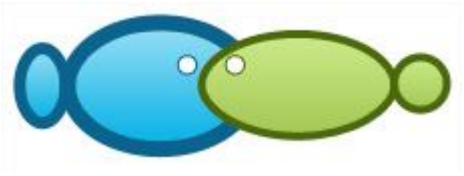

The design of regulatory reform in aquaculture in Indonesia: opportunities and threats of the implementation of SDGs in fisheries governance

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Abstract. The geographical position of the Indonesian archipelago is quite strategic to serve as the central maritime across continents. Abundant coastal and marine resources in Indonesia have not given any significant contribution to economic and national development. On a national scale, aquaculture management is expected to be sustainably performed and bring welfare to the locals. Aquaculture management in Indonesia is also expected to be more integrated in the future, as pertinent to the environmental capacity to allow the empowerment of the coastal people and islets. Marine resources and fisheries management require comprehensive, integrated, and appropriately-addressed policies. This article is emphasized on the urgency of law reform and trans-sectoral participation-based enforcement model, involving NGOs, business sectors, local community, and government that are integrated to underpin the food security agenda. This article opines that Indonesia needs to adopt SDGs framework in the design of aquaculture regulation in the time to come and merge the utilization and the development of technology proportionally, which is expected to yield civilized social, economic, and environmental sustainability.

Key Words: fisheries governance, food security, Indonesia, regulatory framework, SGDs.

Introduction. Aquaculture industry or water organism cultivation are considered as food industries with vast expansion globally, growing to about 5.8% annually (FAO 2016). The commodity boom of aquaculture is deemed to be the logical consequence of what is dubbed as the 'blue revolution' - an approach aiming to increase production to contribute to nutrition improvement in humans and maintain food security (Ahmed et al 2018). Aquafarming species such as fish and other aquatic food from freshwater or seawater (or commonly known as seafood) are protein sources that can be easily and widely accessed these days and in the future. Aquafarming is predicted to replace illegal fishing that results in falling supply due to excessive exploitation that spoils the marine ecosystem. This challenge is deemed crucial to be solved in line with the booming population predicted to reach 9.7 million inhabitants by 2050, energy crisis threat, climate change, marine population, and dietary trend that leans towards more resource-intensive foods (Gephart et al 2021). Moreover, crises amidst Covid 19 also potentially disturb the commodity supply of cultivated fish and increase the risk of food rarity at a global level (Ma et al 2021). To allow the transition required to extend the industrial prospect of aquaculture, countries are demanded to set a legal, institutional scope and fisheries governance that adopts Sustainable Development Goals (henceforth referred to as SDGs) frameworks with the outcomes as targeted and supervised periodically (UNCTAD et al 2018).

As one of the largest maritime countries in the Asia Pacific, Indonesia heavily relies on fish and freshwater species commodities and other marine commodities to meet the standard of national nutrition. Indonesia's oceans account for 5.8 million km^2 (including 0.3 million km^2 territorial oceans and 2.95 million km^2 archipelagic water, and

2.55 million km^2 Exclusive Economic Zone/EEZ Indonesia) with its longest coastline worldwide (Ministry of Marine Affairs and Fisheries 2015). Without a doubt, Indonesia has been a prosperous country for thousands of years, serving as the maritime civilization center of the past (Lombard 2008). Santos (2010) concluded that referring to research evidence for three decades, Indonesia is the place of birth of the world's maritime civilization. Another study conducted by Oppenheimer (2010) also suggests that the Indonesian archipelago and Southeast Asia were seen as the center of global civilization and commerce back in precolonial time. Factually, Indonesia has great potential for aquaculture, including 2.8 million hectares (15.8%) of freshwater, 2.96 million hectares (16.5) of brackish water, and 12.12 million hectares (67.7%) of seawater (Agussalim 2019). Indonesian maritime has also been home to about 950 species of coral reefs, 8500 species of tropical fish, 555 species of seaweed, and 18 species of seagrass (Nurhayati & Putra 2019). Recently, the Ministry of Marine Affairs and Fisheries has set an ambitious growth target for the majority of the aquaculture species with the figure accounting for 8.5% annually to the year 2030 to meet the demand of domestic needs and exports (Director General of Aquaculture 2020).

Despite the great prospects in underpinning food security, most seafood consumed in Indonesia has come from wild fisheries: most fishery resources have been exploited in non-sustainable ways without strict conservation and control (Hendriksson et al 2019). The yield of wild fish in the time to come is predicted to decrease to 30% due to climate change, anthropogenic pollution such as plastic waste and coral reef damage (Muawanah et al 2018). Indonesia has not succeeded in meeting the capacity as needed to adapt to changes, and there have been several obstacles and issues at all government levels affecting the management of aquacultural resources (Muawanah et al 2018). Besides, the aquaculture industry is quite heterogeneous, involving the economic sector of small-scale family farming utilizing conventional rearing methods and extensive, multinational, and automated companies (Anderson et al 2017). Not all people work as permanent fishermen and they heavily rely on climate conditions and peak season for fishing (Susilo et al 2021). That is, to support optimal access to the prospects of fish farming, Indonesia requires the existence of the rules of law that are comprehensive with sustainable fisheries governance according to the SGDs outcomes (Ma et al 2021).

This article analyzes the aquaculture regulations in Indonesia by finding out to what extent the SGDs frameworks have been adopted to help promote sustainable fish farming. Specifically, this article identifies the gaps between frameworks of sustainable development in several rules of law regarding aquaculture and fisheries in Indonesia and offers relevant grand design to face existing challenges. Departing from such a historical background, sustainable marine development is needed to expand the potential of natural resources in Indonesia, including the aquaculture sector as to build a maritime axis. Thus, to put the perspective towards the maritime potential back on track, Indonesia must go beyond the perspective that focuses on land resources and shift to a more comprehensive approach to seeing the sea as an ecosystem and national economic development resource in the future. The aquaculture sector demands proper management and should contribute to ecology, economy, and social politics. Therefore, underpinning the grand design aimed for the development of the fishery sector and seafood is essential to allow optimal potential development for the sake of the economy of the people and to strengthen food security. To develop and improve the welfare of the people, the government has promoted the policy regarding maritime to help improve the development, welfare, and productivity.

The first part of this article elaborates on SDGs frameworks to evaluate regulatory provisions related to the aquaculture sector in Indonesia, followed by the discussion of a regulatory framework that governs the aquaculture sector. With its focus on the capacity of laws in accommodating sustainable aquaculture and the targets of SDGs, this part will also present the challenges and limitations of existing laws in governing the aquaculture sector.

Material and Method. This article uses a normative legal research to understand how the acuaculture legal framework in Indonesia adopts the SDGs. This includes using a

statute approach and a conceptual approach to analyze legal products in the aquaculture sector. Various legal products and various development plan documents are used as the legal material of this article. By this, this article is expected to contribute to developing a better understanding of the barriers and challenges to aquaculture governance in Indonesia.

Results and Discussions

SDGs, aquaculture, and food security sectors. The concept of sustainable aquaculture has been widely accepted by several countries, business sectors, NGOs, and multilateral financial organizations as one of the parameters to achieve food security of the Agenda 2030 to support the sustainable development of the UN. Launched in 2015, the agenda of SDGs consists of 17 principles of SDGs, 169 targets, and 232 indicators, including five dimensions such as human, earth planet, welfare, peace, and partnership (Sampantamit et al 2020). Under the agenda 2030 of Sustainable Development, the aquaculture sector is intended to eradicate global famine (SDG 2); ensure that citizens live a healthy and prosperous life (SDG 3); encourage inclusive economic growth (SDG 8); and conserve marine resources (SDG 14) (Stead 2019; Ma et al 2021). Sustainable aquaculture development aims to provide aquatic nutrition supply for the sustainability of human life without spoiling the existing ecosystem and exceeding what the earth can bear in terms of renewing natural resources needed for aquaculture production (Boyd et al 2020). Whether farmed in saltwater, freshwater, brackish water, or artificial environment, the aquatic food sources play an essential role in supporting economic revenue, social activities, and have been part of the cultures worldwide (Troell et al 2021). To fulfill the global agenda 2030 for sustainable development, this will certainly present challenges that demand partnership, innovation, and strategic and comprehensive approaches relevant across scales (Troell et al 2021).

United Nations World Commission on Environment and Development (commonly referred to as Brundtland Commission) defines sustainable development as 'the utilization of environment and resources to meet the current needs without ruling out the capacity of the future generation in keeping up with their own needs' (WCED 1987). Recalling that SDGs have their extensive contexts since they serve as the guidelines of the policy of the member states - SDGs do not set forth technical problems required to achieve the target, thereby giving flexibility to each country for interpretation (Said & Chuenpagdee 2019). Conceptually, there are three pillars in the concept of sustainable aquaculture.

First, economic sustainability is a pillar emphasizing that aquaculture should give decent business opportunities along with stable long-term prospects (Le Blanc et al 2017). Second, social sustainability involves the acceptance by the members of the public to aquaculture production activities (Murphy 2012). Social sustainability also deals with the way people organize their life within society to achieve the development as desired (Ahman 2013). Third, environmental sustainability represents the capability to carry out activities without spoiling the environment and natural resources so that they will remain intact and available for future generations (Fleming et al 2017). The development of the aquaculture sector can serve as a solution to climate change mitigation since the degrading ecosystem in the high seas has led to wild fish supply rarity. This sector also leads to inclusivism and gender equality among women, adat people, and vulnerable people who were initially not included in economic development. That is, SDGs are designed to support collaborative work across countries, non-government organizations, the members of the public, and business sectors to achieve food security for all.

Meanwhile, the global aquaculture industry has provided opportunities to contribute to the agenda of food security of SDGs, and several factors are found to have affected the outcomes of SDGs from varied farming systems (species, strain, and hybrid) in different environmental situations and conditions (Troell et al 2021). The aquaculture sector is varied with over 500 species, including seaweed, salmon, goldfish, bivalves, parrotfish, shrimp, lobster, and catfish all farmed with different methods, technology, and input to yield varied final products in the market. Aquaculture is developed as an

alternative in wild fisheries. However, some initial efforts of this sector have posed negative and significant impacts, causing the disappearing mangrove, waste buildup, the use of prophylaxis antibiotics, the genetic impacts on the native species, and also the use of other chemical substances that harm the environment (Tlusty et al 2012). Nutrition impacts released to the environment such as phosphor and nitrogen spilled as animal food and fish waste can contribute to water eutrophication which can pollute water resources. Overlooking the nutrition pollutants discharged from aquaculture industries contravenes the sustainability principle set as the objective of the SDGs (Kyronviita et al 2021). On the other hand, the water ecosystem in aquafarms can benefit from the practice of controllable aquaculture governance such as restocking, fish habitat improvement, and growing water plants as natural food sources for farmed fish (Stead 2019). In brief, in the context of the blue revolution, the SDGs imply that the development of the aquaculture sector should be inclusive and enviro-friendly and should take into account the equilibrium between economic, social, and environmental dimensions based on sustainable marine development (Lee et al 2020).

The paradigm of SDGs in the legal framework of aquaculture in Indonesia. The Unitary State of the Republic of Indonesia is an archipelagic state (Ma et al 2021) distinguished by a variety of maritime economic activities with its absolute sovereignty over regions and independent rights outside the sovereignty of its lands and authority available for substantial cultivation and utilization for the prosperity of the people of Indonesia. In the context of the domestic aquaculture sector, economic activities contributed 3.1% to the total national GDP and 21.0% to agricultural GDP, creating 6.4 million job opportunities and supporting about US$ 4.2 billion of exported food products in Indonesia in 2012 (Tran et al 2017). Eight species contributed about 90% of Indonesian fish farming production (excluding seaweed/macroalgae) in 2014, including Nile tilapia *Oreochromis niloticus* (23%), walking catfish *Clarias batrachus* (16%), milkfish *Chanos chanos* (13%), whiteleg shrimp *Litopenaeus vannamei* (10%), pangasius catfish *Pangasianodon hypophthalmus* (10%), and Asian tiger shrimp *Penaeus monodon* (3%) (Tran et al 2017).

The Preamble of the 1945 Indonesian Constitution formulated some objectives of the state: (1) protecting all the people of Indonesia; and (2) improving public welfare. To achieve those constitutional objectives, the optimization of the development of the maritime industrial sector is an important aspect serving as a tool to achieve the objectives. The industry has high economic values, provides major job opportunities, has a long history, and raises wide political impacts. Industries in maritime have changed along with the development of civilization and the utilization of technology and global political conditions (Widjaja & Kadarusman 2019).

During the colonial era, the economy of fisheries in Indonesia was characterized by an economic dualism between the capitalist economic system (large-scale sector) that was capital accumulation-oriented and the traditional economic system (small-scale sector) managed by native people (Furnivall 2010). Traditional fisheries economy is often intended to meet the domestic needs or local community positioned next to the economic sector of modern capital-intensive industries striving to accumulate capital. The legacy of such an economic structure has become the target for decolonization that requires national assets, including the aquaculture sector, to be controlled by the state used for the public interest. Pertinent to the frameworks of SDGs and according to the mandate as set forth in Article 18, Article 18A, Article 18B, and Article 25A, the Constitution of the Republic of Indonesia implicitly consist of the substance on the recognition of the state regarding the regulatory specification for the role of local governments in developing the maritime economy, including aquaculture sector (Nurhayati & Putra 2019; Anggoro & Negara 2021). Furthermore, the main juridical fundamental towards the reality asserting that Indonesia is an archipelagic state requires a regulatory specification for the archipelago, as outlined in Article 25A of the Constitution of the Republic of Indonesia stating “The Unitary State of the Republic of Indonesia is an archipelagic state, the boundaries and rights of whose territory shall be established by law.”

Furthermore, the mandate of the Constitution concerning the development of the specialty of archipelagic regions is also in line with Law of the Republic of Indonesia Number 17 of 2007 concerning the national Long-Term Development Plan (henceforth referred to as RPJPN) 2005-2025, formulating the vision of the development in Indonesia as an independent, developed, just, and prosperous state. To achieve this vision, there have been 8 (eight) missions of national development set forth. This plan is relevant to the target that is set to eradicate poverty (SDG 1) and famine (SDG 2), health and welfare improvement (SDG 3), education improvement (SDG 4), and gender equality (SDG 5) (Agussalim et al 2019). Mission 7 indicates that Indonesia is an archipelagic state that is independent, developed, resilient, and national interest-based. In accord with the visions and missions of the RPJPN 2005-2025, the future of Indonesia has been agreed upon and jointly formulated by optimizing the prospects of the maritime state.

The potential seas in Indonesia are rich with abundant natural resources lying in strategic and geographical positions. However, the majority of the population in the state has not appropriately used what the seas have to offer. Indonesia confirms that it "possesses" abundant natural richness, not corresponding to the fact that this richness is majorly under the control of other capitalist states. This possession must be counterbalanced by the act of "controlling". Controlling does not mean authoritative or despotic towards Mother Nature, but this word should be more understood as to do what is mandated while simultaneously serving as God's representative on earth with the commitment to act justly in managing marine resources (Mukhlish & Lutfi 2011).

The fisheries sector is specifically governed in Law of the Republic of Indonesia Number 31 of 2004 concerning Fisheries that sees a paradigm shift from fish farming to the fisheries ecosystem approach. This change involves fisheries, fishing boat, equipment and permit, added values, research, and development of fisheries, justice and arbitration of fisheries, and sanctions. Law of the Republic of Indonesia Number 45 of 2009 concerning Amendment to law Number 31 of 2004 concerning Fisheries gives access to the Minister of Marine Affairs and Fisheries to fish cultivation to control fishing and fish farming (Muawanah et al 2018). In addition, under negative investment registration 2016, the government puts the aquaculture sector including marketing, distribution, fish product export in Indonesia as a chance open to foreign capital as long as a corporation with small and medium enterprises or cooperatives is always taken into account (Ikrami 2017). The government also sees the national benefits in an economy in terms of the huge quantity of fish owned and produced from the aquaculture sector through an investment plan reaching US$ 165 million to support aquaculture development all over Indonesia (McIlgorm & Campbell 2018).

Asshiddiqie (2021) opines that the essence of the paradigm in developing Indonesia should not only depart from the lands as it has always been, but it should also take into account seas. Through the concept of the unity of islands with their interconnectivity, the development could start from the lands representing the islands that are interconnected to nearby islands, creating the unity of integrated economy.

As an archipelagic state whose existence is recognized by the United Nations Convention on the Law of the Sea (United Nations 1994), Indonesia holds its entire sovereignty over its waters, involving inland waters and archipelagic waters and territorial seas (Ahmad 2011). Moreover, the sovereignty of the state also embraces the bottom of the oceans and their ecosystems and the air above the waters, to all the natural resources contained therein. This sovereign right should be counterbalanced by the responsibilities performed by the Indonesian Government by properly and sustainably cultivating the resources for the welfare of the people of Indonesia relevant to the national interest.

The existence of waters on earth affects human civilization, serving as the resources to support human survival by giving people access to drinking water or water transportation to allow their mobility. The seas and oceans are unlimited natural resources enabling people to get access to transportation, food sources, leisure, off-shore mining, marine commerce, and the media to project the resilience of a state (UNESCO World Water Assessment Programme 2003). Seas and their natural resources contained therein for the people of Indonesia are an inseparable part of day-to-day life. Not only

are they politically important in terms of the integrated islands but they also contribute economic, social, and scientific benefits (World Bank 2021).

During the presidency of Joko Widodo (Kadarusman 2019) these days, Indonesia initiates a great vision where Indonesia plans to serve as the global maritime axis (hereinafter referred to as PMD). This doctrine has led the Government to focusing on the improvement of five elements: maritime culture, marine resources, infrastructure, maritime connectivity, maritime diplomacy, and maritime defense (Ikrami & Bernard 2018). The doctrine of a maritime axis is claimed to mark the rediscovery of the maritime culture of Indonesia, intended to revive the former identity of the nation as a maritime state (Sato & Damayanti 2015). Following presidential instruction to reach the great vision, the president has instructed all the regions in Indonesia that have seas to apply the concept of PMD and to cover the aspect of management and control according to the sustainable development concept.

As the biggest archipelagic state globally, Indonesia, with its abundance and biodiversity comparable to none, is an asset to become the global maritime axis for the welfare of the nation (Puspitawati 2017). Indonesia has abundant seas and coastal regions, and these are reasonable assets to make Indonesia a state of a resource-based economy. For Indonesia, the maritime domain is very salient (Nurhayati & Putra 2019).

Susiana (2015) argues that sustainable development is not new. During the time sustainable development was not much heard, the economic growth was the only objective for which development took place without considering other aspects. However, in the era of sustainable development in the present time, the three main stages of the development are required for each country to take into account: ecological balance, social justice, and political and socio-cultural aspiration aspects of the locals.

Aquaculture development will encourage what is commonly referred to as blue development. According to this concept, blue development results from economic activities utilizing renewable living resources from the sea, wetlands, and coastal areas to reduce environmental degradation, the loss of biodiversity, and the utilization of non-sustainable water resources, and to maximize economic and social advantages (Kadarusman 2019). Blue development aims to meet life sustainability and biodiversity and human day-to-day needs. Thus, principally, blue development is the logical consequence of the development that integrates ecological, economic, and social problems. This sustainable development should cover the whole sector of development, including fisheries (Mustafa et al 2018). The concept of sustainable fisheries was set as world agenda in 1995, where the concept of sustainable fisheries was formulated by FAO by drafting the documents of the Code of Conduct for Responsible Fisheries (CCRF). Furthermore, the formulation of the definition regarding sustainable fisheries was performed by either competent agencies or experts (FAO 2018).

Marine Stewardship Council (MSC) is the only agency related to sustainable fisheries program, where sustainable fisheries are defined as one of fish production methods that are maintained to help it survive at a proportional level by taking into account ecological health, minimizing side effects that disturb diversity, structure, and ecosystem function for just and responsible management according to local regulations and national and international laws to fulfill the needs of the present and future generations (Deere 1999).

In terms of the regulatory frameworks, Indonesia currently has over 50,000 laws. The Center of Indonesian Law and Policy Studies (PSHK) reported that there are 182 rules and regulations at the national level concerning wild fisheries and fish farming (Pusat Studi Hukum Dan Kebijakan Indonesia (PSHK) 2019). The Table 1 presents legal frameworks concerning wild fisheries and fish farming.

A profound understanding of regulatory frameworks, legal systems, and lawmaking in Indonesia is vital. However, legal mapping and institutions related to fisheries are still separated and difficult to direct. Although several reports and articles of scientific journals have given descriptions, there have not been any sources that map the whole conditions of the present time in terms of regulations, laws, related agencies, and historical context. This article aims to fill the gaps in the situations in Indonesia through comprehensive studies on current conditions and legal elements and agencies related to

fisheries. Therefore, knowledge, understanding, and capability for all parties giving their attention to sustainable fish farming in Indonesia are expected to improve.

Table 1

Scope of legal frameworks concerning wild fisheries and fish farming

Type	*Total*	*Period*
Constitutional Law of Indonesia	1	1945
Laws	33	1960-2016
Government regulations	20	1962-2017
Presidential regulations	14	1959-2017
Presidential decrees	6	1975-2000
Presidential instructions	1	2016
Minister regulations	77	1973-2017
Minister decrees	25	1973-2016
Joint decrees	2	1972-2012
Others	3	2015-2018
Total	182	

Source: processed from the executive summary (PSHK 2019).

The development policy in the maritime and fisheries sector is adopted in The Long-Term National Development Plan (*Rencana Pembangunan Jangka Panjang*/RPJPN) and National Middle-term Development Plan (*Rencana Pembangunan Jangka Menengah Nasional*/RPJMN). These plans consist of where the strategic plans lead us to, development target, and, when necessary, they set laws to reach the target.

It is important to remember that weaknesses in the management of fisheries involve an absence of the mechanism of coordination among agencies regarding fisheries management. Regarding the bureaucracy aspect, however, conflict of interest over fisheries management is common to see. In the legal aspect, the problems are related to law enforcement, sanction formulation, and jurisdiction and relative competence of district courts over crime in fisheries outside the authority of the district courts) (Ma et al 2021).

In an example given by Siombo (2010), the conflict of authority can cause material loss for the state since the authorized organizations to impose sanctions are likely to be in charge of enquiries towards the report of IUU fishing in the waters of Indonesia and they are likely to jointly arrange Police Investigation Report and submit it to General Prosecutors. In Article 73 of Law Number 31 of 2004, amended to Law Number 45 of 2009 concerning Amendment to Law Number 31 of 2004 concerning Fisheries, it is elaborated that fisheries-related crime in EEZ and fisheries seaport territories should be investigated by enquirers as civil servants (PPNS), while other enquirers are assigned to coordination to support the establishment of coordination forum. Regarding this matter, Presidential Regulation Number 115 of 2015 concerning illegal Fishing Eradication Task Force was issued as a command in the implementation of sanction operation in IUU Fishing.

Thus, the urgency of the legal frameworks regarding policy and strategy management in the governance of marine resources and farming, the management of coastal areas and islets, and sustainable economic development of the sea needs to be taken into account through conservation, rehabilitation of damaged territories and the control and supervision over the utilization of marine resources. All those issues need to be seriously addressed to allow law enforcement in fisheries since this is considered vital and strategic to help support sustainable and controlled fishery developmentt.

Conclusions. Indonesia is an archipelagic state with its potential aquatic resources offering alternatives to support the agenda of food security and local economic growth as outlined in SDGs. Although Indonesia has set its legal frameworks governing issues in aquaculture industries in several regulations, their implementation is proven challenging since they require support from non-regulatory aspects such as technology, human

resource capacity, and coordination among agencies in charge of the aquaculture sector. The problems faced involve the extent of the regulation of varied aquaculture industries distributed in several regions, but they do not get their rights to the access to finance, improvement of the capacity in technology, and sustainable environmental insights, including supervision from the central and local governments. Therefore, the need of the law reform and restructuring the strategies of the improvement of aquaculture governance is expected to involve cross-sectoral participation, embracing NGOs, the business sector, local community, and governments all integrated to support sustainable aquaculture agenda intended to increase the rehabilitation of the damaged territories and the control and supervision of marine resource utilization. All these objectives can be achieved by adopting the frameworks of SDGs in the regulation of aquaculture under supervision and with appropriate implementation of technology development. Relevantly, law enforcement in aquaculture fish farming is vital and strategic in its capacity to support social, economic, and environmental sustainability.

Conflict of interest. The authors declare that there is no conflict of interest.

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