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Concept of Multi-Orientation Shipyard Industry Development Environmentally Friendly and Sustainable

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***Abstract*— Indonesia's geographical conditions and position are very favorable and various policies from the government from 2005 until now are expected to become the shipyard industry to become a tough industry, but in reality it is still not as expected. The condition of the domestic shipyard industry in 2017 until now there is only ship repair and maintenance work, while orders for new ships or buildings are very few and even zero demand ship orders, causing business continuity in the shipyard industry to be disrupted and even out of business. This paper aims to develop a concept for the development of a multi-oriented shipyard industry that is environmentally friendly and sustainable. The preparation of this concept begins with identifying problems, collecting secondary data, reviewing related articles (shipyard industry, ship recycling yard industry, environment, sustainability, and supporting methods), analyzing and developing a development concept. The results obtained from drafting the concept are in the form of a diagrammatic model for the development of a multi-oriented shipyard industry that is environmentally friendly and sustainable. The development concept consists of (1) research background in the form of the existing conditions of the shipyard industry, ship recycling industry, geography, infrastructure, superstructure; (2) research that has been conducted in the form of relevant journal articles and proceedings; (3) research to be conducted in the form of sustainability criteria, orientation diversification and strategy selection; (4) implementation.**

Keywords— world maritime axis; sea highway; diagrammatic model; criteria; diversification; selection

I. INTRODUCTION

Infrastructure conditions are very potential and beneficial for the development of the World Maritime Axis and Sea Highway programs, especially the shipyard industry in Indonesia. These geographical conditions include: the largest archipelagic country in the world, the length of the coast is number 2 in the world after Canada, 2/3 of the area is water, consisting of more than 17,000 islands, located between two continents (Asia and Australia), located between the Indian and Pacific Oceans, a sea transportation crossing between industrial areas (East Asia) and energy centers (Middle East) [1].

The superstructure conditions include: (1) The issuance of Presidential Instruction Number 5 of 2005 concerning Empowerment of the National Shipping Industry and followed by the revision of the Shipping Law Number 21 of 1992 concerning Shipping into Law Number 17 of 2008 concerning Shipping, thus starting a new era in industrial development. national ship yard. (2) President Jokowi's maritime vision and "sea highway" program in 2014-2019 are both a momentum and a challenge for the development of the national shipyard industry in order to create the independence and sovereignty of the Indonesian Maritime Continent. Fleet support in implementing the Sea Toll Program consists of 3,000 pelra vessels, 250 asdp vessels, 260 pioneer vessels, 14,300 commercial vessels [2]. (3) The National Industrial Development Master Plan 2015-2035 has a vision of national industrial development, namely that Indonesia becomes a strong industrial country. Strong Industry is characterized by: (a) a strong, deep, healthy and just national industrial structure; (b) highly competitive industry at the global level; and (c) industry based on innovation and technology. The shipyard industry is part of the transportation equipment industry and is included in the 10 (ten) priority industries which are grouped into the mainstay industry [3]. The condition of infrastructure in Indonesia, which was marked by the infrastructure development by President Jokowi in 2015-2019, including: roads, airports, ships and ports, railroads, bus rapid transit and mass transportation has placed Indonesia in the third best rank in Southeast Asia in the transportation infrastructure category. [4].

Indonesia's geographical conditions and position are very favorable and various policies from the government from 2005 until now are expected to become the shipyard industry to become a tough industry, but in reality it is still not as expected. The condition of the domestic ship yard industry in 2017 until now has only had ship repair and

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maintenance work, while very few ship orders or new buildings (low demand ship orders) even zero demand ship orders, causing business continuity in the ship yard industry to be disrupted and even go out of business. Data from the Batam Shipyard Offshore Association (BSOA) noted that currently there are 20 shipyards that have closed due to lack of orders from 50 BSOA member shipyards [5]. The Indonesian Association of Shipbuilding and Offshore Facilities (IPERINDO) also stated that the national shipyard industry has 250 companies with an average utilization of only 30 percent of the new ship building capacity of 1.2 million DWT or 8.5 million GT [6], and 12 million ships DWT per year for ship repair capacity [7]. The shipyard industry in Indonesia has the following characteristics and characteristics: capital intensive, labor intensive, slow yielding, low value added, complex value chain, high risk business, low demand ship orders, high technology, high skilled ship design & fabrication, high import content and low local content, long term ship delivery [8].

Various efforts have been made by the government to create a strong shipyard industry by issuing Ministerial Regulation No. 124 of 2009 concerning the Guide Map for the Development of Shipyard Industry Clusters. The target to be achieved is that this industry is able to build, repair and maintain high-tech vessels with a size of 300,000 DWT supported by technological infrastructure and increasingly strong component industries in the country. This Ministerial Regulation is based on a study from the Ministry of Industry of the Republic of Indonesia regarding the application concept of the shipyard industry cluster development, but the cluster elements do not accommodate the ship recycling yard industry and its implementation between cluster elements is less effective [8]. Ma'ruf has developed a strategy for developing the national shipbuilding industry based on production technology and the domestic market using the David model, and obtained the Yardstrat model by applying intensive and integrative strategies to create sustainable competitiveness [9]. The strategy for implementing this model has been implemented, and the domestic market for new ship construction is still dominated by orders from the government, which are decreasing in number. So the shipyard industry must look for new market opportunities that are bigger and more promising.

Orientation shipyard industry in Indonesia generally consists of the construction of new vessels (ship building), repair and maintenance of the ship (ship repairing). Meanwhile, another orientation that is quite promising and has great potential to maintain the sustainability of the shipyard industry and is still not managed properly is ship scrapping/ship recycling. The addition of ship recycling orientation in the shipyard industry so that it becomes multi-oriented can be done through diversification or collaboration.

Several studies have shown the potential for ship recycling. The Ministry of Industry of the Republic of Indonesia has conducted a study on the potential development of the ship recycling yard industry in Indonesia and concluded that the potential for the scrapping market is quite large with 1,404 vessels or 21.07% of the total active ships of 6,663 units with a capacity of 2.7 million GT [10]. Based on data from the Head of Sub-Directorate for Domestic Sea Transportation of the Indonesian Ministry of Transportation, the number of Indonesian-flagged ships sailing in Indonesia as of December 2018 amounted to 29,928 units of ships of various types and sizes [11]. Lukman, et al. states that the market potential for green ship recycling yards in Indonesia is that the number of ships that are over 25 years old is 8516 units, with details of bulker 68 units, container 1 68 units, ferry 339 units, tanker 737 units, general cargo 1908 units. , barge 1123 units, tug boat 1543 units, others 2630 units, and a total of 11,895,653 gross tonnage [12]. The sustainability of the shipping industry is threatened and the impact of environmental damage in the ship recycling industry is a major issue that needs to be discussed. This paper aims to develop a concept for developing a multi-oriented shipyard industry that is environmentally friendly and sustainable in order to develop in accordance with the vision and mission of the shipyard industry.

II. LITERATURE REVIEW

The potential is quite promising and environmental problems in the shipyard industry are very important aspects because business actors in the ship recycling industry are mostly ignorant. Several studies have been conducted related to environmental aspects in the shipyard industry and ship recycling industry in several countries in the world (Egypt, South Korea, Turkey, Bangladesh, and Indonesia). The environmental impacts associated with shipbuilding and ship repair activities in Egypt have been studied by Papaioannou, and it is concluded that shipyards generate large amounts of waste. Some of the methods used to reduce pollution are prevention, source reduction, reuse/recycling and maintenance [13]. The operation of shipbuilding companies in South Korea also results in environmental pollution that the public complains about in the form of dust, odor and noise [14].

Basuki, et al. conducted an environmental risk assessment due to the operations of the Surabaya sub-cluster national shipyard company and the greatest probability of environmental disturbances in new ship building work is dust due to the sandblasting process and odors due to the painting process of the ship's hull [15]. While the environmental risks that are very influential in ship repair work are the remains of marine animals and plants, dust during blasting of the ship's hull, odors from painting the ship's hull, smoke resulting from the welding process and cutting profile plates, smoke due to the operation of lifting equipment, residual - residual oil, residual dirt in the hull sewers, residual water mixed with oil from the rest of the ship's operations (oil water separator) [16].

A study on the environmental impact of ship repairs was conducted by Abdullah, et al. to analyze the environmental effect in the form of material pollutants as a result of the scrapping of the vessel (ship - breaking) of the animal and plant life in the waters around the ship scrapping process based on statistical data recorded and remote sensing [17]. The ship breaking and recycling industry in Sitakunda Chittagong, Bangladesh also results

in tremendous environmental degradation and some recommended steps include: layout plans, implementation of national and international policies for environmental safety and effective environmental management plans [18]. Extraordinary oil pollution also occurs due to the operation of the ship recycling industry in Turkey, and sea traffic in Candarli Bay, so remote sensing is used to anticipate it [19]. Losses that occur to health, safety and the environment are based on technological and economic aspects for ship recycling in Egypt [20].

The magnitude of the resulting environmental damage has prompted the development of the shipyard industry and ship recycling industry that are environmentally friendly. Rahman and Karim conducted an analysis related to green shipbuilding and recycling using a literature review, and focused on the by-products of shipbuilding companies' activities, in the form of water, air and soil pollutants, in order to improve socio-economic factors [21]. Syaifi, et al. developed a repair and maintenance shipyard model, complete with the latest technology, the best docking facilities and other supporting units by considering technical aspects, environmental functions [22]. The planned shipyard model has a length of 130 m, a width of 30 m, a draft of 6 m and a capacity of 13000 tons. Able to accommodate and raise two ships with a total length of less than 130 m or one ship with a maximum length of 130 m. Has sufficient area for ships to dock, and is equipped with several supporting facilities, such as weapons workshops, welding machines, tooling equipment, sandblast equipment, painting equipment and mechanical hoppers, as well as other supporting equipment.

Akriananta and Suastika studied the development of the ship recycling yard in Kamal Madura into a green ship-recycling yard by adding facilities, technology updates and environmentally friendly recycling processes in accordance with applicable national and international regulations [23]. The analytical network process (ANP) method is used to choose the method of handling ship scrapping and the economic analysis of ship recycling business is feasible to be developed. Sunaryo and Indianto designed an environmentally friendly ship recycling shipyard with a maximum capacity of 30,000 DWT vessels or 330 ft. barges and tugs using national and international regulations [24]. Based on the ship's weight and recycling process, the recycling shipyard facility can be determined by the docking process and ensuring that no waste pollutes the sea. The proposed project is located in the Maritime Industry Cluster in Tanggamus Regency, Lampung Province, Sumatra [25].

The studies that have been carried out related to environmental aspects are still carried out separately only in the shipping industry or in the shipbuilding industry in several countries in the world, including Indonesia, so that an integrated study of environmental aspects in two industries needs to be carried out if there is a diversification of orientation in the shipping industry. In addition to environmental aspects, sustainability aspects in a business are very important and crucial, including the shipping industry and the shipbuilding industry.

Nughroho, et al. has studied the development of a sustainable maritime industry based on Mina-Agro-Tourism with a dynamic systems approach in setting the right policies for the development of the maritime industry by considering environmental aspects to strengthen the regional innovation system in Lamongan Regency [26]. The competitiveness and sustainability of the shipbuilding industry in India from a global multi-faceted analysis, in order to increase the competitiveness of the shipbuilding industry, several interventions are needed in the areas of regulatory framework, investment policy, trade policy, fiscal policy, infrastructure, R&D, skills, financing, processes, collaboration and technology [27]. The sustainability of the ship recycling industry in Brazil needs to consider legal, technical and economic aspects [28]. Ozturkoglu, et al. stated that sustainable risk management in the ship recycling industry needs to be developed and applied so that the industry can exist. [29]

The sustainability research that has been carried out considers aspects that are still partial, for example: environmental, legal, technical, economic, risk, and regulatory so that a more integrated study needs to be carried out. The large potential of the ship recycling industry market, and the existing operational conditions of the shipyard industry to meet environmentally friendly business sustainability, the orientation of the existing shipping industry in Indonesia generally consists of building new ships, repairing and maintaining ships, it is necessary to add an orientation to ship repair through diversification. Diversification strategy is an effort to find and develop new products or markets, or both, in order to pursue growth, increase sales, profitability, and flexibility [30]. Diversification can be done through concentric, vertical, horizontal, and conglomerate diversification [31].

The diversification model that will be studied, in order to fulfill the sustainability of an environmentally friendly business, considers integrated aspects (economic prosperity, environmental quality and social justice) through the development of the three bottom line (TBL) initiated by Elkington and symbolized through profit, people and planets (3P) [32]. TBL was later developed by Suyudi by adding a spiritual dimension so that it became QBL (quadrangle bottom line) and symbolized through profit, people, planet and prophet (4P) [33], and Sukoharsono QBL was developed again into PBL (pentaple bottom line) and symbolized planet, people, profit, phenotechnology and prophet (5P) [34]. Some of these studies show the application of TBL and its hybrids in the multi-oriented shipping industry, but the criteria still need further development so that they are more integrated.

Sustainability aspects obtained through the development of TBL will be used as criteria or factors that influence the selection of a diversification strategy that is suitable for the multi-oriented shipyard industry. The choice of diversification strategy will use many criteria, both qualitative and quantitative, in general the method used is the analytical hierarchy process (AHP) which was coined by Saaty in 1971-1975. To improve the weakness of AHP related to the breadth of the pairwise selection scale, Feng Kong and Hongyan Liu developed it into Fuzzy AHP [35] and Kuntjoro refined it again to make it

more accurate, simpler and have better consistency into the AHP fuzzy simplification method (SFAHP) [36].

III. METHOD

The drafting of the concept of developing a multi-oriented shipyard industry that is environmentally friendly and sustainable begins with identifying problems related to: (1) geographical conditions, infrastructure and superstructure in Indonesia; (2) the condition and orientation of the shipyard industry; (3) the condition and potential of the ship recycling industry. The next stage is collecting secondary data offline and online from research results, journal articles and proceedings, government agencies, shipyard associations. Reviews of journal articles and proceedings were carried out related to the topics of the shipyard industry, ship recycling industry, environment, sustainability, supporting methods. The final stage is analyzing the results of the review and compiling a development concept consisting of: (1) research background in the form of the existing conditions of the shipyard industry, ship recycling industry, geography, infrastructure, superstructure; (2) research that has been carried out in the form of relevant journal articles and proceedings; (3) research to be conducted in the form of sustainability criteria, orientation diversification and strategy selection; (4) implementation.

IV. Results and Discussion

Based on identifying problems, collecting secondary data, reviewing related articles (shipyard industry, ship recycling industry, environment, sustainability, supporting methods), the concept of developing a multi-oriented and sustainable shipping industry can be seen in Figure 1. There are 3 main elements in the development concept, consisting of: (1) geographical conditions, infrastructure and superstructure in Indonesia; (2) the condition and orientation of the shipyard industry; (3) the condition and potential of the ship recycling industry. The geographical condition, infrastructure and superstructure in Indonesia have problems: the condition is very strategic and supports the shipyard industry, but until now it has not been used optimally. The conditions and orientation of the shipyard industry have problems: fewer new ship orders and even zero demand ship orders; the orientation is only new building and ship maintenance and repair. There are problems with the condition and potential of the ship recycling industry: the impact of environmental damage and the potential for the market is very large but has not been used optimally. The accumulation of these problems causes the sustainability of the shipyard industry to be threatened and the impact of environmental damage in the ship recycling industry.

The preparation of this development concept begins with a review of the shipyard industry study conducted by the Ministry of Industry of the Republic of Indonesia regarding the development of the shipyard industry cluster with meso, micro, macro analysis [8], and a study conducted by Ma'ruf on the technology-based national ship industry development strategy production and domestic market with the David model [9]. The next study related to the potential of the ship recycling industry conducted by the Ministry of Industry of the Republic of Indonesia with fuzzy multi criteria decision making [10] and Lukman, et al. regarding the potential of the ship recycling yard industry in Indonesia [11]. The potential is very large but its operations because environmental damage in various countries based on a study from Chung, et al. on environmental pollution in South Korean shipyards [14], Basuki, et al. regarding the operational environmental risks of new buildings and repairs in national shipyards using environmental risk analysis [15][16], Abdullah, et al. [17]; Talukder, et al. on environmental effects due to the process of scrapping vessels with senses in Bangladesh [18], in Turkey [19], in Egypt with fuzzy logic [20].

The magnitude of the impact of environmental damage, encourages researchers to minimize it with various methods such as those carried out by Rahman and Karim regarding green shipbuilding and recycling [21]; Syaifi, et al. designs a technical and environmental-based repair and maintenance shipyard model [22]. Akriananta and Suastika developed a green ship-recycling yard in Kamal Madura with an analytic network process and economic analysis [23], Sunaryo and Pahalatua; Sunaryo and Indianto designed an environmentally friendly ship recycling shipyard [24][25], while Fariya discussed occupational safety risks with a safety risk assessment in the ship recycling industry in Indonesia [37]. The sustainability aspect is an important aspect besides the environmental aspect. Several studies on sustainability were carried out by Nughroho, et al. which discusses the sustainable maritime industry with dynamic systems [26]; Thangam and Sureshkumar on the sustainability of the shipbuilding industry in India [27]; Ocampo and Pereira on the sustainability of the ship recycling industry in Brazil [28]; Ozturkoglu, et al. sustainable risk management in the ship recycling industry with fuzzy dematel [29].

The large potential of the ship recycling industry market, and the existing operational conditions of the shipyard industry to meet environmentally friendly business sustainability, the orientation of the existing shipyard industry in Indonesia generally consists of building new ships, repairing and maintaining ships, it is necessary to add an orientation to ship recycling through diversification. The diversification strategy that will be studied, in order to fulfill the sustainability of an environmentally friendly business, considers integrated aspects (economic prosperity, environmental quality and social justice) through the development of the three bottom line (TBL) initiated by Elkington and symbolized through profit, people and planets (3P) [32]. This research begins by compiling and analyzing sustainability criteria in the multi-oriented shipping industry through the development of the pentaple bottom line (PBL) to the octaple bottom line (OBL).

Several studies that have been conducted in various fields related to sustainability aspects with TBL or its hybrids include: Wu, et al. on the TBL hierarchical

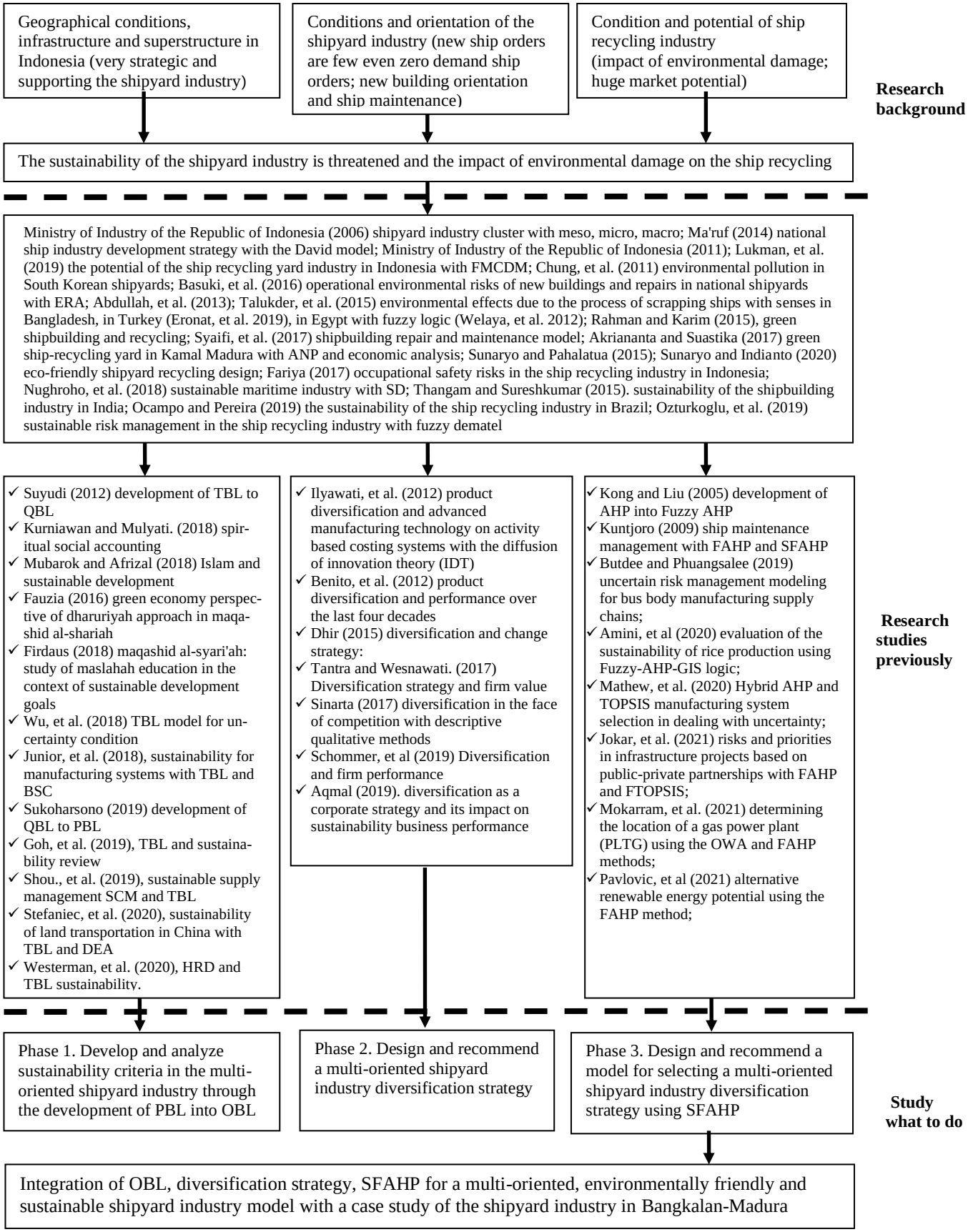

Figure 1. Concept of Multi-Orientation Shipyard Industry Development Environmentally Friendly and Sustainable

structure model for uncertainty conditions [38]; Junior, et al. on sustainability for manufacturing systems based on TBL and balanced score cards [39]; Goh, et al. on the review of TBL and sustainability [40]; Shou., et al. on sustainable supply chain management and TBL [41]; Stefaniec, et al. on the sustainability of land transportation in China with TBL and employment analysis data [42] ; Westerman, et al. On the sustainability of human resources development and TBL [43]. TBL was later developed by Suyudi by adding a spiritual dimension so that it became QBL (quadrangle bottom line) and symbolized through profit, people, planet and prophet (4P) [33], and Sukoharsono, QBL was developed again into PBL and symbolized planet , people , profit, phenotechnology and prophet (5P). [34] Studies on spiritual or prophets are also carried out to ensure sustainability, including Kurniawan and Mulyati about spiritual social accounting presenting divine values, so that everything that is done by oneself, individuals and entities is God's goal and is reflected by making Islamic social responsibility as a guide in the corporate sustainability report [44].

Mubarok and Afrizal also discuss about Islam and sustainable development as multidimensional matters, Islam provides a way to achieve welfare goals or what is referred to as the Falah concept, and all forms of economic development activities oriented to religious teachings such as monotheism, justice and the prohibition of usury [45]. Fauzia reveals the concept of green economy from the perspective of sharia goals (maqashid al-shariah), with content analysis it is necessary to add hifz al-bi'ah (environmental protection) to be one that must be maintained, after hifz al- din (religious protection), hifz al-nafs (protection of the soul), hifz al-'aql (guarding the mind), hifz al-nasl (protection of offspring), and hifz al-mal (protection of property) [46]. Firdaus examines maqashid al-syari'ah: the study of mashlahah education in the context of the sustainable development goals (SDGs) program and social piety, noble character is the goal of the SDGs program. Some of these studies show the application of TBL, PBL and their hybrids in the multi-oriented shipyard industry, but the criteria still need further development so that they are more integrated [47].

The next research after compiling and analyzing the sustainability criteria in the shipyard industry, needs to design and recommend a multi-oriented shipyard industry diversification strategy using the Kotler and Keller model. Several studies have produced a positive impact on company performance after diversifying. Ilyawati, et al. examines product diversification and advanced manufacturing technology on activity based costing systems with the theory of diffusion of innovation [48]. Benito, et al., product diversification and performance over the last four decades [49]. Dhir discusses diversification and change strategies [50]. Tantra and Wesnawati diversification strategy and firm value [51]. Sinarta discusses diversification in the face of competition. Schommer, et al discuss diversification and firm performance [52]. Aqmal discusses diversification as a corporate strategy and its impact on sustainable business performance [53].

Various strategies for diversification of the multi-oriented shipyard industry have resulted, so the next research needs to design and recommend a model for selecting a strategy for selecting the multi-oriented shipyard industry diversification strategy with SFAHP. Several studies related to AHP and FAHP include Kong and Liu the development of AHP into Fuzzy AHP [35]. Kuntjoro discussed the concept of ship maintenance management with FAHP and SFAHP [36]. Butdee and Phuangsalee discuss uncertain risk management modeling for bus body manufacturing supply chains [54]. Amini, et al discussed the evaluation of the sustainability of rice production using Fuzzy-AHP-GIS logic [55]. Mathew, et al. discusses the hybrid AHP and TOPSIS manufacturing system selection in dealing with uncertainty [56]. Jokar, et al. discuss the risks and priorities in infrastructure projects based on public-private partnerships with FAHP and FTOPSIS [57]. Mokarram, et al. Discusses determining the location of a gas power plant (PLTG) using the OWA and FAHP methods [58]. Pavlovic, et al discussed the potential of alternative renewable energy using the FAHP method [59].

Based on the description above, there is no concept of developing a multi-oriented shipping industry that is environmentally sound and sustainable using an integrated approach using OBL, diversification and SFAHP, so it needs to be researched to determine the criteria, diversification and strategy selection as well as the implementation of the shipping industry in Bangkalan-Madura. Some of the reasons used as the basis for choosing a location in Bangkalan Regency are: (1) the multiplier effect of the operation of the Suramadu Bridge on the economy of Madura Island makes Bangkalan Regency a center for the development of the Gatekertosusila metropolitan city in in accordance with Government Regulation No. 26 of 2008 [60]. Ease of access and transportation to Madura Island will increase the attractiveness of local, domestic and foreign investors, especially land prices are relatively cheaper than those in Surabaya, Gresik, Lamongan, Sidoarjo, Mojokerto; (2) Based on the resources owned by Madura Island, the agro-industry, maritime, creative economy and tourism industrial clusters are the entrances and main drivers of Madura industrialization [61]; (3) Bangkalan Regency has been designated as one of the Industrial Growth Center Areas (WPPI) in the 2015-2035 National Industrial Development Master Plan [3].

IV. CONCLUSION

The concept of developing a multi-oriented shipyard industry that is environmentally sound and sustainable consists of: (1) research background in the form of the existing conditions of the shipyard industry, ship recycling industry, geography, infrastructure, superstructure; (2) research that has been conducted in the form of relevant journal articles and proceedings; (3) research to be conducted in the form of sustainability criteria, orientation diversification and strategy selection; (4) implementation.

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