extended period, offering a more robust empirical foundation for our findings. In the contemporary era of globalization, talent stands as the fundamental competitive advantage for any nation or region. As a burgeoning hub of free trade, Hainan confronts a complex array of demands pertaining to talent acquisition. Vocational education, encompassing educational institutions, vocational training centers, and higher learning facilities, serves as a comprehensive platform for talent nurturing across diverse disciplines and fields. Regardless of location, whether domestic or international, and irrespective of sector, public or private, the vocational talents Hainan requires necessarily possess a technological educational background.

Currently, the scarcity of domestic educational resources in the realm of navigation technology necessitates Hainan's reliance on international resources. To assess the current status of international navigation technology and education, and their respective contributions, it is imperative to benchmark the international landscape against the domestic context in China. This analysis must be grounded in statistical data pertaining to international labor and human resource distribution, coupled with job analysis conducted by technical committees.

High-precision instruments and autocontrol technology have emerged as the bedrock of the modern navigation industry. The transition from traditional navigation, which relied heavily on human senses, to modern navigation, which relies on equipment, electronics, and information technology, has been profound. This shift has transformed the job requirements in the navigation industry, necessitating a diverse pool of engineering and technological personnel who possess not only a fundamental understanding of navigation theory and seamanship but also extensive knowledge in modern electronics, information technology, and industrial advancements. (4)

1.2.2. To explore the potential for internationalization in Hainan free trade port

To enhance the methodological rigor, our research will incorporate a mixed-methods approach, combining big data analysis with qualitative insights. We will use UNCTAD's 2019 data on commercial ships as a quantitative foundation and supplement it with in-depth interviews and case studies from vocational institutions and maritime industry stakeholders. This will provide a more nuanced understanding of how ship tonnage and flagging patterns directly influence vocational education strategies and talent development needs in the Hainan Free Trade Port. It is universally recognized that the education of navigational vocations in Hainan necessitates internationalization. However, what precisely does the term "internationalization" entail? Merely inviting foreigners to study in Hainan or dispatching teachers or students abroad for education or participation in international conferences does not constitute comprehensive internationalization. Furthermore, directly adopting foreign education systems or methodologies is also insufficient. If the objective of navigational vocational education in Hainan is to adequately prepare individuals for participation in the global community, then it is imperative for its institutions to cultivate an environment conducive to the coexistence and collaboration of individuals of diverse nationalities. The establishment of such an environment in Hainan is solely achievable through the cultivation of a genuinely internationalized educational system. (5)

2. Literature Review

The domestic labor market's interests are undergoing significant transformations as a result of the pervasive forces of globalization. On the plane of higher education, globalization is exerting a profound influence on various aspects, including scientific and technological innovation, the generation of knowledge, curriculum development, access to higher educational institutions, and the "marketplace" for academic

pursuits. The shape and direction of international trends in higher education are partly contingent upon the evolving economic, political, and social landscapes across various regions of the world.(6)

There has been an assessment of the European Union's policy aimed at reinforcing the Bologna Declaration's implementation. The Bologna process strives to establish the European Higher Education Area by enhancing the compatibility and comparability of academic degree standards and quality assurance mechanisms across Europe. This endeavor serves to enhance the employability of EU graduates and facilitate the exchange of students among member states. Additionally, the Bologna process advocates for the diversification of education, urging educational institutions to prioritize their unique areas of expertise in order to maintain competitiveness. This resonates with the current emphasis on niche-based education in local universities, particularly MSU, as they adapt to changing educational landscapes.

The escalating demand for foreign degrees among Asian students, coupled with the high costs associated with obtaining them in Western countries, has rendered the prospect of transnational higher education increasingly viable. This trend will expose local educational institutions to a broader international context. The appealing advantages and growing demand have led to a surge in the global movement of both students and faculty, accelerated by the advancements in information and communication technology. (7)

2.1. Internationalization in vocational education

Education is pivotal for safeguarding sustainability, and one strategic approach towards reinventing its role lies in internationalization. According to Knight, the pursuit of internationalization reflects a responsive posture towards the globalizing trends. He defines internationalization as a deliberate process of integrating an international, intercultural, or global perspective into the objectives, functionalities, and delivery modalities of post-secondary education.

Recognizing the significance of internationalization, it becomes imperative to delve into the perceptions and aspirations of vocational navigation students towards international exposure. Undoubtedly, the global maritime industry values professionals who possess an international perspective and proficient language skills. This assertion is corroborated by the escalating job opportunities in multinational corporations and the escalating demands on maritime professionals in utilizing English as their working language. Such conditions present local navigation professionals with a gateway to compete on a global scale. (8)

The vocational education system, underpinned by RI and RII principles, has nurtured numerous accomplished experts and scholars. While some may contend that the current state of affairs is adequate for Indonesia, given the abundance yet varying quality of its human resources, we must be cognizant of the evolving global education landscape and the increasing quality of vocational professionals abroad who pose a potential threat to Indonesia's need for skilled manpower. The high mobility and frequent relocation of international vocational professionals have placed Indonesia in a reverse brain drain situation, resulting in the loss of high-caliber professionals who are unable to compete with their foreign counterparts. These circumstances underscore the necessity for vocational exchanges and the establishment of avenues that facilitate the entry of foreign vocational professionals into the Indonesian vocational ecosystem.

2.2. Navigation technology education in other regions

Legal requirements must be adhered to, ultimately fostering the comprehensive well-being of society. Given the exponential growth and seamless integration of navigation systems across numerous aspects of contemporary life on a global scale, the demands and challenges facing navigation technology professionals have become increasingly intricate and diverse. Consequently, the development of novel navigation systems has occurred in various forms, encompassing aviation, land, marine, offshore, and numerous other domains.

These systems consist of an extensive array of components, including the Global Navigation Satellite Systems (GNSS), enhanced mapping technologies, sonar systems, radar systems, Automatic Identification Systems (AIS), and numerous others (9).

Therefore, it is unequivocally essential for a navigation technology professional to possess extensive knowledge and proficiency across a diverse range of navigation systems and technologies, while simultaneously demonstrating adaptability to the rapidly evolving advancements in technology. Essentially, a navigation technology professional must exhibit a profound understanding of how to effectively execute tasks and processes in an accurate and efficient manner, coupled with the ability to exercise critical thinking in discerning and prioritizing the most appropriate actions in a plethora of constantly changing situations and job roles. The dynamic nature of the field necessitates the constant updating and refinement of knowledge and skills to successfully navigate through the diverse challenges posed in the realm of navigation technology. The relentless pursuit of excellence and innovation remains at the core of a navigation technology professional's career trajectory, as they strive to consistently enhance their proficiency and contribute to the progression of this ever-evolving discipline (10).

2.3. Current shipping industry in Hainan FTZ

Hainan Province, an island province boasting China's vastest oceanic territory, has achieved remarkable progress in its marine industry, contributing 30% of its GDP to the sector by 2020, thereby emerging as a rapidly ascending economic hub. The provincial government has accorded priority to the marine economy in its 14th Five-Year Plan, with the objective of cultivating a robust marine province. The implementation of the Hainan Free Trade Port's Master Plan has further escalated the demand for maritime talents. However, China's stringent ship registration system, characterized by stringent requirements, intricate procedures, and substantial costs, has prompted over 2000 Chinese-funded vessels to seek registration in cost-effective open registration countries.

In a significant step forward, the Chinese government announced on June 1, 2020, its intention to establish a pilot program for a more liberal shipping system in Hainan, aimed at establishing an International Ship Registration Center with "Yangpu, China" designated as the registry. This initiative aims to streamline inspection procedures, gradually liberalize ship inspections, and establish efficient registration mechanisms, thereby attracting ships to register within Hainan's Free Trade Zone. This development, aligned with the implementation of the Master Plan for the Construction of Hainan Free Trade Port, has prompted numerous ocean-going vessels and shipping companies to opt for registration in Hainan, leading to a notable surge in the demand for maritime professionals. (11)

The writer conducts descriptive big data analysis on the distribution of Chinese-funded vessels across different flags around the world according to the figure of commercial ships of 1000 GT and above, released by the United Nations Committee on Trade and Development (UNCTAD) in 2019. See **Table 1** & **Table 2**

Table 1. Commercial ships of 1000 GT and above , released by UNCTAD, 2019.

Flag of registration (Ranked by tonnage registered)								
Economy ownership	Panama	Marshall	Liberia	H.K	Singapore	Malta	China	World
Greece	25,642	71,339	76,272	1,191	2,175	65,774	0	349,195
Japan	134,705	11,944	14,686	2,990	7,408	491	0	225,121
China	20,898	2,485	3,365	75,268	4,656	2,687	90930	206,301
Singapore	9,377	7,455	12,064	6,845	71,287	889	52	121,486
China,HK	9,458	2,736	6,215	72,311	3,613	307	192	98,128
Germany	865	7,694	36,396	1,316	3,690	7,707	34	96,532
Korea,	34,917	24,553	1,682	1,219	10	183	0	76,702
Norway	3,105	5,941	4,141	6,185	2,781	1,328	0	61,115
U S A	1,186	27,091	6,876	3,325	183	377	0	58,382
Bermuda	2,628	17,346	3,757	7,403	1,077	266	0	58,232
World	332,809	245,745	243,112	198,686	129,363	110,653	91,499	1,962,582

Table 2. Fleet ownership and registration, main economies, 1 January 2019 (in thousand tonnage).

ship number	Flag of registration Ranked by number of ships registered 2019							
	Panama	China	Liberia	Marshall	Singapore	H.K	Indonesia	World
China	573	3,987	60	53	51	905	7	6,125
Greece	454	0	958	952	32	20	1	4,536
Japan	2,060	0	178	189	128	58	9	3,822
Singapore	257	2	152	122	1,511	131	87	2,727
Germany	32	1	673	137	70	20	0	2,672
Indonesia	17	1	7	0	7	4	2,062	2,145
Norway	54	0	85	126	95	41	4	2,038
U S A	74	0	95	356	6	49	0	1,978
Russian	35	0	130	1	2	1	0	1,707
south	455	0	43	255	3	25	5	1,647
World	6,465	4,039	3,456	3,454	2,600	2442	2,216	51684

Sources: UNCTADstat (UNCTAD, 2019a); Clarksons Research.

Note: Commercial ships of 1000 gt and above; beginning-of-year figures.

The descriptive big data analysis results show that **there are 34.91% of the number of Chinese-funded international trade ships under the flag of convenience, which the tonnage of those vessels accounts for 55.92%.** (See figure 1, 2&3) The statistics also reveal that most of those ships are in big size with large carrying capacity.

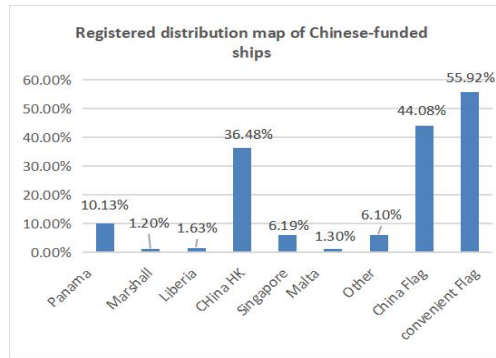


Figure 1. Ratio of Chinese-funded ships flying flag of Convenience in tonnage.

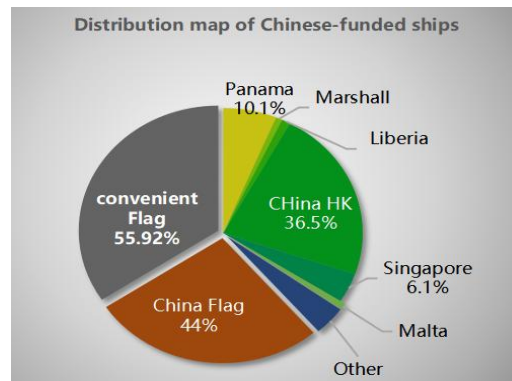


Figure 2. flying convenience flag of Chinese-funded ships.

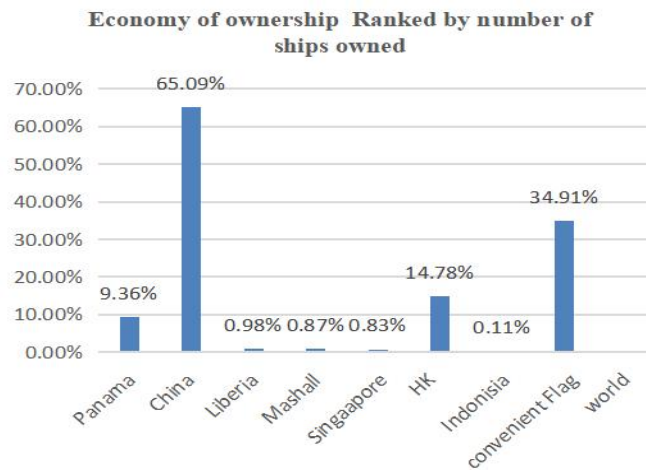


Figure 3. Ratio of Chinese-funded ships flying convenience flag in number.

3. Analysis and Discussion

Acknowledging the need for representatives, we will conduct a stratified sampling approach to ensure that our data accurately reflects the educational landscape and maritime industry needs of the Hainan Free Trade Port. This will include collecting data from a diverse range of vocational schools and training institutions, focusing on variables such as student demographics, curriculum alignment with industry standards, and employment success rates post-training. We will also incorporate local industry reports and policy documents to contextualize our findings within the broader socioeconomic development of the region. The Hainan Free Trade Port was officially launched in June 2020, attracting over 90 shipping

enterprises to register within a single year. Furthermore, 30 ships have been registered in Hainan, significantly enhancing the tonnage of international vessels and contributing an additional 5 billion yuan to the local GDP. The ship registration system in Hainan has gained widespread recognition, and it is anticipated that the number of registered ships and companies in Hainan will continue to grow in the future. (12)

In recent years, numerous shipping companies have chosen to register in the Hainan Free Trade Port, leading to a corresponding increase in the demand for skilled professionals, including seafarers, shore-based management personnel, and ship-related vocational personnel from the maritime auxiliary industry (hereinafter referred to as shipping talents).

However, for a considerable period, maritime education and ship-related personnel training in the Hainan Free Trade Port lagged behind. The revitalization of maritime education and training began in 2007. Currently, there are only two colleges offering ship-related majors such as Marine navigation, engineering, and shipping management, with an annual intake limited to approximately 300 students.

To ensure efficient ship operations, a shore-based management team is essential within shipping companies. This team comprises technical officers, maritime officers, businessmen, and personnel. Collectively, they are capable of managing four ships concurrently within China. Onboard operations require deck officers and engineers operating in a 4x4 configuration. Additionally, the cooperation of agency and port authority personnel is vital for cargo handling at the port. Overall, a total of 44 individuals are involved in the operation of four ships, with a talent proportion of 8:3 between shipboard and shore-based personnel. (13)

Table 3. Minimum ship-related talent to maintain 4-ship running and port operation.

Minimum ship-related talent to maintain 4-ship running and port operation			
on ship or shore	Department	rank or role	staff for 4-ship
ship	Deck department	master & 3 officers for one ship	16
	Engine department	chief engineer & 3 engineer for one ship	16
company shorebase	company ISM management Team	Technical,marine bussiness,personal	4
shoreside	Agent	Internal staff & outdoor staff	2
shoreside	Stevedore	Foreman & tallyman	2
shoreside	port administration	Pliot ,cargo survyor, PSC or other inspector	4
ship total			32
on-shore total			12
ratio of ship to shore			8:3

The ratio shows that Hainan's shipping-related majors are insufficient for the operational needs of fewer than 25 ships, including management and port administration. The current cultivation scale in the Free Trade Port is insufficient for the increasing demand due to more international trading ships. Maritime education in Hainan is smaller compared to other coastal provinces and faces challenges with investment and enrollment.

To ensure survival and development, maritime education must prioritize its duty to respond to the regional economy's needs.

By analyzing the features and demands in its structure and levels of local maritime industries, maritime education should adjust the objective, structure, levels and standards of marine education to construct a cultivation mode adapting to the demands of development of local marine economy .It is widely agreed that the education of navigational vocationals in Hainan has to be internationalized

4. Methodology

To address the complexities and challenges of aligning vocational education with industry needs, we will delve deeper into the conceptual framework of internationalization. This includes an exploration of the cultural, economic, and pedagogical factors that influence the integration of international standards and practices within vocational education curricula. We will also discuss the challenges faced by vocational institutions in adapting to the rapidly changing demands of the maritime industry, particularly in relation to technological advancements and global market shifts. Model design and data collection techniques are crucial for research. They verify the targeting of intended audience and underscore the validity of the sample. Accessibility issues must be recognized and addressed. Data analysis assesses the research's efficacy in achieving objectives. (14)

To carry out the study, several aspects require consideration. The study design is the fundamental framework for data collection, measurement, and analysis. This research adopts a cross-sectional observational approach to assess a population or subset at a defined time. This methodology is versatile, accommodates both quantitative and qualitative data, and is cost-effective. Additionally, survey-based observational studies, including interviews, will gather information about the target population. This approach offers rich and granular data, enabling precise assessments of the relationship between exposures and outcomes.

4.1. Data collection

Vocational education in navigation technology within the Hainan Free Trade Port is currently experiencing progress, albeit with a notable absence of a comprehensive international talent training program. To address this gap, a strategic approach is proposed that aims to integrate into the international vocational education system and foster the development of highly skilled professionals. (15)

To further enhance navigation technology education in the Hainan Free Trade Port, it is imperative to strengthen international collaborations and introduce high-quality educational resources. This will not only alleviate resource shortages but also expedite the pace of educational development.

By collaborating with international institutions, the Hainan Free Trade Port stands to enhance its vocational education system in navigation technology, positioning it as a preeminent educational hub. This collaboration will provide access to esteemed educators who can deliver specialized courses, workshops, and seminars, thereby equipping students and vocational personnel with the necessary skills to excel in this rapidly evolving industry.

Engaging with international partners will also benefit students and vocational personnel in the Hainan Free Trade Port, driving advancements in global navigation technology. This collaboration will foster innovation, breakthroughs, and advancements, further enhancing the Port's reputation as a center for research and development excellence.

Expanding vocational education in navigation technology within the Hainan Free Trade Port is crucial for promoting trade and investment facilitation, as well as fostering the development of the modern service industry. Through the implementation of the strategy of "going out, bringing in, and building up" and leveraging international cooperation in education, the Free Trade Port can overcome resource limitations and accelerate the development of its vocational education system. This will cultivate a pool of highly skilled international professionals, establish the Port as a global leader in navigation technology education, and contribute significantly to advancements in this field globally.

4.2. Current state of vocational education in navigation technology

Hainan FTP has prioritized the internationalization of skilled education in navigation technology, rather than focusing solely on attracting international students to its shores or emphasizing national strategies for exporting education or labor. This approach underscores the region's commitment to emerging as a premier hub for skilled training within the realm of education.

Furthermore, Professor Hagedorn identifies two additional pivotal factors driving internationalization. Firstly, the objective of elevating the quality of education through international collaboration and exchange stands as a cornerstone. By fostering partnerships with foreign institutions and organizations, universities are able to broaden their academic horizons and expose their students to a diverse array of perspectives and experiences. Such collaborations facilitate the transfer of knowledge and expertise, ultimately contributing to the enhancement of the overall educational quality offered by institutions of higher learning.

Additionally, Hagedorn underscores the economic advantages of attracting international students to universities. By admitting these students, institutions are able to generate revenue through tuition fees and associated expenses. Moreover, the presence of international students injects vitality into the local economy through their spending, thus providing an incentive for universities and policymakers to pursue internationalization efforts.

In summation, Hainan FTP places significant value on the internationalization of skilled education in navigation technology, promoting vocational reform that integrates high-level institutions with applied knowledge. This comprehensive approach aims to cultivate a skilled workforce in a swift and efficient manner. By acknowledging the drivers of internationalization, including the aspiration to become an educational hub, the enhancement of educational quality through collaboration, and the economic benefits associated with attracting international students, Hainan FTP is emerging as a leader in a vibrant and globally-oriented education sector.

5. Discussion

In response to the need for practical recommendations, we will develop a set of actionable strategies tailored to the specific context of the Hainan Free Trade Port. These will include recommendations for curriculum reform, faculty development, industry collaboration, and policy advocacy. We will also provide detailed guidelines on how these strategies can be implemented, taking into account the unique challenges and opportunities presented by the regional context. Our recommendations will be grounded in the empirical findings of our research and will be designed to facilitate tangible improvements in the vocational education system. The quality of the workforce remains a key concern, especially in the Philippines, which, despite its proactive approach, has encountered significant challenges in achieving its goals due to financial constraints.

Developing countries have experienced limited success in various aspects, primarily attributed to factors such as opportunity costs, political agendas, limited industry support, and insufficient public awareness. While education is recognized as a long-term investment, it often gets overshadowed by more pressing issues.

Additionally, bureaucratic complexities and conflicts frequently lead to allocation issues. Some countries, for instance, prioritize the provision of cheap labor, exemplified by the Filipino seafarers, potentially limiting the scope and depth of vocational education.

Furthermore, global economic downturns have a profound impact on industries such as the maritime sector, directly affecting newly trained workers seeking employment opportunities. This situation is likely to persist in both current and future HFTP regions.

6. Challenges and Potential Solutions

One of the primary challenges in advancing vocational education in Hainan lies in the absence of established advanced degree qualifications. While this presents an opportunity for educators to innovate, it can also be confusing for prospective students. Although the industries in Hainan possess strong vocational elements, the lack of standardized high-level qualification requirements restricts the mobility and practical opportunities for graduates.

To address these challenges, it is imperative for educational entities developing courses in these fields to engage in collaborative efforts with industry stakeholders. Such collaborations will enable the entities to gain a deeper understanding of students' needs and effectively promote the value of the courses. By collaborating with the government and industry partners, it is possible to identify the future skill requirements of the workforce and establish incentives for upskilling the current workforce. This collaboration can, in turn, increase the demand for high-level qualifications and create a seamless transition from education to the workplace. Given Hainan's aspiration to become a leader in these industries, it is crucial to prioritize the establishment of standards for vocational qualifications and facilitate the alignment of education with the workforce needs. (16)

7. Recommendations

To align with the journal's focus on environment and social psychology, we will expand our analysis to include the social development impacts of vocational education in the maritime sector. This will involve an examination of how vocational education contributes to social mobility, community empowerment, and environmental sustainability within the Hainan Free Trade Port. We will also discuss the psychosocial factors that influence the success of vocational education initiatives, such as student motivation, career aspirations, and the role of social support networks. The curriculum at HNIST requires enhanced practical training for vocational students. It is imperative that technical terminology be translated into Chinese to facilitate comprehension within the institution, while emphasizing the comprehension of underlying concepts rather than mere memorization of English terms. As students' English proficiency gradually improves, they will naturally assimilate the technical terms into their vocabulary.

Furthermore, HNIST ought to establish its own international internship program to enhance the job prospects of its students. This should include arranging a series of internships with collaborating companies, arranging exchange programs with European universities, and developing 2+2 and 3+1 programs with foreign universities as integral components of its educational offerings.

7.1. Enhancing collaboration with international institutions

The proposed navigation technology program for undergraduates and postgraduates aims to attract students and invite international institutions for collaboration and research. This program offers Indonesian students, especially from ITS, the opportunity to obtain a degree and participate in student exchanges with partner universities in China. This indirectly enhances their language skills and technology acceptance.

Sending students to pursue education abroad, especially to western countries, is considered a reverse action of internationalization. This is due to the unbalanced technology and knowledge transfer between east and west, with developed countries still considered education hubs. Many graduates pursue advanced degrees in navigation technology in these countries but their contributions are limited due to their foreign status and lack of recognition by the local community. Joint degree or research programs with foreign students can further enhance career opportunities in this field.

7.2. Advanced Navigation Technology Programs future innovation.

Specialized programs in navigation technology require creating and modifying programs. The challenge is to provide high-quality programs. There are quality undergraduate programs in computer science and information systems. Graduates usually lack knowledge in navigation technology but can acquire jobs due to computing training. Post-baccalaureate training programs in navigation technology should be provided. New graduates can benefit from undergraduate programs in specific areas. The highest demand is for RNs with a bachelor's degree. Convenient programs combining online and classroom study are preferred. There is a shortage of graduate programs in navigation technology, especially at the master's level, and virtually no PhD programs.

Analyze current programs leading to employment in Hainan Province and their demands for navigation technologists. This information helps to decide which programs to target and guides curriculum development. Identify programs that are growing or declining. This affects the mix of entry to practice students and post-graduating training. Research should be done on the national level to identify migration patterns in employment and training.

This is a long-term project with the goal of creating a data mining resource providing up-to-date intelligence on employment and education trends in navigation technology.

7.3. Promoting cultural exchange and language proficiency

The use of straightforward English in shipboard protocols and records has had limited success. Plain English and comprehensible information presentation remain ambiguous. Officers must adapt to English, but superficial use can lead to terminology misunderstandings and cultural nuance loss. This is seen in maritime education, especially in non-native English-speaking faculty lectures. As Chinese seafarer education internationalizes, it's crucial to balance linguistic proficiency and cultural exchange while maintaining educational objectives. This balance is essential in areas with potential for mutual learning, like high-stakes operations involving multinational teams. (17)

8. Conclusion

Current vocational education on navigation technology focuses on operational ability and related knowledge. The Nautical Institute and similar institutions need to research and develop suitable education patterns for navigators.

Traditional education faces challenges due to changes in navigation technology, which is pressuring the traditional pattern. "Navigating the Future" highlights these issues. Predictions suggest significant changes to deck officers' vocational requirements, making the traditional academic route less likely and attractive.

Modern marine corporations are dissatisfied with current seafarers' lack of dynamic problem-solving skills. People-related problems in the maritime industry include incompetence, poor decision-making, inadequate training, and ineffective leadership. Present and future seafarers must handle uncertainties from technical advancements and ensure safe and efficient management. This requires navigators to have higher

vocational knowledge, strong analytical and problem-solving skills, and more expertise. The demand for talented modern navigators is significantly higher.

In response to the need for practical recommendations, we will develop a set of actionable strategies tailored to the specific context of the Hainan Free Trade Port. These will include recommendations for curriculum reform, faculty development, industry collaboration, and policy advocacy. We will also provide detailed guidelines on how these strategies can be implemented, taking into account the unique challenges and opportunities presented by the regional context. Our recommendations will be grounded in the empirical findings of our research and will be designed to facilitate tangible improvements in the vocational education system.

Author Contributions

Aimin Wei: Led the conceptualization and design of the study, provided oversight for data collection, and contributed to the writing of the manuscript.

Hui Wang: Responsible for data analysis, interpretation of results, and drafting significant portions of the manuscript.

Donglou Li: Participated in the design of the study, contributed to the analysis and discussion of the findings, and was involved in critically revising the manuscript for intellectual content.

Congjin Miao: Assisted in data collection, helped in drafting the manuscript, and provided insights into the vocational education landscape in the Hainan Free Trade Port.

All authors have read and approved the final version of the manuscript. Corresponding author: Aimin Wei, who is responsible for communicating with all co-authors, ensuring the consent of all co-authors for publication, and managing all correspondence related to the article.

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