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A Blue approach to assessing Maritime and Fisheries Vocational Education A case in Ambon, Kupang and Bitung

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ABSTRACT

The notion of "blue economy" has evolved as a significant way to promoting sustainable development of coasts and oceans, with a direct impact on economic growth. However, the principles have remained ambiguous, particularly for use in the development of vocational education and its impact to coastal fisheries communities' village. The paper provides a framework to measure the adoption of the green and blue economy concept and uses the framework to analyze the effectiveness of the vocational program in improving the current economic and societal values of the oceans, which could be a novel approach to address key ocean economy challenges. The Blue Education Maturity Model (BEM) was developed to assess the efficacy of vocational school programs in integrating the triple helix: education, business, and coastal village community. The BEM is an effective evaluation tool based on BAN-PT and Blue Economy Company Index (BECdex), and Risk Maturity Model (RMM) broken down into five variables, 10 dimensions, and 20 competency items that show where the HMM program stands on five levels of maturity, ranging from Ad hoc (1) to Optimized (5). Data was obtained at the three vocational schools in Eastern Indonesia through observation and response of questionnaire. With a total score of 80, 78, 79, or a maturity level of 3 (Repeatable), the vocational school of maritime and fisheries in Kupang, Ambon, and Bitung,, has established a hybrid green and blue economy in policies, curriculum, research and innovation, and community development. The school's strategies include: improving curriculum, capacity building in entrepreneurship, sustainable coastal aquaculture, research and innovation for economic growth and environmental sustainability.

Keywords: Green Economy, Blue Economy, Hybrid Maturity Model, Fisheries vocational school, Fishing village community

Introduction

Despite that oceans are central to Indonesia's prosperity through economic activities, worth over $256 billion annually, more than one quarter of the national economy (Bank, 2021), yet the maritime sector is not well-known in the field of education, so it receives little attention (Sari & Muslimah, 2020). Indonesia has 17,500 islands, most of Indonesia's territory is about 62% surrounded by ocean. With 108,000 kilometres of coastline, Indonesia's marine and fisheries potential is quite large and requires graduates majoring in marine and fisheries to manage the potential of marine wealth resources. The lack of literature on marine education and the fact that many researchers have not focused on this area demonstrate the gap (Umuhire & Fang, 2016). Furthermore, marine education is the most uncommon field of study and is extremely difficult to come by because marine research methodologies are difficult to implement since early education (Hapidin, Nurjannah, & Hartati, 2018). According to Gandha and Pranata (2015) the existing curriculum still focuses on teachers and textbooks without direct interaction with the learning object, resulting in the underdevelopment of Indonesian children's awareness of Indonesian nature, particularly in the maritime sector. Teachers' knowledge of the curriculum is also still limited especially in coastal areas. Marine education is critical in helping student develop the knowledge, skills, and attitudes necessary to preserve the environment in the future, particularly coastal ecosystems. (Irawan & Hindrasti, 2018) discovered that in order for maritime education to be successful, students must be taught to have a strong understanding of the ocean. According to (Fletcher, Potts, Heeps, & Pike, 2009) a lack of information about marine affairs contributes to a lack of public knowledge and awareness. In Indonesia, marine education is not explicitly mentioned in the 2013 curriculum. However, there are several topics that allow teachers to develop it as marine learning, such as life sciences or biology. At several universities Marine education is implemented at the tertiary level by organizing the Marine Education Study Program. Increasing concern for ocean protection begins with a paradigm shift from seeing it as an effort to protect the earth to seeing it as an effort to protect human life because it is human nature that will be threatened if environmental damage occurs

The notion of "blue economy" has evolved as a significant way to promoting sustainable development of coasts and oceans, with a direct impact on economic growth.) Education, research and innovation is a central driver not only for developing a sustainable blue economy but also for green recovery from the COVID-19 crisis, certainly cannot be achieved without skilled people. For Blue economy to be a truly useful approach, we argue that the role of education to support public awareness, research and community service must be explicitly prioritized, particularly for use in the development of vocational education and its impact to. the growing demand of the marine-based industry (e.g. shipbuilding) in the digital domain, green technologies, and coastal fisheries communities' village.

Indonesia has 14 Marine and Fisheries Polytechnics, which is a vocational school education in the field of marine and fisheries within the Ministry of Marine Affairs and Fisheries, which is under and responsible to the Head of the Marine and Fisheries Research and Human Resources Agency (LAUT). The Polytechnic has the task of 1) organizing vocational education, 2) research, and 3) community service in the marine and fisheries sector. In carrying out its duties, Polytechnics in Indonesia carries out the following functions: a) Implementation and development of vocational education which includes teaching and training in the marine and fisheries sector; b) Development of the academic community and its relationship with the environment; c) Implementation of research and community service d) organizes Diploma Three (D3) education programs.(Huwae, 2016) The programs are varying in range of: Marine Fisheries Nautical, Marine Fisheries Engineering, Fishery Product Processing Technology, Aquaculture Technology. Nevertheless, there are concerns in knowledge and skills

development in blue economy, such as related to the lack of: i) communication and cooperation between education and industry; ii) communication and cooperation between education and community and iii) attractiveness and awareness of career opportunities in the blue economy. Thereby, a continuous monitoring and evaluation of vocational education system in order to ensure blue objectives are achieved. With the fast-paced introduction of new technologies in the blue economy sector, there is also urgent need for a continuous evaluation of vocational education system in order to ensure objectives are achieved for societal inclusion, and up to date with the market dynamics.

There has been a lot of research done on the marine education, However, research that produce a maturity model to assess the effectiveness of the adoption of blue economy in marine & fishery education is still very rare. This study examines the continuous evaluation of vocational education, by developing an instrument of maturity model in order to ensure they are achieving Marine & Fishery Education's objectives and adopt the blue economy for societal inclusion, and up to date with the market dynamics. The study provides a framework to measure the adoption of the blue-green and economy concept and uses the framework to analyse the effectiveness of the vocational program in improving the current economic and societal values of the oceans, which could be a novel approach to address education in blue economy

Literature Review
Blue Economy Definition

The concept of "Oceans Economy" or "Blue Economy" is recent and originated from the United Nations Conference on Sustainable Development held in Rio de Janeiro in 2012. (Smith-Godfrey, 2016). At the heart of the concept is a separation of socio-economic development from environmental degradation. In the Economist, specifically the Intelligence Unit of 2015, in a report on "The Blue Economy: Growth, Opportunity and a Sustainable Ocean Economy", a working definition of Blue Economy is stated as follows: "A sustainable ocean economy emerges when economic activity is in balance with the long term capacity of ocean ecosystems to support this activity and remain resilient and healthy". (Smith-Godfrey, 2016). In the Rio+20 Green Economy Initiative, Blue Economy was espoused with the desired outcome of "improved human wellbeing and social equity, while significantly reducing environmental risks and ecological scarcities, endorsing low carbon, resource efficiency and social inclusion'(Smith-Godfrey, 2016). This desired outcome is based on the current circumstances and needs of a developing, changing and increasingly populous world, whose future resource base is located in the oceans: "Improved human wellbeing and social equity, while significantly reducing environmental risks and ecological scarcities, endorsing low carbon, resource efficiency and social inclusion"(Choudhary et al., 2021).

The Complexity in Small Island Developing States (SIDS) concept paper of the World Bank provides a working definition as follows: "Blue Economy is a marine-based economic development that leads to improved human wellbeing and social equity, while significantly reducing environmental risks and ecological scarcities".(Smith-Godfrey, 2016). In a synthesis report in 2012, UNEP initiated the consideration of 'Green economy in Blue world" which stated the importance of marine environment as integral component for urgently needed paradigm shift in bioeconomy called as "blue economy" as coined by pacific Small Island Developing States (SIDS) (UNEP et al., 2012). To Smith-Godfrey (2016) and Spalding (2016), 'Blue Economy' is a systematic way of utilizing ocean resources by integration of short-and

long-term economic activities based on principles of social inclusion, environmental sustainability and innovations on and around the sea.

The Blue Education Maturity Model (BEM)

The maturity model is a solution to help vocational education evaluate the effectiveness of their organization's in adopting education for blue economy. The Blue Education Maturity (BEM) model for vocational education in maritime and fishery is an effective evaluation tool to benchmark verses other organizations. It identifies the areas where organization is weakest, as the weakest links are ultimately what drive down the program effectiveness.
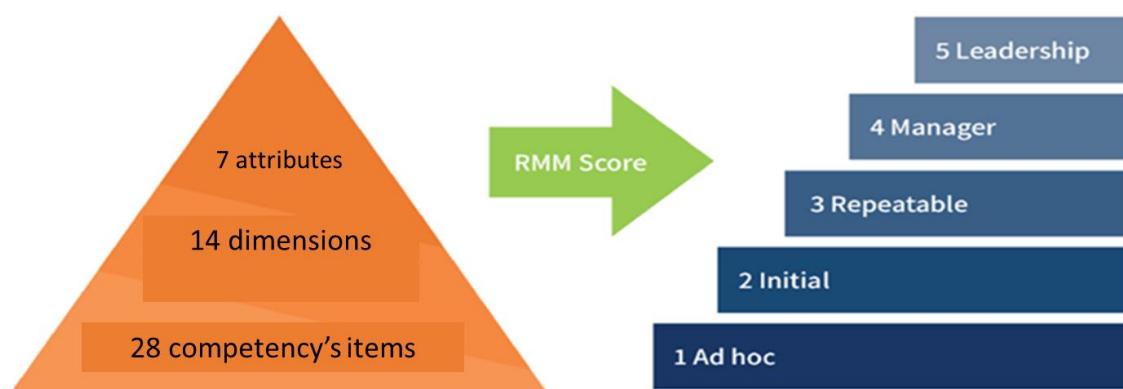

Figure 7 The Research Model

The instrument is adapted from previous research's questionnaires used in previous research (Misuari, Bambang, & Purwanto, 2015) and Blue Economy Company Index (BECdex) (Akhir, Farand, Araujo, & Nahumariri, 2021) and Risk Maturity Model (Minsky, 2017) broken down into 7 attributes or variables, 14 dimensions, and 28 competency items that show where the program stands on five levels of maturity, ranging from Ad hoc (1) to Leadership (5). The seven variables of BEM are: 1) Adoption of Blue economy-based approach 2) Curriculum 3) Teaching Factory 4) Facilities and infrastructure 5) Research and Innovation 6) Social equity and inclusion 7) Pollution control

Marine and Fisheries Polytechnics in Kupang, Ambon, and Bitung

Marine and Fisheries Polytechnics is in administration of the Ministry of Marine Affairs and Fisheries, which is under and responsible to the Head of the Marine and Fisheries Research and Human Resources Agency. The profile of three Marine and Fisheries Polytechnics in Eastern Indonesia is shown in Table 1.

Table 7Profile of Polytechnics in Kupang, Ambon and Bitung

Location	Kupang	Ambon	Bitung
D3-Study Program	Fishing techniques Fisheries mechanization Aquaculture technology	Fishing technique Fisheries mechanization Aquaculture technology	Nautical, Engineering, Fishery Product Processing Technology,

			Aquaculture Technology
Number of students	1600	1300	1500
Number of staff	60	50	55

Source: KKP.go.id 2022

Methods

This research uses a combination of quantitative and qualitative descriptive methods in understanding the phenomenon under study as well as to describe compare between indices in the results. Respondents were sampled from three Maritime and Fishery Polytechnics in 3 location in eastern Indonesia: Ambon, Kupang and Bitung, through observation, interview, and focus group discussion session. The population of staff and managerial level totalled are 100 in every location. Using stratified and quota sampling, we sampled 35 staff and 15 managers in every location. Data collection was carried out through questionnaires, observations, and interviews of school residents consisting of educators, education staff, and students. The implementation of blue economy in terms of seven criteria's: 1) Adoption of Blue economy-based approach 2) Curriculum 3) Teaching Factory 4) Facilities and infrastructure 5) Research and Innovation 6) Social equity and inclusion 7) Pollution control were examined by conducting assessments or scoring through questionnaires. The assessment's result is classified into 5 levels, consecutively as shown in Table 2.

Table 8 Maturity Level

	Level 1	Level 2	Level 3	Level 4	Level 5
	Key drivers: degree of …				
Adoption of Blue economy-based approach	• vision, mission and goals far-sighted orientation toward blue-economy, internalized to the school community. • support from senior management • process definition determining ownership and assimilation into all area • blue culture's accountability, communication and pervasiveness				
Curriculum	• the structure of the curriculum contains blue economy principles • lecturers have the competence to develop learning activities on the environment and sustainable fisheries • students carry out learning activities on fisheries and environmental resource management. • application of knowledge in problem solving in everyday life.				
Teaching Factory	• the school carries out the development of an entrepreneurial culture based on blue economy principles • students take part in field work practice activities in the business world • the school establishes partnerships with various parties • the school provides support for increased environmental sustainability				
Facilities and infrastructure	• availability of infrastructure to overcome environmental and resource issues • availability of infrastructure facilities to support learning and research p				

	• maintenance of environmentally friendly school infrastructure • facility management and maintenance mechanisms are available
Research and Innovation	• research and innovation road map to support the blue economy for lecturers and students is available • funding is budgeted and access to funds available lecturers and students produce research that is associated with the principle of sustainable development goals • research and innovation collaborate with quad helix (government, industry, community and other school/university)
Social equity and inclusion	• community service activities as a graduation requirement • assist in the formation of fishing cooperatives and facilitate the supply chain of cooperative products • providing scholarship programs to fishermen's students in sub-districts • incorporate environmental education and conservation, and local economic benefits without compromising environmental sustainability
Pollution control	• policy and procedures are available in pollution prevention due to learning activities • conduct research and innovation for pollution prevention • educate local residents about pollution prevention • participate in pollution prevention activities of the ministry

Based on the score of maturity level a polytechnic can be classified into five categories maturity level: Ad-hoc, Initial, repeatable, Managed, and Leadership, as shown in Table 3

Table 9 The maturity level category

Maturity Level	Category	Score
5	Leadership	101 - 120
4	Managed	81 – 100
3	Repeatable	61 – 80
2	Initial	41 – 60
1	Ad-hoc	0 - 40

Findings and Discussion

The assessment results show that Marine and Fisheries Polytechnics in Kupang, Ambon, and Bitung have had a good blue education maturity level through Adoption of Blue economy-based approach, Curriculum Teaching Factory, Facilities and infrastructure, Research and Innovation, Social equity and inclusion, Pollution control with total scores of 80, 78, 79 respectively. The strength of the three polytechnics is in categories 1 to 5, namely: Adoption of Blue economy-based approach, Curriculum Teaching Factory, Facilities and infrastructure, Research and Innovation. Results also indicated that Polytechnic Kupang tended to have a higher score on the research and triple helix innovation and co-operation with industry, and coastal community development. Example of the program is cultivated of lobsters in the waters of Mulut Seribu, Pukuafu Village and increase productivity of seaweed in Tablolong village including: seaweed coffee, Kajarula innovation program to increase seaweed productivity so as to increase fishermen's income. (Hariyadi, 2023).

What needs to be improved is in the category of Social equity and inclusion and Pollution control, especially in student community service activities, the formation of service cooperatives and participation in participation in the development of fishermen village by lecturers and students, facilitating the down streaming of fishermen's cooperative results, and collaborating with quad helix, namely with the government, industry, universities / schools and cooperatives communities and facilitate the supply chain of cooperative products. In the Pollution Control category, it is necessary to conduct research and innovation for pollution prevention, and educate local residents about pollution prevention. We also found that school strategy and policies in Implementing the Blue Economy was carried out in four-year basis, through SWOT analysis, should be improved to more frequently strategy review

Conclusion and Recommendation

Marine and Fisheries Polytechnics in Kupang, Ambon, and Bitung already has maturity level 3, with strength in categories 1 to 5, while areas that need to be improved are in categories 6 and 7. We contribute to the body of knowledge in the blue economy adoption in education by created and tested Blue Education Maturity (BEM) model for Vocational Education among the first in the blue economy instrument to assess vocational education, based on literature review and applied the initial model in three Polytechnic in eastern Indonesia: Ambon (Maluku), Kupang (East Nusa Tenggara), and Bitung (North Sulawesi). This analysis, based on guidelines set forth in the model, will provide Polytechnics educations a roadmap for improvement

The results of this study have some important practical implications of three major area, learning and teaching, research and community development, and the adoption of blue-green economy. Therefore, the report should endeavour the management which is the Head of the Marine and Fisheries Research and Human Resources Agency, within the Ministry of Marine Affairs and Fisheries. Improving the system of vocational school should give economic benefits to residents and involving them in the learning, teaching, research and innovation process would significantly enhance the livelihood of residents.

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